COURSE OUTLINE

(1) GENERAL

SCHOOL	**UNIVERSITY OF THESSALY**		
ACADEMIC UNIT	DEPARTMENT OF CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	ΓΚ0306	**SEMESTER**	3
COURSE TITLE	ORDINARY DIFFERENTIAL EQUATIONS		

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	6
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, specialized general knowledge, skills development*	General background
PREREQUISITE COURSES:	(Recommended) Linear algebra and analytic geometry, Calculus I
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	
COURSE WEBSITE (URL)	http://eclass.uth.gr/eclass/courses/MHXC129/

(2) LEARNINGOUTCOMES

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 EducationArea*
- *DescriptorsforLevels6,7&8oftheEuropeanQualificationsFrameworkforLifelongLearningand AppendixB*
- *Guidelines for writing LearningOutcomes*

The course is based on the knowledge of linear algebra and infinitesimal calculus of one real variable acquired during the previous academic year. Emphasis is placed on the development of the understanding and the ability to formulate differential equations as initial value problems in the context of mathematical modeling of simple physical phenomena from engineering science and to subsequently solve them analytically and provide an interpretation of the solution.

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 thenecessarytechnology	*Project planning and management*
Adapting to newsituations	*Respect for differenceandmulticulturalism*
Decision-making	*Respect for the naturalenvironment*
Workingindependently	*Showing social, professional and ethical responsibilityand sensitivity to genderissues*
Teamwork	*Criticism andself-criticism*
Working in aninternationalenvironment	*Production of free, creative andinductivethinking*
Working in aninterdisciplinaryenvironment	*……*
Production of newresearchideas	*Others…*
	…….

The course aims at learning and applying methods for the analytical solution of ordinary differential equations, with emphasis on both theory and applications, particularly in physics. At the same time, the aim is to promote critical thinking as well as productive and inductive thinking regarding the applicability of applied mathematics and in particular of ordinary differential equations in the study of Nature**.**

(3) **SYLLABUS**

Introductory concepts: existence and uniqueness of a solution, well-posed problems, geometric characteristics of solutions (integral curves, direction fields).

1st order equations: separation of variables, initial value problems, homogeneous equations, equations reducible to homogeneous, general linear equation, method of variation of constants, exact equations, Euler integral factor, autonomous equations, singular solutions, Bernoulli eq., Riccati eq., orthogonal orbits, mathematical models of simple physical phenomena.

Higher order equations: general theory of n-th order linear equations, Wronski's determinant, homogeneous and non-homogeneous equations, method of order reduction, method of variation of constants.

Linear equations with constant coefficients: homogeneous and non-homogeneous equations, method of determination of coefficients, Euler eq., simple dynamics problems, oscillations of spring-mass systems.

Laplace transformation: properties, inverse transformation, Heaviside step function, application to the solution of linear equations and initial value problems.

Systems of differential equations: systems in normal form, homogeneous and non-homogeneous systems, method of elimination, method of variation of constants, method of determination of coefficients, method of Laplace transformation.

Solutions with power series: regular points, singular points, Fuchs' theorem, solution by general power series, solution by Taylor/Maclaurin series, solution by the Frobenius' method.

(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*	

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*
	Lecture hours	56 hours
	Study and analysis of bibliography	35 hours
	Individual study	36 hours
	Exam preparation	20 hours
	Exam	3 hours
	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.*	Language of evaluation: Greek The evaluation is carried out through (a) optional exercises which the student submits at regular intervals (b) a written examination at the end of the semester The assessment includes: Written examinations (80% of the final grade if the student has handed in exercises, otherwise 100%) Optional exercises (20% of the final grade) Assess whether the examinee has the competence: - to construct differential equations as initial value problems in the context of mathematical modeling of natural phenomena -to proceed to their subsequent analytical solution and give an interpretation of the solution Assessment criteria are discussed in class at the beginning of the semester.

(5) **ATTACHED BIBLIOGRAPHY**

-Suggested bibliography (in Greek)

Αλικάκος Ν., Καλογερόπουλος Γ., *Συνήθεις Διαφορικές Εξισώσεις*, 2003, Σύγχρονη Εκδοτική
Δάσιος Γ., *Συνήθεις Διαφορικές Εξισώσεις*, 1991, Πάτρα
Δασκαλόπουλος Γ., *Διαφορικές Εξισώσεις*, 1999, Εκδ. Ζήτη
Κραββαρίτης Δ., *Εισαγωγή στις Διαφορικές Εξισώσεις*, 2014, Εκδ. Τσότρα
Κυβεντίδης Θ., *Διαφορικές Εξισώσεις*, 2η έκδ., 2012, Εκδ. Ζήτη
Logan J.D., *Εισαγωγή στις Διαφορικές Εξισώσεις*, 2014, Εκδ. Liberal Books
Boyce W., DiPrima R., *Στοιχειώδεις Διαφορικές Εξισώσεις και Προβλήματα Συνοριακών Τιμών*, 2η έκδ., 2015, Πανεπ. Εκδ. Ε.Μ.Π.
Παντελίδης Γ., Κραββαρίτης Δ., Χατζησάββας Ν., *Συνήθεις Διαφορικές Εξισώσεις*, 1990, Εκδ. Ζήτη
Σεραφειμίδης Κ., *Διαφορικές Εξισώσεις*, 3η έκδ., 2009, Εκδ. Σοφία
Σταυρακάκης Ν., *Συνήθεις Διαφορικές Εξισώσεις*, 2η έκδ., 2010, Εκδ. Παπασωτηρίου
Τραχανάς Σ., *Συνήθεις Διαφορικές Εξισώσεις*, 2008, Π.Ε.Κ.

- Related academic journals: