

Course unit title:	Distributed Computing & Parallel Processing
Course unit code:	CSC605
Type of course unit: (Compulsory/optional)	Optioal
Level of course unit: (First, second or third cycle)	Master (2 nd cycle)
Year of study:	1
Semester when the unit is delivered:	2
Number of ECTS credits allocated:	8
Name of lecturer(s):	TBA
Learning outcomes of the course unit:	
<p>Upon successful completion of this course students should be able to:</p> <ul style="list-style-type: none"> • Describe and discuss on fundamentals of parallel and distributed computing including parallel/distributed architectures and paradigms. • Describe currency and the issues that arise in concurrent computation as opposed to serial computation. • Discuss the requirements and special concerns of real-time environments. • Describe, discuss and compare on fault tolerant systems, distributed algorithms, and multiprocessing. • Evaluate the impact and performance of architecture topology on the formulation of parallel/distributed algorithms. • Utilize basic techniques in system performance evaluation 	
Mode of delivery:	Face-to-Face
Prerequisites and co-requisites:	CSC604
Recommended optional program components:	None

Course contents:**Objective:**

This course provides graduate students with experience of parallel and distributed computing. It gives an overview of parallel and distributed computers, and parallel computation. The goal of the course is to introduce the main algorithmic techniques in the framework of parallel and distributed models of computing; to define the most significant complexity parameters and the computational limits of parallelism and concurrency. Finally computational tools to design and analyze parallel and distributed algorithms are given.

Description:

- Interconnection networks
 - Rings, meshes, meshes of trees, hypercubes, butterflies, trees, fat trees, Clos, Benes, de Bruijn, shuffle-exchange, Omega, flip, etc.
 - Diameter, bisection, average distance, symmetry
- Parallel architectures
- Arithmetic algorithms
 - Addition, multiplication, division
 - Straightline codes and parallelization
- Combinatorial algorithms
 - Maximum spanning tree
 - Maximum matching
- Numerical algorithms
- Systolic array algorithms
- Fundamental algorithms: prefix, sorting, and FFT
- Routing
 - Randomized vs deterministic algorithms
 - Packet routing
 - Wormhole routing
 - Buffer analysis
- Embedding and simulation
- Parallel primitives: scans, broadcast, total exchange
- Fault tolerance

- Optical networks
 - Technology
 - Routing
 - Lower bounds

- Reconfigurable architectures
 - Rationale
 - Networks and reconfiguration algorithms
 - Embedding

- Simulation of ideal parallel models

- Distributed algorithms
 - Symmetry breaking
 - Leader election
 - Byzantine Generals Problem (consensus problems)
 - Approximate consensus
 - Snapshots
 - Broadcasting
 - Clock synchronization

<p>Recommended or required reading:</p>	<p>F. T. Leighton., Introduction to Parallel Algorithms and Architectures: Arrays, Trees, Hypercubes. Morgan Kaufmann, 1992.</p> <p>N. Lynch.,Distributed Algorithms. Morgan Kaufmann, 1996.</p> <p>Nicola Santoro: Design and Analysis of Distributed Algorithms, Wiley ed., 2007</p> <p>Attiya, Hagit, and Jennifer Welch. Distributed Computing., Fundamentals, Simulations, and Advanced Topics. 2nd ed. New York, NY: Wiley-Interscience, 2004. ISBN:9780471453246.</p> <p>Herlihy, Maurice, and Nir Shavit. <i>The Art of Multiprocessor Programming</i>. Burlington, MA: Morgan Kaufmann, 2008. ISBN: 9780123705914.</p>				
<p>Planned learning activities and teaching methods:</p>	<table border="1" style="width: 100%;"> <tr> <td style="width: 60%;">Class Instruction:</td> <td style="text-align: center;">42 hours</td> </tr> <tr> <td>Consultation:</td> <td style="text-align: center;">15 Hours</td> </tr> </table>	Class Instruction:	42 hours	Consultation:	15 Hours
Class Instruction:	42 hours				
Consultation:	15 Hours				

Assessment methods and criteria:	<table border="1"> <tr> <td>Examinations</td> <td>50%</td> </tr> <tr> <td>Project/Assignments</td> <td>50%</td> </tr> <tr> <td></td> <td>100%</td> </tr> </table>	Examinations	50%	Project/Assignments	50%		100%
Examinations	50%						
Project/Assignments	50%						
	100%						
Language of instruction:	English						
Work placement(s):	No						
Place of Teaching:	<p>Regular Classroom European University Cyprus, Nicosia</p> <p>Computer Science Laboratory European University Cyprus, Nicosia</p>						