

SPECIAL TOPICS IN DIFFERENTIAL AND DIFFERENCE EQUATIONS

1. GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
DEPARTMENT	CIVIL ENGINEERING		
LEVEL OF STUDIES	POST-GRADUATE, LEVEL 7		
COURSE CODE		SEMESTER	1 st SEMESTER
COURSE TITLE	SPECIAL TOPICS IN DIFFERENTIAL AND DIFFERENCE EQUATIONS		
TEACHING ACTIVITIES <i>If the ECTS Credits are distributed in distinct parts of the course e.g. lectures, labs etc. If the ECTS Credits are awarded to the whole course, then please indicate the teaching hours per week and the corresponding ECTS Credits.</i>		TEACHING HOURS PER WEEK	ECTS CREDITS
		3	7,5
<i>Please, add lines if necessary. Teaching methods and organization of the course are described in section 4.</i>			
COURSE TYPE <i>Background, General Knowledge, Scientific Area, Skill Development</i>	Scientific Area		
PREREQUISITES:	None		
TEACHING & EXAMINATION LANGUAGE:	Greek		
COURSE OFFERED TO ERASMUS STUDENTS:	No		
COURSE URL:	https://eclass.duth.gr/courses/TMB292/		

2. LEARNING OUTCOMES

Learning Outcomes <i>Please describe the learning outcomes of the course: Knowledge, skills and abilities acquired after the successful completion of the course.</i>
After the successful completion of this course, the post-graduate students will be able: <ul style="list-style-type: none"> • To apply methods like “separation of variables” • To solve partial differential equations • To solve boundary-initial value problems • To study the asymptotic behavior of the solutions of difference equations • To study the boundedness, the convergence and the stability of difference equations
General Skills <i>Name the desirable general skills upon successful completion of the module</i> Search, analysis and synthesis of data and information, Project design and management ICT Use Equity and Inclusion

<i>Adaptation to new situations</i>	<i>Respect for the natural environment</i>
<i>Decision making</i>	<i>Sustainability</i>
<i>Autonomous work</i>	<i>Demonstration of social, professional and moral responsibility and sensitivity to gender issues</i>
<i>Teamwork</i>	<i>Critical thinking</i>
<i>Working in an international environment</i>	<i>Promoting free, creative and inductive reasoning</i>
<i>Working in an interdisciplinary environment</i>	
<i>Production of new research ideas</i>	

<ul style="list-style-type: none"> – Search, analysis and synthesis of data and information, ICT Use. – Adaptation to new situations. – Decision making. – Autonomous work.

3. COURSE CONTENT

PART A: Basic theory of Ordinary and Partial Differential Equations. Method of Separation of variables. Initial and boundary value problems. The wave equation. The heat equation. The potential equation (Laplace equation). The wave equation in two dimensions. The overlapping principle. The heat equation in three dimensions. Bessel functions. Spherical harmonic coordinates. Legendre polynomials. The Laplace equation in three dimensions. Linear vector spaces. Inner product. Linear subspaces.

PART B: Basic theory of difference equations, Linear difference equations of first order, Linear homogenous difference equations with constant coefficients, Linear non-homogenous difference equations: Method of undetermined coefficients, The method of variation of constants, Systems of difference equations, Fixed points (Equilibrium points) of a difference equation of first order: Hyperbolic fixed points, Nonhyperbolic fixed points, Stability of a hyperbolic fixed point, Stability of a nonhyperbolic fixed point, Stability of linear systems, Stability of difference equations of second order: Stability of a hyperbolic fixed point via linearization, Central manifolds, Stability of a nonhyperbolic fixed point via the central manifold, Attractivity of fixed points, Applications of difference equations in Population Dynamics, Biomathematics.

4. LEARNING & TEACHING METHODS - EVALUATION

TEACHING METHOD <i>Face to face, Distance learning, etc.</i>	Live distance learning	
USE OF INFORMATION & COMMUNICATIONS TECHNOLOGY (ICT) <i>Use of ICT in Teaching, in Laboratory Education, in Communication with students</i>	Use of ICT in teaching and in communication with the students	
TEACHING ORGANIZATION <i>The ways and methods of teaching are described in detail.</i> <i>Lectures, Seminars, Laboratory Exercise, Field Exercise, Bibliographic research & analysis, Tutoring, Internship (Placement), Clinical Exercise, Art Workshop, Interactive learning, Study visits, Study / creation, project, creation, project. Etc.</i>	Activity	Workload/semester
	Lectures	39
	Bibliographical research and study	78
	Assignments during the course	30
	Final written exam	3
	Total	150

<p><i>The supervised and unsupervised workload per activity is indicated here, so that total workload per semester complies to ECTS standards.</i></p>	
<p style="text-align: center;">STUDENT EVALUATION</p> <p><i>Description of the evaluation process</i></p> <p><i>Assessment Language, Assessment Methods, Formative or Concluding, Multiple Choice Test, Short Answer Questions, Essay Development Questions, Problem Solving, Written Assignment, Essay / Report, Oral Exam, Presentation in audience, Laboratory Report, Clinical examination of a patient, Artistic interpretation, Other/Others</i></p> <p><i>Please indicate all relevant information about the course assessment and how students are informed</i></p>	<p>Assignments during the course.</p> <p>Final written exam.</p>

5. SUGGESTED BIBLIOGRAPHY

1. R. P. Agarwal, Difference equations and inequalities, Marcel Dekker, New York, 1992.
2. E. Camouzis and G. Ladas, Dynamics of Third-Order Rational Difference Equations with Open Problems and Conjectures, Chapman & Hall/CRC, Boca Raton, London, 2008.
3. L. Edelstein-Keshet, Mathematical Models in Biology, Birkhauser Mathematical Series, NY, 1988
4. S. Elaydi, An introduction to Difference Equations, Springer-Verlag, New York, 1996.
5. E. A. Grove and G. Ladas, Periodicities in Nonlinear Difference Equations, Chapman & Hall/CRC, 2005.
6. V. L. Kocic and G. Ladas, Global behavior of nonlinear difference equations of higher order with applications, Kluwer Academic Publishers, Dordrecht, 1993.
7. M. R. S. Kulenovic and G. Ladas, Dynamics of Second Order Rational Difference Equations, Chapman & Hall/CRC, 2002.
8. L. C. Andrews, Elementary PDE's with Boundary Value Problems, Academic Press Inc..
9. H. Sagan, Boundary Eigenvalue Problems in Mathematical Physics, Dover Publications, Inc..
10. I. N. Sneddon, Elements of Partial Differential Equations, McGraw-Hill Kogakusha, Ltd..

ANNEX OF THE COURSE OUTLINE

Alternative ways of examining a course in emergency situations

Teacher (full name):	Prof. Christos Schinas Prof. Garyfalos Papaschinopoulos
Contact details:	Email: cschinas@ee.duth.gr , Telephone: +30 25410 79763 Email: gpapas@env.duth.gr , Telephone: +30 25410 79758
Supervisors: (1)	No
Evaluation methods: (2)	Students are evaluated via written assignments during the course and a written final assignment.
Implementation Instructions: (3)	The course is given via live distance learning and emergency situations will not affect lectures and student evaluation.

(4) Please write YES or NO

(5) Note down the evaluation methods used by the teacher, e.g.

6. *written assignment* or/and exercises

7. written or oral examination with distance learning methods, provided that the integrity and reliability of the examination are ensured.

(6) In the **Implementation Instructions** section, the teacher notes down clear instructions to the students:

a) in case of **written assignment and / or exercises**: the deadline (e.g. the last week of the semester), the means of submission, the grading system, the grade percentage of the assignment in the final grade and **any other necessary information**.

b) in case of **oral examination with distance learning methods**: the instructions for conducting the examination (e.g. in groups of X people), the way of administration of the questions to be answered, the distance learning platforms to be used, the technical means for the implementation of the examination (microphone, camera, word processor, internet connection, communication platform), the hyperlinks for the examination, the duration of the exam, the grading system, the percentage of the oral exam in the final grade, the ways in which the inviolability and reliability of the exam are ensured and any other necessary information.

c) in case of **written examination with distance learning methods**: the way of administration of the questions to be answered, the way of submitting the answers, the duration of the exam, the grading system, the percentage of the written exam of the exam in the final grade, the ways in which the integrity and reliability of the exam are ensured and any other necessary information.

There should be an attached list with the Student Registration Numbers only of students eligible to participate in the examination.