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|---|---|---|---|---|---|---|---|
| **INSTITUTION** | NATIONAL AND KAPODISTRIAN UNIVERSITY OF ATHENS | | | | | | |
| **SCHOOL** | SCHOOL OF SCIENCE | | | | | | |
| **DEPARTMENT** | INFORMATICS AND TELECOMMUNICATIONS | | | | | | |
| **COURSE LEVEL** | UNDERGRADUATE | | | | | | |
| **COURSE TITLE** | **Parallel Algorithms** | | | | | | |
| **COURSE CODE** | **ΘΠ19** | | **Semester** | **8** | **ECTS** | **6** | |
| **TEACHING HOURS per week** | **THEORY** | **3** | **SEMINAR.** | **1** | **LABORATORY** | | |
| **COURSE TYPE** | Track Compulsory (EYM) | | | | | | |

| **K** | **E1** | **E2** | **E3** | **E4** | **E5** | **E6** |
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| A | E | | | | | |

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| **URL** | https://eclass.uoa.gr/courses/DI307/ |
| **EXPECTED PRIOR KNOWLEDGE/ PREREQUISITES AND PREPARATION:** | Recommended compulsory K17 Algorithms and Complexity |
| **TEACHING AND EXAMINATIONSLANGUAGE:** | GREEK |
| **THE COURSE IS OFFERED TO ERASMUS STUDENTS** | NO |

| **COURSE CONTENT** |
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| The course introduces the concept of design and analysis of parallel numerical and non numerical algorithms. In particular, covers the following subjects:<br>**Part I :** Parallel Non Numerical Algorithms. Introductory concepts, Parallel Architectures, Methods of design and development of Parallel Algorithms, Efficiency of Parallel algorithms, Parallel Selection, Parallel Merge, Parallel Sorting and Searching, Parallel Graph Algorithms, Parallel Algorithms of Computational Geometry.<br>**Part II :** Parallel numerical algorithms. Introductory concepts, Parallel matrix computations (parallel transpose of a matrix, parallel matrix vector multiplication, parallel matrix multiplication), Parallel direct methods for solving linear systems (parallel Gaussian Elimination, parallel Gauss-Jordan, parallel Huard, Parallel LU, parallel WZ), Parallel Iterative methods for solving linear systems with application to the solution of Partial Differential equations (Red-Black SOR, multicolor SOR, Local SOR), Parallel methods for computing the eigenpair of a matrix. Systolic algorithms. |

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| Also, during the tutorials students are introduced to the basics of MPI for the implementation of the parallel algorithms of the course. |

| **STUDENT LEARNING OBJECTIVES** |
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| Teaching-Learning Goals-Expected Learning Outcomes<br>To introduce students to the basic techniques of design and development parallel algorithms for the different parallel architectures.<br><br>Upon successful completion of the course the student will be able to:<br>• Describe the basic techniques for the development of parallel algorithms.<br>• Compare the efficiency of two parallel algorithms.<br>• Design and develop efficient parallel algorithms for various parallel architectures.<br>• Evaluate the suitability of a parallel algorithm for a given problem.<br>• Implement parallel algorithms using MPI. |

| **TEACHING AND LEARNING METHODS – ASSESSMENT** | |
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| **TEACHING METHOD** | In Class (Face to Face) |
| **USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES** | Learning process supported by the e-class platform. In particular, slide presentation of course and laboratory lectures, Discussions, Announcements, Task assignments and submissions, Student groups, Laboratory assignments, External Links of electronic books, notes, chapters, lectures, international Laboratories and Job announcements.<br>Email communication<br>Live transmission of lectures<br>Ability to track recorded lectures<br>Utilization of MPI |
| **TEACHING ORGANIZATION**<br>*Describe in detail the way and methods of teaching:*<br>*Enhanced Lectures,*<br>*Online Lectures,*<br>*Seminars,*<br>*Tutorial,*<br>*Laboratory,*<br>*Laboratory Exercise,*<br>*Study & analysis of literature,*<br>*Practice (Positioning),*<br>*Interactive teaching,*<br>*Developing a project,* | The theory and the tutorials are presented by slides. Students are required to submit 2 individual assignments which require the design, development and evaluation of algorithms implemented in MPI. The students have the possibility of taking advice through discussions in eclass or during office hours.<br><br>**Activity** \| ***Student Workload*** |

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| *Individual / group work*<br>*Telework (reference to tools)etc.*<br><br>*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* | |

| | *(hours)* |
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| Lectures | 39 |
| Tutorial | 13 |
| Study MPI Laboratory | 13 |
| Individual Assignments | 40 |
| Independent Study | 45 |
| ***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 mentionedand if and where they are accessible to students.*

The students are required to submit 2 individual assignments and take the final exam. The final exam is a problem solving type and covers the theoretical part of the course while the individual assignments require implementation of algorithms and cover the programming part. Students are eligible to access their written exam paper as well as their assignments and make comments on the evaluation.

| **Assessment methods** | ***Number*** | ***Percentage*** |
|---|---|---|
| Written examination | 1 | 70% |
| Assignments | 2 | 30% |

**LITERATURE AND STUDY MATERIALS / READING LIST**

1. Pantziou G, Mamalis B and Tomaras A., Introduction to Parallel Computing, New Technologies Publ., 2013.
2. Gene H. Golub, Charles F. Van Loan, Theory and Matrix Computations, John Hopkins University Press, 2015 (translated in greek, Pedio Publ.).