Add. 3		Course program for the second level (second cycle - postgraduate) of studies		
1.	Course title	Automation of environmental processes		
2.	Code	1M6SEE08		
3.	Study group(s)	SEE		
4.	The organizer of the study program (unit, institute, department)	"Ss. Cyril and Methodius" University in Skopje, Faculty of Mechanical Engineering – Skopje		
5.	Level (first, second, third)	Second		
6.	Academic year / semester	V / summer	7. ECTS credits	6
8.	Professor(s)	Ass. prof. dr. Emil Zaev Ass. prof. dr. Darko Babunski		
9.	Prerequisites	None		
10.	Course objectives (competences): Acquire knowledge of: Analysis and design of automation systems for river monitoring and water and wastewater treatment processes. Acquire programming skills in the Matlab platform. Analysis, design and implementation of SCADA systems – Supervisory Control and Data Acquisition and Programmable Logic Controllers (PLC). Functionality and characteristics of environmental measurement systems to monitor and control environmental processes;			
11.	Course content: Introduction to the most commonly used types of control algorithms (sequential, continuous, On-Off and Feedforward control, feedback (P, PI and PID Control) Advanced control algorithms: adaptive, nonlinear, model control) - Examples of implementation of control algorithms in facilities for treatment of drinking water (Basic plant model: Control of pumps, coagulation dosing, pH, purification and sedimentation, filtration and chlorination) plants for wastewater treatment (Control of dissolved oxygen, depth of the sludge refiner) and general control algorithms in the plant, - Control system architecture. Supervisory Control and Data Acquisition (SCADA) and DCS systems (Introduction, SCADA / DCS software, hardware management system (PLC, RTU, Networks), OPC), - Programming and configure the Programmable Logic Controllers (PLC) control subsystem (PLC programming) - Basic instrumentation (instrumentation for measuring flow, temperature, level, pressure and analytical instrumentation).			
12.	Study methods: lectures, lab, project assignments, individual assignments, self-study.			
13.	Total hours	6 ECTS x 30 = 180 hours		
14.	Hours allocation per activity:	30 + 15 + 40 + 30 + 65 = 180 hours		
15.	Lectures/Lab	15.1.	Lectures (15 weeks x 2)	30 hours
		15.2.	Lab (student work)	15 hours
16.	Project Work/Assignments	16.1.	Project assignments	40 hours
		16.2.	Individual assignments	30 hours
		16.3.	Self-study	65 hours

17.	Points/Marks:			
	17.1.	Exams		40
	17.2.	Projects		50
	17.3.	Attendance		10
18.	Grading scale		Under 50	5 (five) (F)
			51 - 60 points	6 (six) (E)
			61 - 70 points	7 (seven) (D)
			71 - 80 points	8 (eight) (C)
			81 - 90 points	9 (nine) (B)
			91 - 100 points	10 (ten) (A)
19.	Prerequisites for taking the final exam		Activity 16.1	
20.	Language		English	
21.	Course evaluation		Student questionnaire	
22.	Textbooks			

22.1	Instruction materials				
	No.	Author	Title	Publisher	Year
	1.	AWWA	Water treatment plant design	McGraw-Hill	1990
	2.	G. Tchobanoblous	Wastewater Engineering Treatment and Reuse	McGraw-Hill	2003
	3.	M.L. Davis	Water and Wastewater Engineering	McGraw Hill	2010.

22.2	Supplemental Instruction Materials				
	No.	Author	Title	Publisher	Year
	1.	S.A.Boyer	SCADA: Supervisory Control and Data Acquisition	ISA - The Instrumentation, Systems, and Automation Society	1999
	2.	W. Bolton	Programmable Logic Controllers	Elsevier	2009