MODERN DISTRIBUTED SYSTEMS AND HIGH-PERFORMANCE APPLICATIONS

GENERAL

SCHOOL	ENGINEERING		
DEPARTMENT	INFORMATICS AND COMPUTER ENGINEERING		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE		**SEMESTER**	1st
COURSE TITLE	Modern Distributed Systems and High-Performance Applications		

INDEPENDENT TEACHING ACTIVITIES *(In case credits are allocated to distinct parts of the course, e.g., Lectures, Laboratory Exercises, etc. If credits are allocated uniformly to the entire course, state the weekly teaching hours and total credits.)*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	3	8

COURSE CONTENT

The course includes the following teaching units:

- **Basic principles of distributed and parallel processing.**
- **Modern processor systems and parallel computer architectures** (multiprocessor systems, computer clusters, hybrid systems, integrated data centers, many-core architectures, accelerators, and co-processors).
- **Instruction Level Parallelism (ILP):** Dynamic instruction scheduling, out-of-order execution, speculative execution, branch prediction techniques. Main memory technologies, memory system hierarchy, cache memory. Very Long Instruction Word (VLIW) processors, superscalar processors.
- **Multiprocessors/Multicomputers:** Communication methods (shared address space, message passing), interconnection network topologies, cache coherence problem.
- **Multicore Processors:** Organization of multiple cores in embedded systems, mobile devices, personal computers, servers, and large computing systems.
- **Graphics Processing Units (GPUs):** Accelerators for graphics processing and general-purpose units for computation-intensive applications.
- **Parallel algorithms in shared memory environments.**
- **Parallel/Multithreaded programming:** High-performance applications in shared memory environments (OpenMP) and in modern accelerator/GPUs environments (CUDA, OpenCL).
- **Parallel algorithms in distributed memory environments.**
- **Parallel programming:** High-performance applications in distributed memory environments via message passing (MPI) and in hybrid environments/architectures (MPI+OpenMP+CUDA).
- **Basic algorithmic topics of distributed computing:** (clock synchronization, leader election, mutual exclusion, fault tolerance, consensus, and distributed commitment).
- **Peer-to-peer systems and their applications.**
- **Modern client-server systems, middleware, and their applications.**
- **Cluster computing.**
- **Distributed file systems for big data.**
- **Distributed processing in grid computing and cloud computing.**
- **The MapReduce model and its applications** (using Hadoop and Spark) in distributed big data systems.