POLYTECHNIC OF MEĐIMURJE IN ČAKOVEC

COURSE SYLLABUS

ACADEMIC YEAR: 2020/2021

1. GENERAL COURSE INFORMATION				
1.1 Course name	Power plants			
1.2 Study program/s	Sustainable Development			
1.3 Course status (O,E)	O	**1.6 Mode of instruction (number of hours)**	**Lectures**	30
1.4 Course code	4046		**Exercises**	30
1.5 Course abbreviation	PP		**Seminars**	
1.6 Semester	IV		**E-learning**	
1.7 ECTS	5	**1.7 Place and time of instruction**	Facilities of Polytechnic of Medjimurje in čakovec	

2. TEACHING STAFF			
2.1 Course leader/s-title	Doc.dr.sc. Tanja Tomic	**contact**	tanja.tomic@mev.hr
		contact	00385 91 232 0098
2.2 Assistant/s- title		**contact**	
		contact	
2.3 Instruction held by-title		**contact**	

3. COURSE DESCRIPTION	
3.1 Course goals	Introducing the general concept and terms used in this research field of Power plants including the basic of energetic, energy sources and energy forms, the importance of power plants, production of primary energy in form of thermal od electrical energy. The lectures will include the challenges that occur in the ecological and economy aspects of projecting power plants. The students will be introduced to the global reserves and the transportation ways to the end user.
3.2 Prerequisites	There are no prerequisites
3.3 Course outcomes	The students will be able to: I1 – define the basic terms in the field of energetics, functioning of the power plant, distinguishing different energetic systems. I2 – describe the production of the energetics and the transportation way to the end user I3 – differentiate the energetic systems according to their energetic product and the functioning method I4 – present the power turbines, hydro-energetic plants I5 – differentiate the emissions to the environment as a product of thermo-energetic plants and their impact . I6 – Choose and recommend a power plant for producing the electrical and thermal energy
3.4 Course content	This lectured will include the basic principles of energetics, power sources, importance of power plants and the production method of producing thermal or electrical energy. The economic aspect will be reviewed and the influence these power plants have on the environment, regarding the pros and cons. The students will be introduced to the function and structure of the energetic system, power plant, combined plants and using geothermal energy according to new technologies and methods of CO2 storage.

3.5 Types of coursework

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

3.6 Language of instruction

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	0,5	Seminars		Essay
0.25	Class activity		Project		Report/paper
0.75	Midterm exams		Practical task		Continuous knowledge check
1,0	Written exam		Experimental work		
1,0	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	20%	20
Midterm exam 1	35%	35
Midterm exam 2	35%	35
Exam assessment for the students who failed to fullfil all the obligatory requirements during the semester		
Written exam	*70%*	*70*
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**	**Practical work**	**Total**
Outcome 1			5		5	10
Outcome 2			5	10		15
Outcome 3			10		5	15
Outcome 4			15			15
Outcome 5				10	5	15
Outcome 6				15	5	20
Outcome not-related						
Total	**5**	**5**	**35**	**35**	**20**	**100**

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

In case the student accumulates more than 50% of the points, he/she is can directly approach the oral exam. In case the student does not accomplish the proper amount of points on the first midterm (1st Midterm), he/she cannot take a part on the following midterm (2nd Midterm).

	The accomplished points on the midterms cannot be deleted unless the student makes the decision to improve his/her grade. The points for homework assignments are calculated regarding the quality of the written assignment. The points gained on the assignments and class activity are valid through the whole academic year unless the student decides to better their grades. The student cannot approach the written exam unless the signed homework assignment is done and graded. The homework assignment must be held in 3 days before the written exam. The final grade is given on the oral exam.	
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	The homework assignment must be typed out on a PC and must have maximum 12 text cards (Times New Roman, font 12) including the introduction and the pictured, attachments and tables, etc. The homework assignments must have an according front page, content with page numeration, introduction. The homework assignment must be divided in chapters, and include the literature references, and list of picture and list of table content. The chapter with the conclusion must have 250 words. The student guaranties the authentic work as its own.	
3.13 Required reading	1.	Mustapić, N.; Guzović, Z.; Staniša, B.: Energetski sustavi. Veleučilište u Karlovcu, 2013.
	2.	
3.14 Additional reading	1.	Khalil, E.; Steam power plants, Department of Mechanical Power Engineering, Cairo University, Cairo, Egypt
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	Personal knowledge and skills: - Introducing information, ideas, problems and solution to the competent and general public and communities - Adaptability to new technologies, techniques and recent systems as a part of the whole life education. General knowledge and skills: - The capacity to apply the gained knowledge in the field of technical expertise on concrete engineering assignments, - The capacity to identify, algorithm and finding solution for engineering problems in the field of material strength Special expert knowledge and skills gained in completing the courses in Faculty department Sustainable development: - Taking part in research and development business fields and institutions - Working in the project, consulting and executing development and business sectors within the field 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.	Primary sources and energy forms	• Direct teaching (lecture, instruction, pp presentation)	Defining the basic terms in the field of energetics	I1, I2
2.	Classification of primary energy forms and the transport or transition energy forms	• Direct teaching (lecture, instruction, pp presentation)	Defining the classification of primary energy forms, indicate the renewable and unrenewable energy sources	I1, I2, I3
3.	Steam turbine and the process of steam turbine	• Direct teaching (lecture, instruction, pp presentation)	Defining the energy transitions in the ideal action and defining the usage of steam turbines,	I3, I4, I5

			the theory of ideal fluid theory	
4.	Energy transmition in the axial turbine	• Direct teaching (lecture, instruction, pp presentation)	Defining the energy transformation	I1
5.	Turbine stage	• Direct teaching (lecture, instruction, pp presentation)	Defining with scheme and text turbine stage	I1, I2, I3
6.	Regulation of steam turbines	• Direct teaching (lecture, instruction, pp presentation)	Defining the working method of steam turbine in alternating loading conditions.	I1, I2, I3
7.	Steam turbines	• Direct teaching (lecture, instruction, pp presentation)	Defining and describing the development and progress of the steam turbine trough history	I4, I5, I6
8.	Thermal processes of the open cycle gas turbine plant	• Direct teaching (lecture, instruction, pp presentation)	Defining the process of aircraft gas turbines	I5, I6
9.	The main parts of the gas turbine plant	• Direct teaching (lecture, instruction, pp presentation)	Defining the turbo compressors	I4, I3
10.	Combine cycle of the gas and steam turbine	• Direct teaching (lecture, instruction, pp presentation)	Defining the combi cycle	I2, I3, I4
11.	Combine the gas and steam plant	• Direct teaching (lecture, instruction, pp presentation)	Defining the combi system of the gas and steam turbine, their importance and the parameters	I3, I4, I5
12.	Engine with internal combustion	• Direct teaching (lecture, instruction, pp presentation)	Defining the Otto four stroke engine	I1, I2
13.	Engine with external combustion – Stirling engine	• Direct teaching (lecture, instruction, pp presentation)	Defining the functioning	I1, I2, I3
14.	Usage of geothermal energy	• Direct teaching (lecture, instruction, pp presentation)	Defining the terms of geothermal energy, and the types	I1, I2, I3
15.	New technologies – fuel cells, impact of the power plant on the environment, CO2 storage, global warming	• Direct teaching (lecture, instruction, pp presentation)	Defining a fuel cell, membrane fuel cell, environment impact	I1, I2, I5, 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.	Energy of the sun, geothermal energy and gravitation	• Direct teaching (lecture, instruction, pp presentation) • Discovery learning (individual, lead, discussion)	Defining the basic terms	I1, I2
2.	Fossil fuel, nuclear fuel, geothermal energy	• Direct teaching (lecture, instruction, pp presentation) • Discovery learning (individual, lead, discussion)	Defining the pros and cons of the renewable and unrenewable energy sources, distinguishing the natural or primary energy forms according to the physical characteristics	I1, I2, I3
3.	Steam turbines and processes, nozzle flow	• Direct teaching (lecture, instruction, pp presentation) • Discovery learning (individual, lead, discussion)	Defining the equation of state, continuity equation, equation of momentum	I1
4.	Transition of energy in the axial grade	• Direct teaching (lecture, instruction, pp presentation) • Discovery learning (individual, lead, discussion)	Defining the reaction	I3, I4, I5
5.	Experimental researches in the turbine stage	• Direct teaching (lecture, instruction, pp presentation) • Discovery learning (individual, lead, discussion)	Defining the geometric and aerodynamic characteristics	I1, I2
6.	Regulation of steam turbines	• Direct teaching (lecture, instruction, pp presentation) • Discovery learning (individual, lead, discussion)	Defining the steam turbine regulations	I1, I2, I3
7.	The classification od the gas turbines	• Direct teaching (lecture, instruction, pp presentation)	Defining the classification according to the	I4, I5, I6

		• Discovery learning (individual, lead, discussion)	combustion and expansion in the turbine	
8.	Usage of the gas-turbine plant	• Direct teaching (lecture, instruction, pp presentation) • Discovery learning (individual, lead, discussion)	Defining the thermal usage and power	I5, I6
9.	Transition of energy and energy balance of the turbo-compressors	• Direct teaching (lecture, instruction, pp presentation) • Discovery learning (individual, lead, discussion)	Defining the compression, air flow after compression, mechanical work, reaction grade of the turbo-compressor	I3, I4
10.	Analysing the combine ideal cyclus	• Direct teaching (lecture, instruction, pp presentation) • Discovery learning (individual, lead, discussion)	Defining through equation	I2, I3, I4
11.	The effectiveness of the combi gas and steam turbine	• Direct teaching (lecture, instruction, pp presentation) • Discovery learning (individual, lead, discussion)	Defining the expression for effectiveness and impact usage of the combi steam and gas power plant	I3, I4, I5
12.	Engine with internal combustion	• Direct teaching (lecture, instruction, pp presentation) • Discovery learning (individual, lead, discussion)	Defining the type classification	I1, I2
13.	Engine with external combustion	• Direct teaching (lecture, instruction, pp presentation) • Discovery learning (individual, lead, discussion)	Defining the type classification of the engines	I1, I2
14.	Classification of the geothermal sources	• Direct teaching (lecture, instruction, pp presentation) • Discovery learning (individual, lead, discussion)	Defining the sources according to the thermodynamic and hydro characteristics regarding the entry or exit of water	I1, I2, I3
15.	New technologies in fuel cells, impact on the environment and storage of CO2, global warming 2nd Midterm test	• Direct teaching (lecture, instruction, pp presentation) • Discovery learning (individual, lead, discussion)	Defining the impact of power plants on the environment and importance of the CO2, impact on global warming	I1, I2, I5, I6