POLYTECHNIC OF MEĐIMURJE IN ČAKOVEC

COURSE SYLLABUS

ACADEMIC YEAR: 2020/2021

1. GENERAL COURSE INFORMATION

1.1 Course name	**Electrical engineering**			
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	4039		**Exercises**	30
1.5 Course abbreviation	E		**Seminars**	
1.6 Semester	III		**E-learning**	
1.7 ECTS	5	**1.7 Place and time of instruction**	The 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	Jurica Trstenjak/ senior lecturer	**contact**	jtrstenjak@mev.hr
		contact	
2.2 Assistant/s- title	Damir Stampar, associate	**contact**	damir.stampar@mev.hr
		contact	
2.3 Instruction held by-title	Jurica Trstenjak/ senior lecturer	**contact**	jtrstenjak@mev.hr

3. COURSE DESCRIPTION

3.1 Course goals	The student will acquire basic knowledge in electrical engineering, electronics and management
3.2 Prerequisites	No
3.3 Course outcomes	After successfully completing the course, students will be able to: O1 - Interpret basic phenomena in electrostatics O2 - Define the elements and calculate the basic electrical quantities of direct current circuits O3 - Explain the electrical conditions in and around current-flow metal conductors and the basic magnetic effects O4 - Define the elements and calculate the basic electrical quantities of alternating current circuits O5 - Describe the use of modern elements and assemblies of applied electronics
3.4 Course content	Basic electrical quantities. Electrostatics. Electrostatic networks. Basic laws of electrical engineering (Kirchhoff's laws and Ohm's law). Energy, work, power. Phenomena in the electric field. Electromagnetic phenomena. Alternating current. Resistors in the AC circuit. Power and AC operation. Losses in the AC circuit. Three-phase system. Obtaining semiconductors. Basic semiconductor elements, regulators, Arduino platform

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

		Other				
3.6 Language of instruction	Croatian/English					
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	Eam (Midterm exams)		Practical task		Continuous knowledge check
		Written exam		Experimental work	1	Homework
		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
Auditory exercises	20%	20
Oral part of midterms	10%	10
Midterm exam 1	30%	30
Midterm exam 2	30%	30
Exam assessment for the students who failed to fullfil all the obligatory requirements during the semester		
Written exam	*60%*	*60*
Oral exam	*10%*	*10*
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**	**Auditory exercises**	**Oral part of midterms**	**Total**
Outcome 1			10		4	2	16
Outcome 2			10		4	2	16
Outcome 3			10	10	4	2	26
Outcome 4				10	4	2	16
Outcome 5				10	4	2	16
Outcome not-related	5	5					10
Total	5	5	30	30	20	10	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 order for a student to pass the course, he / she must earn a minimum of 50% of the points available for that learning outcome for EACH learning outcome. If a student does not achieve a sufficient number of points in the 1st midterm exam (minimum 50% of the total number of points), he / she cannot take the next midterm exam. Once achieved points in intermediate exams for each learning outcome are no longer deleted unless the student decides to correct the result for each learning outcome, whereby the points won until then are

	deleted and newly achieved points for that learning outcome are entered. The final grade is obtained on the exam period and is the sum of points earned during classes. Students who did not take the colloquium access the written and oral part of the exam where all learning outcomes are checked, and are required to submit a practical paper before taking the 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		
3.13 Required reading	1.	M. A. Laughton D.F. Warne: Electrical Engineer's Reference Book, 16th Edition, Newnes, 2002.
	2.	
3.14 Additional reading	1.	
	2.	

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	Analyze the basic elements of electrical engineering and their behavior in the circuits of DC and AC networks

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	Learning outcomes	Course outcome

		• Direct teaching (lecture, instruction, pp presentation) • Discovery learning (individual, lead, discussion) • Group learning • Case study • Field classes…		
1. & 2.	Introduction. Physical basics of electrical engineering. Physical quantities	Discussion, lecture, PP presentation, case study	Distinguish scalars from vector physical quantities	O1
3. & 4.	Electrostatics (electricity, Coulumb's law, Electric field, Gauss's law)	Discussion, lecture, PP presentation, case study	Explain phenomena in electrostatics. Use Culomb's law to solve problems	O1
5. & 6.	Electrostatics (potential, conductor in electric field, electric dipole, dielectric in electrostatic field, capacity)	Discussion, lecture, PP presentation, case study	Combine the knowledge acquired in the field of electrostatics in the calculation of capacitors	O1
7. & 8.	El. direct current circuits (charge motion, electric current, electrical resistance, Ohm's law, application of Kirchhoff's laws)	Discussion, lecture, PP presentation, case study	Explain and apply Ohm's and Kirchhoff's laws in direct current	O2
9. & 10.	El. direct current circuits (operation and power of direct current), effects of el. electricity	Discussion, lecture, PP presentation, case study	Calculate the power and operation of direct current	O2
11. & 12.	Electromagnetism (magnetic field, law of flow, magnetic flux)	Discussion, lecture, PP presentation, case study	Explain the phenomena in the magnetic field due to the flow of el. electricity	O3
13. & 14.	Electromagnetism (Biot-Savart law, induction, self-induction, materials in a magnetic field)	Discussion, lecture, PP presentation, case study	Explain electromagnetic induction, principles of operation of electric motors and generators	O3
15. & 16.	1. midterm exam	On its own	Outcome check O1, O2, O3	
17. & 18.	Electromagnetism (magnetic circuits)	Discussion, lecture, PP presentation, case study	Distinguish the flow of magnetic flux through different materials - magnetic resistance.	O3
19. & 20.	El. alternating current circuits (charge motion, electric current, electrical resistance, Ohm's law, application of Kirchhoff's laws)	Discussion, lecture, PP presentation, case study	Explain and apply Ohm's and Kirchhoff's laws in alternating current	O4
21. & 22.	El. alternating current circuits (operation and power of direct current), effects of el. electricity	Discussion, lecture, PP presentation, case study	Calculate the power and operation of direct current	O4

23. & 24.	Three-phase system (star / triangle)	Discussion, lecture, PP presentation, case study	Explain and plot a 3-phase system	O4
25. & 26.	Electronics (diode, transistor, switch)	Discussion, lecture, PP presentation, case study	Draw and explain the obtaining of semiconductors and basic electronic elements (diode and transistor)	O5
27. & 28.	OP, regulators, Arduino platform	Discussion, lecture, PP presentation, case study	Explain the application of OP and regulators, and apply the Arduino platform in the control system	O5
29. & 30.	2. midterm exam + oral part of midterms	On its own	Outcome check O3, O4, O5	
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.	Physical basics of electrical engineering. Physical quantities	Presentation, instructions, independent work, discussion	Use vector representation of quantities, decomposition of vector quantities, vector product	O1
3. & 4.	Electrostatics (electricity, Coulumb's law, Electric field, Gauss's law)	Presentation, instructions, independent work, discussion	Solve the problem using Culomb's law, identify and calculate the strength of el. fields for different situations	O1
5. & 6.	Electrostatics (potential, conductor in electric field, electric dipole, dielectric in electrostatic field, capacity)	Presentation, instructions, independent work, discussion	Calculate the value of el. potential, potential differences, plate capacitor capacity, mixed capacitor junction	O1
7. & 8.	Electrostatics (forces and energy in the electric field, electrostatic networks)	Presentation, instructions, independent work, discussion	Apply Kirchhoff's laws to electrostatic networks, calculate the force and energy of el. fields	O1, O2
9. & 10.	El. direct current circuits (charge motion, electric current, electrical resistance, Ohm's law, application of Kirchhoff's laws)	Presentation, instructions, independent work, discussion	Apply Kirchhoff's laws and Ohm's law to simple el. mesh	O2

11. & 12.	El. direct current circuits (operation and power of direct current)	Presentation, instructions, independent work, discussion	Calculate the power and operation of direct current	O2
13. & 14.	Electromagnetism (magnetic field, law of flow, magnetic flux)	Presentation, instructions, independent work, discussion	Apply the law of flow to solve problems	O3
15. & 16.	Repetition of materials for the 1st intermediate exam	Presentation, instructions, independent work, discussion	Systematization and verification of outcomes O1, O2 and O3	
17. & 18.	Electromagnetism (magnetic circuits)	Presentation, instructions, independent work, discussion	Solve tasks in the field of simple mag. circles	O3
19. & 20.	El. alternating current circuits (charge motion, electric current, electrical resistance, Ohm's law, application of Kirchhoff's laws)	Presentation, instructions, independent work, discussion	Apply Kirchhoff's laws and Ohm's law to simple el. mesh	O4
21. & 22.	El. alternating current circuits (operation and power of direct current)	Presentation, instructions, independent work, discussion	Calculate AC power and operation (vector representation)	O4
23. & 24.	Three-phase system (star / triangle)	Presentation, instructions, independent work, discussion	Explain 3-phase system (vector representation), line and phase voltages	O4
25. & 26.	Arduino platform	Presentation, instructions, independent work, discussion	Explain the application of the Arduino DC motor speed control platform	O5
27. & 28.	Arduino platform	Presentation, instructions, independent work, discussion	Solve the task using the Arduino platform	O5
29. & 30.	Repetition of materials for the 2nd intermediate exam	Presentation, instructions, independent work, discussion	Systematization and verification of outcomes O3, O4 and O5	