

Add. 3		Course program for the first, second and third level (cycle) of studies			
1.	Course title	Energy Efficiency			
2.	Code	147			
3.	Study group(s)	EE (Energy and Ecology)			
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	4 / VIII summer	7.	Number of ECTS credits	6
8.	Instructor	assoc. prof. PhD Done Tashevski			
9.	Prerequisites	Thermodynamics - passed			
10.	<p>Course objectives (competences): Introducing the measures, methods and systems to improve energy efficiency in buildings, industry, agriculture and forestry, energy and transport. Candidates will be able to complete energy efficient management in these areas (control, planning, selecting the EE system, implementation, investment and ecology).</p>				
11.	<p>Course content: INTRODUCTION AND DEFINITIONS. Factors affecting of energy needs. Indicators of energy use and energy efficiency. Energy consumption per unit of product. Barriers to improving energy efficiency. Direct link between energy efficiency and the ecology. RESIDENTIAL AND ADMINISTRATIVE BUILDINGS. Energy savings. Thermal insulation. Quality of building elements (windows, doors, etc.). Improve the efficiency of the equipment: sanitary water heating, central heating and cooling, lighting and electrical equipment, ventilation, air conditioning. Economically justified energy savings programs and energy prices. Renewable energy sources. INDUSTRY. Structure of the energy used in different branches of industry. Utilization of waste heat. Improving the efficiency of the systems: combustion (boilers, stoves, and burners), compressed air, technological steam, heat distribution, control (automation), and electric motors. TRANSPORT. Energy consumption, savings and benefits of energy savings in the transport sector. Role of energy efficiency in the transport sector: improving the technical efficiency of vehicles, replacing of the fuel type, the use of alternative fuels and alternative fuel engines, use of modern materials in engines, change the type of transport. AGRICULTURE, LIVESTOCK AND FORESTRY. Role of agriculture in energy consumption. Energy saving and energy efficiency in agriculture. Improving the energy efficiency of the equipment. Use of energy from waste (direct combustion, the use of biogas and biodiesel). Solar energy in drying processes. COMBINED PRODUCTION OF ELECTRICITY AND HEAT. Energy cogeneration systems. Role of cogeneration of electricity and heat in the total energy savings. IMPROVE ENERGY EFFICIENCY. Control of processes. Utilization and process integration. Use of waste materials, reducing and recycling. Policies and programs to improve energy efficiency: industry information and technical assistance programs, technology, development and commercialization, standard and regulation. ENERGY AND ENVIRONMENT. Global climate change and damage to the environment. Land use. Radiation and radioactivity. Disposal of solid waste. Depletion of stratospheric ozone.</p>				
12.	Study methods: Teaching lectures, auditory/laboratory practice, self/team work, home studding				
13.	Total hours	6 ECTS x 30 hours = 180 hours			
14.	Hours allocation per activity:	30 + 30 +10 +10 +100 = 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	10 hours	
		16.2.	Individual assignments	10 hours	
		16.3.	Self-study	100 hours	
17.	Points/Marks:				

	17.1.	Tests	80 points
	17.2.	Projects	10 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		Realized activity 17.2. and 17.3.
20.	Language of Instruction		Macedonian
21.	Course evaluation		Student questionnaire

22.	Textbooks				
	Instruction materials				
	No.	Author	Title	Publisher	Year
22.1	1.	D.Tashevski	Energy efficiency – printed lectures	FME	2009
	2.	D. R. Wulfinghoff	Energy efficiency	Energy institute	1999
	3.	P. Bertoldi	Energy efficiency	Springer	2007
	Supplemental Instruction Materials				
22.2	No.	Author	Title	Publisher	Year
	1.	S. Armenski	Renewable energy sources	Alafa-94 Skopje	2008
	2.	S. Armenski	Thermo technical machines and equipment	Alafa-94 Skopje	2010
	3.	D. Tashevski, S. Armenski	Thermo technical machines and equipment - exercise	Alafa-94 Skopje	2009