

COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Sciences		
ACADEMIC UNIT	Department of Computer Science		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	811SKOC	SEMESTER	8
COURSE TITLE	HIGH PERFORMANCE COMPUTING		
INDEPENDENT TEACHING ACTIVITIES <i>if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits</i>		WEEKLY TEACHING HOURS	CREDITS
Lectures		2	5
Tutorial ⁹ Exercises		2	
<i>Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).</i>			
COURSE TYPE <i>general background, special background, specialised general knowledge, skills development</i>	Specialised general knowledge, Skills development		
PREREQUISITE COURSES:			
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No		
COURSE WEBSITE (URL)			

(2) LEARNING OUTCOMES

<p>Learning outcomes</p> <p><i>The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.</i></p> <p><i>Consult Appendix A</i></p> <ul style="list-style-type: none"> • <i>Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area</i> • <i>Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B</i> • <i>Guidelines for writing Learning Outcomes</i>
<p>This course aims to introduce the fundamentals of high performance computing. The primary goal of this course is to study the design principles of parallel and distributed algorithms and the effects of memory architectures as cache effects.</p> <p>The course concentrates on modern parallel programming techniques and emphasizes novel high-level constructs that provide easy-to-use implicit threading.</p> <p>Upon the successful completion of this course, the students will have the background in theory as well as in practice to address the following issues:</p>

<ul style="list-style-type: none"> • Parallelization of a serial algorithm • Design of data access to optimize the cache utilization. • Description and presentation of parallel and distributed implementations • Use of implicit threading. 																		
<p>General Competences</p> <p><i>Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?</i></p> <table> <tr> <td><i>Search for, analysis and synthesis of data and information, with the use of the necessary technology</i></td> <td><i>Project planning and management</i></td> </tr> <tr> <td><i>Adapting to new situations</i></td> <td><i>Respect for difference and multiculturalism</i></td> </tr> <tr> <td><i>Decision-making</i></td> <td><i>Respect for the natural environment</i></td> </tr> <tr> <td><i>Working independently</i></td> <td><i>Showing social, professional and ethical responsibility and sensitivity to gender issues</i></td> </tr> <tr> <td><i>Team work</i></td> <td><i>Criticism and self-criticism</i></td> </tr> <tr> <td><i>Working in an international environment</i></td> <td><i>Production of free, creative and inductive thinking</i></td> </tr> <tr> <td><i>Working in an interdisciplinary environment</i></td> <td>.....</td> </tr> <tr> <td><i>Production of new research ideas</i></td> <td><i>Others...</i></td> </tr> <tr> <td></td> <td>.....</td> </tr> </table>	<i>Search for, analysis and synthesis of data and information, with the use of the necessary technology</i>	<i>Project planning and management</i>	<i>Adapting to new situations</i>	<i>Respect for difference and multiculturalism</i>	<i>Decision-making</i>	<i>Respect for the natural environment</i>	<i>Working independently</i>	<i>Showing social, professional and ethical responsibility and sensitivity to gender issues</i>	<i>Team work</i>	<i>Criticism and self-criticism</i>	<i>Working in an international environment</i>	<i>Production of free, creative and inductive thinking</i>	<i>Working in an interdisciplinary environment</i>	<i>Production of new research ideas</i>	<i>Others...</i>	
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(3) SYLLABUS

<ul style="list-style-type: none"> • Parallel and distributed computing • High performance computing architectures • Advanced topics in parallel computing • Thread safe data structures • Parallel programming patterns • Scalable memory allocation

(4) TEACHING and LEARNING METHODS - EVALUATION

<p>DELIVERY</p> <p><i>Face-to-face, Distance learning, etc.</i></p>	Face-to-face												
<p>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</p> <p><i>Use of ICT in teaching, laboratory education, communication with students</i></p>	Presentation with the help of slides and of the whiteboard, Website of the course with supporting and auxiliary material, Contact by e-mail.												
<p>TEACHING METHODS</p> <p><i>The manner and methods of teaching are described in detail.</i></p> <p><i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i></p> <p><i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></p>	<table border="1"> <thead> <tr> <th>Activity</th> <th>Semester workload</th> </tr> </thead> <tbody> <tr> <td>Lectures</td> <td>52</td> </tr> <tr> <td>Tutorial Exercises: Selected, representative exercises are solved concerning different modules of the course.</td> <td>26</td> </tr> <tr> <td>Literature study & analysis (group)</td> <td>25</td> </tr> <tr> <td>Individual or Group Project</td> <td>20</td> </tr> <tr> <td>Written Exams</td> <td>2x1=2</td> </tr> </tbody> </table>	Activity	Semester workload	Lectures	52	Tutorial Exercises: Selected, representative exercises are solved concerning different modules of the course.	26	Literature study & analysis (group)	25	Individual or Group Project	20	Written Exams	2x1=2
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	Course total	125 hours
STUDENT PERFORMANCE EVALUATION <i>Description of the evaluation procedure</i> <i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i> <i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i>	<p>A. A written, final exam (60%) that includes:</p> <ul style="list-style-type: none"> - Multiple choice questions - Solving exercises and problems related to the syllabus of the course <p>B. Project presentation (40%)</p>	

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- [1] Σ. Παπαδάκης και Κ. Διαμαντάρας, “Προγραμματισμός και αρχιτεκτονική συστημάτων παράλληλης επεξεργασίας”, Εκδόσεις Κλειδάριθμος 1η Έκδοση, 2011. (ΚΩΔ. 12532275). (in Greek)
- [2] Gerassimos Barlas, “Multicore and GPU Programming”, Second Edition, Elsevier, 2023.
- [3] Robert Robey, Yuliana Zamora, “Parallel and High Performance Computing”, Manning 2021.
- [4] Michael Voss, Rafael Asenjo, James Reinders, “Pro TBB”, Intel Corporation, 20199261).
- [5] James Reinders, Ben Ashbaugh, James Brodman, Michael Kunser, John Pennycook, Ximmin Tian, “Data Parallel C++, 2nd Edition”, Intel Corporation, 2023.
- [6] Daniel Kuddwurm, “Modern Parallel Programming with C++ and Assembly Language”, Apress, 2022.
- [7] David B. Kirk, Wen-mei W. Hwu, “Programming Massively Parallel Processors”, 4th Edition, 2021.
- [8] Jaegeun Hab and Bharatkumar Sharma, “Learn CUDA Programming”, Packt 2019.

- Related academic journals:

- IEEE Transactions On Parallel And Distributed Systems
- Journal of Parallel and Distributed Computing
- International Journal of Parallel Programming
- Parallel Computing