INSTITUTION	NATIONAL AND KAPODISTRIAN UNIVERSITY OF ATHENS					
SCHOOL	SCHOOL OF SCIENCE					
DEPARTMENT	INFORMATICS AND TELECOMMUNICATIONS					
COURSE LEVEL	GRADUATE					
COURSE TITLE	**Parameterized Complexity and Algorithms**					
COURSE CODE	**C25**		**Semester**	**2**	**ECTS**	**6**
TEACHING HOURS per week	**THEORY**	**3**	**SEMINAR.**	**0**	**LABORATORY**	**0**
URL	https://eclass.uoa.gr/courses/MATH278/					

COURSE CONTENT
Fixed Parameter Tractability and Algorithm Design: Kernelization (equivalence and techniques), Bounded Search Trees, Iterative Compression, Randomized Methods, Dynamic Programming on Graphs of Bounded Treewidth, Important Separators. Complexity and Lower Bounds: FPT-Reductions, W-hierarchy ,W[1]-complete and W[2]-complete problems, Exponential Time Hypothesis, Kernelization Lower Bounds.

STUDENT LEARNING OBJECTIVES
Upon successful completion of the course the student will be able to: • Define and explain the fundamental parameterized complexity classes (FPT, XP, W[1], W[2]) • Utlize techniques of Parameterized Complexity to design fixed-parameter tractable algorithms for NP-hard problems, if possible • Prove lower bounds on the time complexity of parameterized problems indicating that the design of a fixed-parameter tractable algorithm is not expected.

<table>
<tr><th colspan="2">TEACHING AND LEARNING METHODS - ASSESSMENT</th></tr>
<tr><td><b>TEACHING METHOD</b></td><td>In Class (Face to Face)</td></tr>
<tr><td><b>USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES</b></td><td>Learning process supported by the e-class platform (Discussions, Announcements, Task assignments)
Email communication</td></tr>
<tr><td><b>TEACHING ORGANIZATION</b>
<i>Describe in detail the way and methods of teaching:</i>
<i>Enhanced Lectures,</i>
<i>Online Lectures,</i>
<i>Seminars,</i>
<i>Tutorial,</i>
<i>Laboratory,</i>
<i>Laboratory Exercise,</i>
<i>Study &amp; analysis of literature,</i>
<i>Practice (Positioning),</i>
<i>Interactive teaching,</i>
<i>Developing a project,</i>
<i>Individual / group work</i>
<i>Telework (reference to tools) etc.</i></td><td>
<table>
<tr><th>Activity</th><th><i><b>Student Workload</b></i>
<i>(hours)</i></th></tr>
<tr><td>Lectures</td><td>39</td></tr>
<tr><td>Small Individual Exercises</td><td>30</td></tr>
<tr><td>Project work</td><td>36</td></tr>
<tr><td>Individual study</td><td>45</td></tr>
<tr><td><i><b>Total Course</b></i></td><td><i><b>150</b></i></td></tr>
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<tr><td><i>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</i></td><td></td></tr>
<tr><td><b>ASSESSMENT OF STUDENTS</b>
<i>Description of the assessment process</i>

<i>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</i>

<i>Fully defined evaluation criteria are mentioned and if and where they are accessible to students.</i></td><td><table>
<tr><th>Assessment methods</th><th><i>Number</i></th><th><i>Percentage</i></th></tr>
<tr><td>Exercises</td><td>2</td><td>20%</td></tr>
<tr><td>Presentation</td><td>1</td><td>50%</td></tr>
<tr><td>Final work</td><td>1</td><td>30%</td></tr>
</table></td></tr>
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LITERATURE AND STUDY MATERIALS / READING LIST

- Parameterized Algorithms, by Cygan et al.
- Fundamentals of Parameterized Complexity, by Downey and Fellows
- Kernelization, by Fomin, Lokshtanov, Saurabh and Zehavi
- Invitation to Fixed-Parameter Algorithms, by Niedermeier
- Parameterized Complexity Theory, by Flum and Grohe
- Exact Exponential Algorithms, by Fomin and Kratsch