

Add. 3		Course program for the first, second and third level (cycle) of studies			
1.	Course title	Renewable energy sources			
2.	Code	236			
3.	Study group(s)	TE			
4.	The organizer of the study program (unit, institute, department)	Faculty of Mechanical Engineering - Skopje, Ss. Cyril and Methodius University in Skopje			
5.	Level (first, second, third)	First			
6.	Academic year / semester	summer	7.	ECTS credits	6
8.	Instructor	Slave Armenski			
9.	Prerequisites	no			
10.	Course objectives (competences): Introduction of renewable energy sources (solar, geothermal, biomass and wind), technologies and equipment for their transformation into thermal, mechanical and electrical energy; working fluids; thermal cycles and processes, accumulation of energy; efficiency coefficient; equipment; environment impact				
11.	Course content: SOLAR ENERGY: Technologies for transformation of solar energy into heat and electricity and efficiency of transformation. Systems for water heating, air heating and cooling; drying and seawater desalination. Systems for accumulation of solar energy. GEOTHERMAL: Geothermal energy and geothermal sources. Direct use of geothermal energy for residential, commercial and industrial purposes: greenhouse production, district heating, drying and Aquaculture. Technologies for transformation into electricity. Environmental impact. BIOENERGY: Biomass production and classification. Energy potential of biomass. Technologies for biomass transformation into liquid, gas and solid fuels. Power plants for biomass energy utilization: small and medium capacity and cogeneration power plants. WIND ENERGY: Transformation of wind energy into mechanical energy. Fundamental elements of wind turbine. Designing the blades of wind turbine. Control and management systems. Economy, reliability and availability. Environmental impact				
12.	Study methods: Interactive lectures, exercises auditory and / or laboratory, individual and / or team work project tasks, self-learning.				
13.	Total hours	6 ECTS x 30 = 180 hours			
14.	Hours allocation per activity:	30 + 30 + 30 + 30 + 60 = 180 hours			
15.	Lectures/Lab	15.1.	Lectures	30	
		15.2.	Lab (student work)	30	
16.	Project Work/Assignments	16.1.	Project assignments	30	
		16.2.	Individual assignments	30	
		16.3.	Self-study	60	
17.	Points/Marks:				
	17.1.	Tests			70 points
	17.2.	Projects			20 points
	17.3.	Attendance			10 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	No			
20.	Language of Instruction	Macedonian			
21.	Course evaluation	Student questionnaire			
22.	Textbooks				

		Instruction materials				
	22.1.	No.	Author	Title	Publisher	Year
		1.	Slave ARMENSKI	Renewable – <i>Sustainable</i> Energy Sources	"EVROPA-92"-Kochani	2012
		2.	Slave ARMENSKI	Solar Energy-thermal transformation	"Jofi-sken"-Skopje	2012
		3.	Slave ARMENSKI	Biomass Energy	Alfa-94	2009
		Supplemental Instruction Materials				
	22.2.	No.	Author	Title	Publisher	Year
		1.	A.V da Rosa	Fundamentals of Renewable Energy Processes, 2nd Edition		2009
		2.	B. Sorensen	Renewable Energy, Its physics, engineering, use, environmental impacts, economy and planning aspects, Third Edition		2004
		3.	H. Lund	Renewable Energy Systems, The Choice and Modeling of 100 % Renewable Solutions		2010