POLYTECHNIC OF MEĐIMURJE IN ČAKOVEC

COURSE SYLLABUS

ACADEMIC YEAR: 2020/2021

1. GENERAL COURSE INFORMATION

1.1 Course name	**Basics of Energetics**			
1.2 Study program/s	Undergraduate professional study Sustainable Development			
1.3 Course status (O,E)	O	**1.6 Mode of instruction (number of hours)**	**Lectures**	30
1.4 Course code			**Exercises**	30
1.5 Course abbreviation	OE		**Seminars**	
1.6 Semester	I		**E-learning**	
1.7 ECTS	5	**1.7 Place and time of instruction**	Premises of the Polytechnic of Međimurje in Čakovec, according to the schedule published on the website	

2. TEACHING STAFF

2.1 Course leader/s-title	Marijan Horvat, dipl.ing.str.,pred.	**contact**	mhorvat2@mev.hr
		contact	
2.2 Assistant/s- title	-	**contact**	
		contact	
2.3 Instruction held by-title	Marijan Horvat, dipl.ing.str.,pred.	**contact**	mhorvat2@mev.hr

3. COURSE DESCRIPTION

3.1 Course goals	The student will be able to evaluate energy systems and make simple energetics calculations.
3.2 Prerequisites	There are no conditions
3.3 Course outcomes	After successfully completing the course, students will be able to: I1 - Analyse thermodynamic quantities using basic concepts of thermodynamics. I2 - Analyse the forms and sources of energy regarding production and consumption and the economical-technical-technological-ecological context. I3 - Comment on the laws of energy conversion. I4 - Interpret the principles of operation of thermal and electrical machines. I5 - Propose energy efficiency measures based on the loss calculation of a simple building. I6 - Assess the environmental impacts of energy production, conversion, transport, and use.
3.4 Course content	The course presents contents related to energetics. Based on analyses, comments, interpretations, proposals and calculations, the student will be able to objectively articulate the field of energetics.

3.5 Types of coursework										
	x	Lectures	x	Exercises		Blended e-learning		Individual activities		Laboratory
		Seminars and workshops		Distant learning		Field classes		Multimedia and network		Mentorship
		Other								

3.6 Language of instruction

Croatian

3.7 Monitoring students' work (enter the number of ECTS credits for each activity so that the total number of ECTS credits is equal to the total ECTS value of the course, 1 ECTS = 30 hours)

2	Class attendance		Seminars		Essay
	Class activity		Project		Report/paper
2,00	Midterm exams		Practical task		Continuous knowledge check
(2,00)	Written exam		Experimental work		
1.00	Oral exam		Research		

3.8 Assessment and evaluation of students' work during classes and at the final exam

Activity specification	Percent %	Points
Assessment during instruction		
Attendance	5%	5
Class activity	5%	5
Seminar/ project/ essay	30%	30
Midterm exam 1	30%	30
Midterm exam 2	30%	30
Exam assessment for the students who failed to fulfil all the obligatory requirements during the semester		
Written exam	*60%*	*60*
Total:	**100%**	**100**

3.9 Assessment criteria – analysis per learning outcomes *

	Ways of evaluating learning outcomes						
	Attendance	**Activity**	**Mid-term exam 1**	**Mid-term exam 2**	**Written exam ***	**Oral exam**	**Total**
Outcome 1			10		(10)	5	15
Outcome 2			10		(10)	5	15
Outcome 3			10		(10)	5	15
Outcome 4				15	(15)	5	20
Outcome 5				10	(10)	5	15
Outcome 6				5	(5)	5	10
Outcome not related	5	5					10
Total	**5**	**5**	**30**	**30**	**60**	**30**	**100**

*Students who did not pass the mid-term exam

Grading of outcomes (in order to pass the mid-term exam/exam the student must achieve at least 50% points for each learning outcome)

Points	Grade
89 – 100	excellent (5)
76 – 88	very good (4)
63 – 75	good (3)
50 – 62	pass (2)
0 – 49	fail (1)

3.10 Specific features related with taking the course

If a student does not achieve enough points on the mid-term exam, he / she cannot take the next mid-term exam and access the written exam within the exam period.
The oral exam is taken by students who have collected enough points from the midterm exam or written exam.
Teaching activity is evaluated during lectures and exercises.

3.11 Students obligations

Full-time students are required to attend at least 70% of the total number of hours of lectures and exercises in order to exercise the right to take the exam.
Part-time students are required to attend at least 30% of the total number of hours of lectures and exercises in order to exercise the right to take the exam.

	If the student has not fulfilled all the obligations set by the course, he is obliged to attend the lectures again and meet the conditions for taking the exam. Attendance can be offset by online tuition, organised webinars and added assignments given by teachers. One lesson lasts 45 minutes, and several hours form a teaching unit. Absence from one teaching unit is counted as one absence. Delays and apologies are recorded separately. In that case, if the student missed more than 50% of classes, and has a justifiable reason/apology, the request should be submitted to the Department Council, which then decides on the justification of student absences with the obligatory opinion of the course leader.	
3.12 Written assignments		
3.13 Required reading	1.	Skupina autora: Priručnik za energetsko certificiranje zgrada 1 i 2, Program Ujedinjenih naroda za razvoj - UNDP
	2.	B. Udovičić: Energetika, Školska knjiga, Zagreb, 1993.
3.14 Additional reading	1.	Recknagel, Sprenger, Schramek, Čeperković, Grejanje i klimatizacija, Energetika marketing 2012.
	2.	Skupina autora, Osnove primjene biomase, Energetika marketing 2012.
	3.	Skupina autora, Osnove primjene dizalica topline, Energetika marketing 2012.
	4.	Skupina autora, Osnove primjene fotonaponskih sustava, Energetika marketing 2012.
4 ADDITIONAL COURSE INFORMATION		
4.1 Quality control	The quality of the program, teaching process, teaching skills and level of mastery of the material will be established by conducting a written evaluation based on questionnaires, and in other standardised ways and in accordance with the by-laws of the Polytechnic of Međimurje in Čakovec.	
4.2 Contact the teacher	Students can contact the teacher during the office hours and during classes, while for short questions and explanations they can contact him/her any day during working hours by coming in person or by landline. It is also possible to ask questions by e-mail, which will be answered in 48 hours at the latest. It is desirable for students to come as often as possible for any possible questions during the teacher's office hours.	
4.3 Information about the course	It is the obligation of each student to be regularly informed about the course. All notifications about the classes or possible postponement of classes will be posted on the bulletin board and on the website of the Polytechnic at least 24 hours in advance.	
4.4 Course contribution to the study program	Interpret information, ideas, problems and solutions to professional and general audiences Use new technologies and techniques as part of the lifelong learning process Use foreign languages in professional communication and use of professional literature Advocate an ethical approach to work and to associates in project teams Critically evaluate arguments, assumptions and data in order to form opinions and contribute to solving the problems Apply the basics of thermoenergetics, thermodynamics and hydromechanics in the spatial planning of thermodynamic systems Justify the use of non-renewable and renewable energy sources and characteristic energy sources, applicable to thermotechnical systems in practice	

	Justify the use of non-renewable and renewable energy sources and characteristic energy sources, applicable to thermotechnical systems in practice Maintain thermotechnical systems and thermal distribution networks Propose technical changes and upgrades of conventional thermotechnical systems in the direction of sustainable development

5. ANALYSIS OF COURSE TOPICS (the number of hours is equal to the number of lectures and exercises of the course)

LECTURES

Hours	Topic and description	**Method** • Direct teaching (lecture, instruction, pp presentation) • Discovery learning (individual, lead, discussion) • Group learning • Case study • Field classes…	Learning outcomes	Course outcome
1.2	Basic thermodynamic terms and quantities.	Lecture, pp presentation	Analyse basic energetical quantities and thermodynamic concepts	I1
3.4.	Ideal gas, combustion - the basics.	Lecture, pp presentation	Analyse the basic laws of ideal gas and combustion process	I1
5.6.	Energy forms, sources, consumption in the Republic of Croatia and the world.	Lecture, pp presentation	Distinguish forms of energy and valorise energy sources and consumption in the world and in the Republic of Croatia.	I2
7.8.	Renewable and non-renewable energy sources.	Lecture, pp presentation	Analyse the possibilities of application of renewable and renewable energy sources.	I2
9.10.	Right - hand energy conversion processes - basics.	Lecture, pp presentation	Comment on the basics of the right-handed process	I3
11.12.	Left-handed energy conversion process - basics	Lecture, pp presentation	Comment on the basics of the left-handed process.	I3
13.14.	Conversion of energies into electricity.	Lecture, pp presentation	Comment on the conversion of various forms of energy into electricity.	I3
15.16.	Steam turbines.	Lecture, pp presentation	Interpret the principle of	I4

			operation of a steam turbine.	
17.18.	Internal combustion engines.	Lecture, pp presentation	Interpret the principle of operation of internal combustion engines.	I4
19.20.	Heat pumps.	Lecture, pp presentation	Interpret the principle of operation of heat pumps.	I4
21.22.	Electrical machines.	Lecture, pp presentation	Interpret the principle of operation of electrical machines.	I4
23.24.	Hot water boilers.	Lecture, pp presentation	Interpret the principle of operation of hot water boilers.	I4
25.26.	Heat losses in buildings.	Lecture, pp presentation	Interpret heat loss in buildings.	I5
27.28.	Energy efficiency measures in buildings.	Lecture, pp presentation	Interpret energy efficiency measures in buildings.	I5
29.30.	Energy production and conversion and the environment Transport and use of energy and the environment.	Lecture, pp presentation	Analyse the impact of energy production, transport and conversion on the environment.	I6
EXERCISES/ SEMINARS				
Hours	**Topic and description**	**Method** • Direct teaching (lecture, instruction, pp presentation) • Discovery learning (individual, lead, discussion) • Group learning • Case study • Field classes…	**Learning outcomes**	**Course outcome**
1.2.	Calculation of basic thermodynamic quantities - volume, mass, density, temperature, flow, and heat.	Combination of methods	Calculate basic thermodynamic quantities	I1
3.4.	Calculation of basic thermodynamic quantities - unit states of ideal gas, isobars, isochores	Combination of methods	Calculate basic thermodynamic quantities	I1
5.6.	Calculation of basic thermodynamic quantities - combustion equations	Combination of methods	Calculate basic thermodynamic quantities	I1

7.8.	Analysis of energy production and consumption in the Republic of Croatia and the world	Combination of methods	Analyse relevant statistics	I2
9.10.	Simple calculation of the right-handed Carnot process (diagram analysis, degree of utilization)	Combination of methods	A simple calculation of the right-handed Carnot process	I3
11.12.	Simple calculation of the left-hand process (diagram analysis, degree of utilization)	Combination of methods	A simple calculation of the left-handed process.	I3
13.14.	1. Mid-term exam	Combination of methods	-	I1+I2+I3
15.16.	Water vapor - basic calculations	Combination of methods	Calculate simple tasks with steam	I4
17.18.	Simple process diagrams with water vapor.	Combination of methods	Analyse diagrams of a simple process with water vapor.	I4
19.20.	Calculation (selection) of heat pumps	Combination of methods	Calculate simple examples of heat pumps	I4
21.22.	Calculation (selection) of a hot water boiler	Combination of methods	Select a hot water boiler by calculation	I4
23.24.	Calculation of heat losses of a simple building (use simplified calculation)	Combination of methods	Calculate the heat losses of a simple building	I5
25.26.	Calculation of heat losses of a simple building (use simplified calculation)	Combination of methods	Calculate the heat losses of a simple building	I5
27.28.	Preparation for the II Mid-term exam	Combination of methods	Analyse previous exercises	I5
29.30.	2. Mid-term exam	Combination of methods	-	I1+I2+I3 +I4+I5