INSTITUTION	NATIONAL AND KAPODISTRIAN UNIVERSITY OF ATHENS					
SCHOOL	SCHOOL OF SCIENCE					
DEPARTMENT	INFORMATICS AND TELECOMMUNICATIONS					
COURSE LEVEL	UNDERGRADUATE					
COURSE TITLE	**Computational Complexity**					
COURSE CODE	**C03**		**Semester**	**1**	**ECTS**	**6**
TEACHING HOURS per week	**THEORY**	**3**	**SEMINAR.**	**1**	**LABORATORY**	**0**
URL	https://eclass.uoa.gr/courses/DI436/					

COURSE CONTENT

Computability

- Turing Machines (T. M. with multiple tapes, Non-deterministic T. M.)
- Church – Turing Thesis

Time Complexity

- Complexity relations between different T. M. models (single-tape, multiple tapes, non-deterministic)
- Time complexity of non-deterministic T. M.
- The complexity classes P, NP, coNP, EXP
- Reductions and completeness, the notion of NP-hardness
- Cook-Levin Theorem
- NP-complete languages
- Pseudopolynomial and strongly NP-complete languages

Space Complexity

- Savitch's Theorem
- The complexity class PSPACE and PSPACE-completeness
- The complexity classes L, NL, EXPSPACE
- NL-completeness

Hierarchy Theorems

- The Time Hierarchy Theorem
- The Space Hierarchy Theorem

STUDENT LEARNING OBJECTIVES

Upon successful completion of the course the student will be able to:

- Define the basic computational complexity classes and describe/present representative problems for each one of them
- Describe the notion of non-deterministic computation and explain the P vs NP problem
- Use techniques that will help them classify problems into computational complexity classes

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 (Discussions, Announcements, Task assignments) Email communication
TEACHING ORGANIZATION *Describe in detail the way and methods of teaching:* *Enhanced Lectures,* *Online Lectures,* *Seminars,* *Tutorial,* *Laboratory,* *Laboratory Exercise,* *Study & analysis of literature,* *Practice (Positioning),* *Interactive teaching,* *Developing a project,* *Individual / group work* *Telework (reference to tools) etc.* *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*	

Activity	***Student Workload*** *(hours)*
Lectures	52
Small Individual Exercises	30
Individual study	68
Total Course	***150***

ASSESSMENT OF STUDENTS *Description of the assessment process* *Assessment Methods, Formative or Concluding, Multiple Choice Test, Quick Response Questions, Test Development Questions, Problem Solving, Written Work, Report / Report, Oral Examination, Public Presentation, Laboratory Work, Other / Other* *Fully defined evaluation criteria are mentioned and if and where they are accessible to students.*	

Assessment methods	***Number***	***Percentage***
Exercises	2	10% (bonus)
Written examination	1	100%

LITERATURE AND STUDY MATERIALS / READING LIST

- Christos H. Papadimitriou: Computational Complexity, Pearson publications 1993
- Michael Sipser: Introduction to the Theory of Computation, Cengage 2013
- Harry R. Lewis, Christos H. Papadimitriou: Elements of the Theory of Computation, Prentice- Hall 1997
- Michael R. Garey, David S. Johnson: Computers and Intractability: A Guide to the Theory of NP-completeness, W. H. Freeman and Company 1979
- Sanjeev Arora and Boaz Barak: Computational Complexity: A Modern Approach, Cambridge University Press 2007
- John E Hopcroft, Rajeev Motwani, Jeffrey D Ullman: Introduction to automata theory, languages, and computation, Addison-Wesley 1979