Add. 3	**Course program for the second level (second cycle - postgraduate) of studies**					
1.	Course title		Clean fossil and alternative fuels energy			
2.	Code		1M6SEE09			
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 degree)		Second			
6.	Academic year / semester		V / summer	7.	ECTS credits	6
8.	Professor		Assoc. prof. dr. Risto Filkoski			
9.	Prerequisites for enrolling the course		None			
10.	Course objectives (competences): Acquiring knowledge about the methods and techniques for efficient utilisation of fossil and alternative fuels. Acquiring knowledge regarding energy technologies for environmental protection that apply to combustion plants. Analysis, calculation and optimal performance of combustion systems. Modelling and simulation techniques of aerodynamics, combustion and heat transfer in thermal energy systems (boilers, combustors, furnaces, heat exchangers etc.).					
11.	Course content: Properties of fossil and alternative fuels. Energy transformations of fuels: combustion, pyrolysis, gasification, liquefaction. Mass and energy balance of combustion process. Kinetics and dynamics of fuels combustion. Processing and handling of solid fuels. Methods and techniques for combustion of solid fuels, examples of application. Processing and handling of liquid and gaseous fuels. Methods and techniques for combustion of solid fuels, examples of application. Environmental considerations. Classification of pollutants, sources of plant emissions and discharges. Air pollution control. Techniques for reduction of solid particles emission. Thermodynamics and kinetics of SO_2 formation. Methods and techniques for SO_2 emission reduction. Thermodynamics and kinetics of NO_x formation. Methods and techniques for NO_x emission reduction. Methods and techniques for combined deSO_2/deNO_x. Methods for CO emission reduction. Greenhouse gases emission. Methods and techniques for reduction of GHG emission. Modelling, simulation and optimisation techniques of burners, combustion chambers, boiler plants, furnaces, thermal energy facilities. Modelling of the pollutants formation and reduction.					
12.	Study methods: Interactive lectures, auditory and/or laboratory practice, selfrunning and/or team work on project assignments, selfrunning assignments					
13.	Total hours		6 ECTS x 30 hours = 180 hours			
14.	Hours allocation per activity:		30+ 30 + 40 + 30 + 50 = 180 hours			
15.	Lectures/Lab	15.1.	Lectures	30 hours		
		15.2.	Lab (student work)	30 hours		
16.	Project Work/Assignments	16.1.	Project assignments	40 hours		
		16.2.	Individual assignments	30 hours		

		16.3.	Self-study	50 hours

17.	Points/Marks:		
	17.1.	Exams	50 points
	17.2.	Projects	45 points
	17.3.	Attendance	5 points

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	Activities 15.2 and 16.1	
20.	Language	English	
21.	Course evaluation	Student questionnaire	
22.	Textbooks		

22.1 Instruction materials

No.	Author	Title	Publisher	Year
1.	Edited by J.B. Kitto and S.C. Stultz	Steam, It's generation and use, Ed. 41	The Babcock & Wilcox Compaany	2005
2.	Baukal C.E. et al.	CFD in Industrial Combustion	CRC Press	2001
3.	Group of authors	IPPC, Ref. Document on BAT for Large Combustion Plants	European Commission, Seville	2006

22.2 Supplemental Instruction Materials

No.	Author	Title	Publisher	Year
1.	Warner, Davis and Wark	Air Pollution: Its Origin and Control, 3rd Edition	Addison-Wesley-Longman	2003
2.	Petrovski I. J.	Steam Boilers, 2nd ed.	UKIM	2009
3.	Baukal C.E. et al.	Heat Transfer in Industrial Combustion	CRC Press	2000