# Specification for the book of courses

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| **Study program** | Computing and Informatics | | |
| **Module** | Computer Systems Security | | |
| **Type and level of studies** | Master studies | | |
| **The name of the course** | High-performance Computing | | |
| **Lecturer (for lectures)** | Stojanović M. Natalija, Milentijević Z. Ivan | | |
| **Lecturer/associate (for exercises)** | Dimitrijević M. Aleksandar | | |
| **Lecturer/associate (for OFE)** | | | |
| **Number of ECTS** | 4 | **Course status (obligatory/elective)** | Elective |

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| **Prerequisites** | |
| **Course objectives** | Acquiring knowledge to develop high performance applications that require intensive computation and processing large amounts of data on modern computer architectures (GPU, multicore PCs, network of workstations, cluster, grid, etc.) in different domains. |
| **Course outcomes** | Understanding the concepts and technologies of high-performance computing as well as acquiring the theoretical and practical knowledge for the development and analysis of high performance applications on modern computer architectures. |
| **Course outline** | |
| **Theoretical teaching** | Overview of advanced concepts, methods and techniques in high-performance computing (HPC High Performance Computing). High-performance computing in distributed environment on the network of workstations (cluster), grid and cloud computing. High-performance computing on multi-core computers with shared memory and many-core architectures, such as graphics processing unit (GPU). High-performance computing on hybrid architectures. Modern technologies to achieve high performance (CUDA/OpenCL, OpenACC, Thrust biblioteka, OpenMP, Intel TBB, MPI, Hadoop MapReduce). Performance analysis, assessment and improvement (execution time, energy consumption and programming effort for program parallelization ) of HPC systems using appropriate tools. HPC applications in geographical information systems (GIS), image processing, environmental protection, business systems, bioinformatics, etc. |
| **Practical teaching (exercises, OFE, study and research** | Work through the HPC examples over the set of laboratory exercises. CUDA application development and performance analysis. OpenMP application development and performance analysis. |
| **Textbooks/references** | |
| 1 | Programming Massively Parallel Processors: A Hands-on Approach, David Kirk, Wen-mei W. Hwu, Wen-mei Hwu, Elsevier, 2017. |
| 2 | CUDA by example: an introduction to general-purpose GPU programming, Jason Sanders, Edward Kandrot, Addison-Wesley Professional, 2011 |
| 3 | Using OpenMP : portable shared memory parallel programming / Barbara Chapman, Gabriele Jost, Ruud van der Pas, MIT Press 2008. |
| 4 | Intel Threading Building Blocks Outfitting C++ for Multi-core Processor Parallelism, James Reinders, O' Reilly Media,2007 |
| 5 | |

**Number of classes of active education per week during semester/trimester/year**

| Lectures | Exercises | OFE | Study and research work | Other classes |
|---|---|---|---|---|
| 2 | 1 | 0 | | |

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| **Teaching methods** | Lectures. Lab. exercises. Homeworks, and projects, student seminars (presentation and discussion of students' work). |

**Grade (maximum number of points 100)**

| Pre-exam duties | Points | Final exam | Points |
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| Activity during lectures | | Written exam | |
| Exercises | 50 | Oral exam | 30 |
| Colloquia | | | |
| Projects | 20 | | |