Course name : **Concurrent and Distributed Programming**		
Type of study: **Computer science**	Type of study: **Full-time**	Course code: **D5_02, E5_02**
Course characteristics: **Mandatory within the additional content**	Level: **First**	Year: 3 Semester: 5
Type of classes: **lectures, laboratories**	Hours per week: **2 lect, 2 lab**	ECTS points: **6 ECTS**

COURSE GUIDE

AIMS

A1. Knowledge on parallel architectures and models, standards and techniques for concurrent, distributed, and parallel programming.

A2. Practical skills in concurrent / distributed / parallel programming, running and debugging the application for different types of concurrent and distributed architectures.

PREREQUISITES

1 Basic knowledge of computer architecture and operating systems.
2 Basic knowledge of the theory of algorithms and data structures.
3 Ability of C++ and Java programming.
4 Ability to use different sources of information and technical documentation.
5 Ability to work independently and in a group.
6 Ability to correctly interpret and present their own activities.

LEARNING OUTCOMES

EE 1 – has knowledge about the elements of concurrent programming, parallel and distributed computing.

EE 2 – has knowledge about the parallel architectures, knows the different standards of distributed and concurrent programming.

EE 3 – able to create concurrent, parallel and distributed applications.

EE 4 – has basic skills in analyzing the correctness and performance of parallel and concurrent programs.

EE 5 – able to design and implement a distributed application, based on the programming model.

CONTENT

Lectures	Hours
Lect. 1 - Introduction to parallel processing and parallel system architecture	2
Lect. 2 - Distributed processing / parallel clusters and grid systems	2
Lect. 3 - Examples of application parallel and distributed computing	2
Lect. 4 - Constructing parallel and distributed algorithms – part 1	2
Lect. 5 - Constructing parallel and distributed algorithms – part 2	2
Lect. 6 - Parallel and distributed programming models	2
Lect. 7 - Introduction to languages environments of parallel and distributed programming	2

Lect. 8 - Parallel programming using MPI standard – part 1	**2**
Lect. 9 - Parallel programming using MPI standard – part 2	**2**
Lect. 10 - Basic concepts of concurrent programming	**2**
Lect. 11 - Representative examples of concurrent programming problems and their solutions using MPI	**2**
Lect. 12 - Multithreaded Programming in Java – part 1	**2**
Lect. 13 - Multithreaded Programming in Java – part 2	**2**
Lect. 14 - Representative examples of concurrent programming problems and their solutions using Java	**2**
Lect. 15 - The use of RMI environment for building distributed applications	**2**
LABORATORIES	Hours
Lab. 1 - Principles of creating and running parallel programs in C / C ++ for MPI environment, running simple programs.	**2**
Lab. 2 - Point-to-point communication.	**2**
Lab. 3 - Creating programs using the master-worker model.	**2**
Lab. 4 - Examples of more advanced parallel programs in MPI environment.	**2**
Lab. 5 - Analysis and optimizing the performance of parallel programs in MPI environment – part 1	**2**
Lab. 6 - Analysis and optimizing the performance of parallel programs in MPI environment – part 2	**2**
Lab. 7 - Written test.	**2**
Lab. 8 - Introduction to multithreaded programming in Java.	**2**
Lab. 9 - Synchronization of threads to access shared resources.	**2**
Lab. 10 - Coordination of threads in the producer-consumer problem.	**2**
Lab. 11 - Coordination of threads in the dining philosophers problem.	**2**
Lab. 12 - Coordination of threads in the readers and writers problem.	**2**
Lab. 13 - Profilining of concurrent applications	**2**
Lab. 14 - Analysis and optimizing the performance of parallel programs in Java environment	**2**
Lab. 15 - Written test.	**2**

TEACHING TOOLS

1. – lectures using multimedia presentations
2. – blackboard and chalk or whiteboards and pens
3. – laboratory guides
4. – reports from laboratory activities
5. – computers with software

LITERATURE

Andrews, G.R.: „Foundations of Multithreaded, Paralel and Distributed Programming". Addison Wesley, 2002.
Grama, A., Gupta, A., Kumar, V., Karypis, G.: „Introduction to parallel computing (second edition)". Addison-Wesley, 2003.

TEACHERS

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