1.	Course title	**High performance computing – HPC**		
2.	Course code	KMET-I-13		
3.	Study program	**Computer networks and e-technologies**		
4.	Unit offering the course	**FCSE**		
5.	Undergraduate/master/PhD	**Master**		
6.	Year/semester 1(2)/summer/elective	7. ECTS: **6**		
8.	Teacher(s)	Assoc. Prof. Dimitar Trajanov, Assist. Prof. Sonja Filiposka, Assist. Prof. Boro Jakimovski, Assist. Prof. Anastas Mishev		
9.	Course prerequisites	None		
10.	Goals (competences): After successfully completing the course, the student is expected to understand the high performance computing architectures and systems.			
11.	Course content: What is high-performance computing? High-performance computing architecture. Compilers for HPC systems. High-performance computing programming languages. Programming loop removal. Parallelisation. HPC systems. Mass memories. Interconnection networks and clusters. Grid structures. Pipelining. Performances and optimization. Grid applications. HPC microprocessors. Design and evaluation of modern parallel processors. Parallelism principles, instruction level parallelism. Multiprocessor systems. Memory hierarchy design. Scalable parallel processing. MIMD architecture and alternatives: dataflow, SIMD. Parallel programming models. Communication primitives, programming techniques and compiling. Existing programming languages, compilers, environments, libraries and tools for parallel programming. Hypercube architecture and algorithms. Message Passing Interface-MPI, Parallel Virtual Machine-PVM. Data storage management. Deadlock. Synchronisation and load balancing techniques.			
12.	Teaching methods: Lectures supported by slide presentations, interactive lectures, trainings (using lab equipment and software packages), team work, case studies, invited guests and lectures, individual practical assignments presentations, seminar paper, e-learning (forums, consultations).			
13.	Total available time	6 ECTS x 30 hours = 180 hours		
14.	Distribution of the available time	30 + 15 + 135 = 180 hours		
15.	Teaching activities	15.1.	Lectures	30 hours
		15.2.	Training (labs, problem solving), seminar and team work	15 hours
16.	Other activities	16.1.	Project work	60 hours
		16.2.	Self study	25 hours
		16.3.	Home work	50 hours
17.	Grading			
	17.1.	Tests		45 points
	17.2.	Seminar work/project (written or oral presentation)		45 points

	17.3.	Active participation		10 points
18.	Grading criteria		to 59 points	5 (five) (F)
			from 60 to 68 points	6 (six) (E)
			from 69 to 76 points	7 (seven) (D)
			from 77 to 84 points	8 (eight) (C)
			from 85 to 92 points	9 (nine) (B)
			from 93 to 100 points	10 (ten) (A)
19.	Final exam prerequisites		Successfully completed activities 15.1 and 15.2	
20.	Course language		Macedonian and English	
21.	Quality assurance methods		Internal evaluation and student questionnaires	

22. Literature

22.1. Compulsory

No.	Authors	Title	Publisher	Year
1.	Georg Hager, Gerhard Wellein	Introduction to High Performance Computing for Scientists and Engineers (Chapman & Hall/CRC Computational Science)	CRC Press	2010
2.	Christos Daillidis	Establishing Linux Clusters for High-performance Computing (HPC) at NPS	Amazon Digital Services	2010
3.	Adam Vile, James Liddle	The Savvy GuideTo HPC, Grid, Data Grid, Virtualisation and Cloud Computing	TheSavvyGuideTo	2008

22.2. Additional

No.	Authors	Title	Publisher	Year
1.	F. Berman, G. Fox, T. Hey, (Eds)	Grid Computing; Making the Global Infrastructure a Reality	John Wiley & Sons Ltd	2003
2.		Selected papers		
3.				