Program	Type of studies (cycle)	Third cycle
	Name of the program	SEE Doctoral Studies in Mathematical Science

Course

Course title	**High performance computing**

Course code	Semester	Course status	ECTS credits	Contact hours
	II		10	30

Teaching staff	Teacher	Prof. dr. Marjan Gusev
	Other staff	

Course goals	The main goal of the course is to give an introduction into the field of High performance computing (HPC) in mathematical areas. The students will acquire specialties of recent and future hardware concepts as well as on supporting software standards. The course work will be organized such that all course topics will be implemented on the appropriate hardware ranging from a single CPU via multiple CPUs to clusters of CPUs and GPUs.

Course content/topics

- The von-Neumann computer concept
- Flynn's Taxiometry (SISD, SIMD, MISD, MIMD)
- Topologies of computer/processor networks
- Concurrency and Correctness (data races, atomic operations, deadlock, live lock)
- Shared memory; semaphores/mutex; distributed memory; hybrid environments
- Partitioning; Communications; Synchronization; Data Dependencies; Granularity
- Limits and Coast of Parallel Programming
- Speedup, weak speedup, eciency; Amdahl's law; Gustavson's law
- Review of recent Multi-core processors

LITERATURE

[1] J. L. Hennessy and D. A. Patterson, Computer Architecture: A Quantitative Approach, Morgan Kaufmann Publishers, 3rd edition, 2003.

[2] M.Herlihy and N. Shavit,The Art of Multiprocessor Programming. Morgan Kaufmann, 2008.

[3] T. Rauber and G. Runger, Parallel Programming: for Multicore and Cluster Systems, Springer, Berlin, 2010.

Grading

	Criterion	Points	Cut-off points
1.	Written assignment	20	11
2.	Project	40	22
3	Final exam	40	22
	Total	100	55