1.	Course Title	Embedded microprocessor systems
2.	Code	F18L3S040
3.	Study program	Software engineering and information systems
4.	Study Program Organizer	Faculty of Computer Science and Engineering
5.	Degree (first, second, third cycle)	first cycle
6.	Academic year / semester 3 / summer / mandatory	7. ECTS credits 6
8.	Teacher	associate professor Nevena Ackovska, assistant professor Sashko Ristov, assistant professor Vladimir Zdraveski
9.	Course enrollment prerequisites	Архитектура и организација на компјутери или Компјутерски архитектури

10. Course program goals (competencies):
 Students shall gain familiarity with embedded systems hardware, software and systems design. They will understand the importance of the hardware-software interaction, and interfacing with sensors and actuators. They will gain familiarity in programming embedded systems in both assembly and a high-order language. The students will be able to define and execute architectural trade-offs, including hardware and software needed to build a modern embedded system.

11. Course program content:
  Microprocessors. Embedded systems processor architecture. Types of processors for embedded systems: micro controllers, GPU, heterogeneous SoC. FPGA based processors. Parallel I/O. serial communication. Interrupts and timing. A/D and D/A signal conversion. Control, sensors and actuators. Low power consumption techniques. Networking an mobility of embedded systems - toward Internet of things (IoT). Advanced protocols of r serial communication and memory of embedded systems. Programming the embedded systems.

12. Learning methods:
 Lectures using presentations, interactive lectures, exercises (using equipment and software packages), teamwork, case studies, invited guest lecturers, independent preparation and defense of a project assignment and seminar work.

13.	Total available time	6 ECTS x 30 hours = 180 hours
14.	Distribution of the available time	30 + 45 + 15 + 15 + 75 = 180 hours

15.	Teaching activity forms	15.1.	Lectures – theoretical teaching	30 hours
		15.2.	Exercises (laboratory, auditory), seminar papers, teamwork	45 hours
16.	Other activity forms	16.1.	Project Tasks	15 hours
		16.2.	Independent Learning Tasks	15 hours
		16.3.	Home learning	75 hours

17.	Assessment methodology		
	17.1.	Tests	10 points
	17.2.	Seminar paper/project (presentation: written and oral)	30 points
	17.3.	Activity and learning	10 points
	17.4.	Final exam	50 points

18.	Assessment criteria (points/grade)	up to 50 points	5 (five) (F)
		51 to 60 points	6 (six) (E)
		61 to 70 points	7 (seven) (D)
		71 to 80 points	8 (eight) (C)
		81 to 90 points	9 (nine) (B)
		91 to 100 points	10 (ten) (A)

19.	Course completion and final exam requirements	Realized activities 15.1 and 15.2
20.	Teaching Language	Macedonian and English
21.	Teaching quality evaluation method	Internal evaluation mechanisms and questionnaires
22.	Course Material	
	22.1. Mandatory course material	

No.	Author	Title	Publisher	Year
1	Ed Lipiansky	Embedded Systems Hardware for Software Engineers	McGraw-Hill	2012
2	John Catsoulis	Designing Embedded Hardware: Create New Computers and Devices	O'Reilly	2005
3	Raj Kamal	Microcontrollers: Architecture, Programming, Interfacing and System Design	Pearson	2005
4				0

22.2.	Additional course material			
No.	Author	Title	Publisher	Year