INSTITUTION	**NATIONAL AND KAPODISTRIAN UNIVERSITY OF ATHENS**					
SCHOOL	**SCHOOL OF SCIENCE**					
DEPARTMENT	**INFORMATICS AND TELECOMMUNICATIONS**					
COURSE LEVEL	**UNDERGRADUATE**					
COURSE TITLE	**Applied Mathematics**					
COURSE CODE	**Κ20β**		**Semester**	**5**	**ECTS**	**6**
TEACHING HOURS per week	**THEORY**	**3**	**SEMINAR**	**1**	**LABORATORY**	**0**
COURSE TYPE	**Elective (ΠΜ) – in particular: basic elective course (ΠΜΒ)** **K: A-B; E1: ---; E2: ---; E3: ---; E4: ---; E5: E; E6: B** Track (A: Computer Science, B: Computer Engineering) Core Specialization (B) Elective Specialization (E)					
URL	**https://eclass.uoa.gr/courses/DI417/**					
EXPECTED PRIOR KNOWLEDGE/ PREREQUISITES AND PREPARATION	• **Standard knowledge of Calculus of functions of one and two variables, basic knowledge of Real Analysis.** • **Prerequisite course of the Department's curriculum: K06 Analysis II**					
TEACHING AND EXAMINATIONS LANGUAGE	**Greek**					
THE COURSE IS OFFERED TO ERASMUS STUDENTS	**No**					

COURSE CONTENT
• Ordinary differential equations: definitions, examples. First order equations: separable, linear, reducible to linear (Bernoulli, Riccati), exact, reducible to exact - integrating factors, homogeneous. An introduction to issues on existence and uniqueness of solutions of initial value problems for first order equations. An introduction to qualitative theory: population models (exponential and logistic growth), phase diagrams, linearization, elements of bifurcation theory. Second order linear equations: homogeneous, non-homogeneous, constant coefficients, the methods of variation of constants and of undetermined coefficients, Euler's equation, mechanical and electrical oscillations. Systems of first order linear equations: emphasis in the case of constant coefficients and in dimensions 2 and 3.

- Complex analysis: complex numbers, sequences and series of complex numbers, complex functions (continuous, analytic, the elementary functions), integration (definite and indefinite integral, Cauchy's formula), isolated singularities, Laurent expansion, residues and applications in integrating complex and real functions, applications in electrical circuits.

STUDENT LEARNING OBJECTIVES
Teaching-Learning Goals-Expected Learning Outcomes. Upon successful completion of the course the student will be able to: Part A' : *Ordinary Differential Equations (ODEs)* • Classify ODEs. • Use existence and uniqueness theorems to describe the number and behavior of solutions to Initial Value Problems (IVPs). • Solve first-order linear, separable, homogeneous, and exact ODEs and IVPs. • Model physical situations using first-order IVPs. • Investigate the qualitative behavior of solutions of ODEs and interpret in the context of an underlying model. • Solve second-order linear, homogeneous and nonhomogeneous, equations by means of undetermined coefficients and variation of constants. • Model physical situations using second-order IVPs. • Solve systems of first order linear ODEs with constant coefficients. • Demonstrate their ability to write coherent mathematical proofs and scientific arguments needed to communicate the results obtained from differential equation models. Part B' : *Complex Analysis* • Represent complex numbers algebraically and geometrically. • Define and analyze limits and continuity for complex functions as well as consequences of continuity. • Apply the concept and consequences of analyticity and the Cauchy-Riemann equations and of results on harmonic and entire functions. • Analyze sequences and series of analytic functions and types of convergence. • Evaluate complex contour integrals directly and by the fundamental theorem, apply the Cauchy integral theorem in its various versions, and the Cauchy integral formula. • Represent functions as Taylor, power and Laurent series, classify singularities and poles, find residues and evaluate complex and real integrals using the residue theorem.

TEACHING AND LEARNING METHODS - ASSESSMENT	
TEACHING METHOD	**In Class (Face to Face)**
USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES	• **Learning process supported by the e-class platform (Announcements, Lecture notes uploading, Problem sheets uploading)**

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- **Email communication**
- **Live transmission of lectures**
- **Ability to track recorded lectures**

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TEACHING ORGANIZATION
Enhanced Lectures
Online Lectures
Seminars
Tutorial
Study & analysis of literature

Details of the student's study hours for each learning activity and hours of non-guided study are shown to ensure that the total workload at the semester corresponds to the ECTS

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<table>
<tr><th>Activity</th><th>Student Workload (hours)</th></tr>
<tr><td>Lectures</td><td>80</td></tr>
<tr><td>Tutorial</td><td>30</td></tr>
<tr><td>Independent Study</td><td>40</td></tr>
<tr><td>Total Course (25 hours of workload per unit of credit)</td><td>150</td></tr>
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ASSESSMENT OF STUDENTS
Description of the assessment process

Fully defined evaluation criteria are mentioned and if and where they are accessible to students.

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Describe explicitly methods, evaluation tools and provided feedback.
The table below is supplemented accordingly.

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<tr><th>Assessment methods</th><th>Number</th><th>Percentage</th></tr>
<tr><td>Written examination</td><td>1</td><td>100%</td></tr>
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LITERATURE AND STUDY MATERIALS / READING LIST

- **N. D. Alikakos, G. E. Kalogeropoulos, *Ordinary Differential Equations*** (*in Greek*), Sygkhroni Ekdotiki, Athens, 2007.
- **J. Bak, D. Newman, *Complex Analysis*** (*translation into Greek*), Leader Books, Athens, 2004.
- **W. E. Boyce, R. C. DiPrima, *Elementary Differential Equations and Boundary Value Problems*** (*translation in Greek of the 10th edition*), Panepistimiakes Ekdoseis E.M.Π., Athens, 2015.
- **I. G. Stratis, *An Introduction to Complex Analysis, Lecture Notes*** (*in Greek*), Athens, 2006 (*via e-class*).