

POLYTECHNIC OF MEÐIMURJE 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)	0	0 1.6 Mode of Lectures 30									
1.4 Course code	4039					instruction		Exe	rcises	30	
1.5 Course abbreviation	E				(number of			Sen	ninars		
1.6 Semester	111				hours)		urs)	E-le	arning		
1.7 ECTS	5				1.7 Place and			The	premises	ofthe	9
						tin	ne of	Poly	/technic o	f Međ	imurje in
						ins	struction	Cak	ovec, acco	ording	to the
								sch	edule pub	lished	on the
								wet	osite		
2. TEACHING STAFF	<u> </u>	rico Trotonio	k/ 0	onior				•••••			
2.1 Course leader/s-title	llec	nca instenja cturer	K/ S	enior	cor	itaci	C	Jtrs	tenjak@m	ev.nr	
					cor	tact	t				
2.2 Assistant/s- title	Da	mir Stampa	r, as	sociate	cor	tac	t	damir.stampar@mey.hr			ev.hr
· · ·		· · ·			cor	tac	t				
2.3 Instruction held by-	Ju	rica Trstenja	k/ s	enior	cor	tac	t	jtrstenjak@mev.hr			
title	lec	cturer									
3. COURSE DESCRIPTION					•						
3.1 Course goals	Th	e student w	ill a	cquire ba	isic k	now	/ledge in ele	ectri	cal engine	ering,	electronics
	an	d managem	ent								
3.2 Prerequisites	No)									
3.3 Course outcomes	Af	ter successfu	ully (completii	ng th	e co	ourse, stude	nts	will be abl	e to:	
	01	- Interpret	basi	c phenor	nena	in e	electrostatic	S			
	02	2 - Define the	e ele	ements a	nd ca	lcul	ate the basi	c ele	ectrical qu	antiti	es of direct
	cu	rrent circuits	5		ناء مر م						
		s - Explain th	e ei ส + ค	ectrical c	onali		s in and aro	una	current-fi	ow m	etal
		L - Define the		e Dasic II	nd ca		errecis ato tho basi	ام ما	actrical qu	antiti	as of
	alt	ernating cur	ren	t circuits		ncui		C Ch	ettiltai qu	antiti	23 01
	05	5 - Describe t	he i	use of mo	oderr	n ele	ements and	asse	mblies of	applie	be
	ele	ectronics								- 1- 1	
3.4 Course content	Ва	sic electrica	l qu	antities.	Elect	rost	atics. Electr	osta	atic netwo	rks. B	asic laws of
	ele	ectrical engi	neer	ring (Kirc	hhof	f's la	aws and Oh	m's	law). Ene	rgy, w	ork, power.
	Ph	enomena ir	n th	e electri	ic fie	eld.	Electromag	neti	c phenon	nena.	Alternating
	cu	rrent. Resist	ors	in the AC	C circ	uit.	Power and	AC	operation	. Loss	es in the AC
	cir	cuit. Three-	pha	se systen	n. Ob	otair	ning semico	ndu	ctors. Bas	ic sen	niconductor
	ele	ements, regu	lato	ors, Ardui	no p	latfo	orm	1	1		
3.5 Types of coursework	x	Lectures	x	Exercises			Blended e-	x	Individual		Laboratory
		Seminars							Multimedi	а	
		and	x	Distant			Field	1	and	-	Mentorship
		workshops		learning					network		

	C)ther										
3.6 Language of	~	/-										
instruction	Croatian/English											
3.7 Monitoring students'	2 Class attendance			<u>م</u>	Seminars				F	Fssav		
work (enter the	2	Class a				Seminars				Essay		
number of ECTS		Class a	ctivity	y Pr		Pro	Project			F	Report/paper	
credits for each	2 Fam (Midterm ex		yams)	Practical task			(Continuous				
activity so that the							_	ŀ	knowledge check			
total number of ECTS	Written exam			Experimental work		1	ł	Homework				
credits is equal to		Oral ex	am			Res	search					
the total ECTS value												
of the course, 1 ECTS												
= 30 hours)												
3.8 Assessment and												
evaluation of			Activity	specific	ation		Percent	t %		Point	ts	
students' work		A t t a		A	ssessmer	nt d	luring instru	ction				
during classes and at		Atter	activity				5%			5		
the final exam		Audi	torv exer	cises			20%			20		
		Oral	part of m	idterms	;		10%			10		
		Midt	erm exan	n 1			30%			30		
		Midt	erm exan	n 2			30%			30		
		Exan	n assessm	ent for	the stude	ents	s who failed Juring the se	to fullfil mostor	l all th	e oblig	gatory	
		Writ	ten exam	Teq	unemen	is u	60%	mester		60		
		Oral	exam				10%			10		
		Tota	l:				100%	, D		100		
3.9 Assessment criteria –			Ways of	evaluat	ing learn	ing	outcomes					
3.9 Assessment criteria – analysis per learning			Ways of	evaluat	ing learn Mid-	ing	outcomes Mid-			Ora	I part of	
3.9 Assessment criteria – analysis per learning outcomes			Ways of Atten dance	evaluat Acti	ing learn Mid- term	ing	outcomes Mid- term	Audit	tory	Ora mi	I part of dterms	Total
3.9 Assessment criteria – analysis per learning outcomes			Ways of Atten dance	evaluat Acti vity	ing learn Mid- term exam	ing 1	outcomes Mid- term exam 2	Audit	tory cises	Ora mi	I part of dterms	Total
3.9 Assessment criteria – analysis per learning outcomes	Outo	come 1	Ways of Atten dance	evaluat Acti vity	ing learn Mid- term exam 2 10	ing 1	outcomes Mid- term exam 2	Audit exerc	tory cises	Ora mi	l part of dterms	Total
3.9 Assessment criteria – analysis per learning outcomes	Outo	come 1 come 2 come 3	Ways of Atten dance	evaluat Acti vity	ing learn Mid- term exam 10 10 10	ing 1	outcomes Mid- term exam 2	Audit exerc 4 4	tory ises	Ora mi	ll part of dterms	Total 16 16 26
3.9 Assessment criteria – analysis per learning outcomes	Outo Outo Outo	come 1 come 2 come 3 come 4	Ways of Atten dance	evaluat Acti vity	ing learn Mid- term exam 10 10 10	ing 1	outcomes Mid- term exam 2 10 10	Audit exerc 4 4 4 4	tory ises	Ora mi	l part of idterms 2 2 2 2 2 2	Total 16 16 26 16
3.9 Assessment criteria – analysis per learning outcomes	Outo Outo Outo Outo	come 1 come 2 come 3 come 4 come 5	Ways of Atten dance	evaluat Acti vity	ing learn Mid- term exam 10 10 10	ing 1	outcomes Mid- term exam 2 10 10 10	Audit exerc 4 4 4 4 4 4	tory ises	Ora mi	ll part of idterms 2 2 2 2 2 2 2 2	Total 16 26 16 16
3.9 Assessment criteria – analysis per learning outcomes	Outo Outo Outo Outo	come 1 come 2 come 3 come 4 come 5 come	Ways of Atten dance	evaluat Acti vity	ing learn Mid- term exam 2 10 10 10	ing 1	outcomes Mid- term exam 2 10 10 10	Audit exerci 4 4 4 4 4 4	tory ises	Ora mi	ll part of dterms 2 2 2 2 2 2 2 2 2	Total 16 16 16 16 16 16 16 16 16 16 16
3.9 Assessment criteria – analysis per learning outcomes	Outo Outo Outo Outo Outo Outo	come 1 come 2 come 3 come 4 come 5 come	Ways of Atten dance	evaluat Acti vity	ing learn Mid- term exam 10 10 10	1	outcomes Mid- term exam 2 10 10 10	Audii exerc 4 4 4 4 4 4 4	tory ises	Orami	l part of otterms 2 2 2 2 2 2 2 2	Total 16 16 16 16 16 16 10
3.9 Assessment criteria – analysis per learning outcomes	Outo Outo Outo Outo Outo Outo not- relat Tota	come 1 come 2 come 3 come 4 come 5 come ted	Ways of Atten dance	evaluat Acti vity 5	ing learn Mid- term exam 10 10 10	1 	outcomes Mid- term exam 2 10 10 10 10 30	Audii exerc 4 4 4 4 4 4 4 20	tory cises	Orami	ll part of idterms 2 2 2 2 2 2 2 2	Total 16 16 16 16 16 10 100
3.9 Assessment criteria – analysis per learning outcomes	Outo Outo Outo Outo Outo relat Tota	come 1 come 2 come 3 come 4 come 5 come ted	Ways of Atten dance 5 5 5 outcome	evaluat Acti vity 5 5 es (in c	ing learn Mid- term exam 10 10 10 10 30 order to	1	outcomes Mid- term exam 2 10 10 10 10 30 ass the min	Audit exerce 4 4 4 4 4 4 4 4 0 4 0 0 0 0 0 0 0 0	tory ises	Ora mi	ll part of dterms 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Total 16 16 16 16 16 16 10 100 student
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3.9 Assessment criteria – analysis per learning outcomes	Outo Outo Outo Outo Outo Outo not- relat Tota Grad must Point 89 – 76 –	come 1 come 2 come 3 come 4 come 5 come ted ing of c c achiev ts C 100 e 88 v	Ways of Atten dance 5 5 5 0utcome re at lea Grade excellent ery goo	evaluat Acti vity 5 5 es (in c st 50% t (5) d (4)	ing learn Mid- term exam 10 10 10 10 10 30 order to 5 points	n pa foi	outcomes Mid- term exam 2 10 10 10 10 30 ass the mid r each lea	Audii exerc 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	tory ises	Ora mi m/ex pme)	l part of dterms 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Total 16 16 16 16 16 16 10 100 student
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3.9 Assessment criteria – analysis per learning outcomes	Outo Outo Outo Outo Outo Outo not- relat Tota Grad must Point 89 – 76 – 63 – 50 – 0 –	come 1 come 2 come 3 come 4 come 5 come ted ing of c achiev ts 6 100 e 88 v 75 g 62 p 49 fa	Ways of Atten dance 5 5 5 0utcome re at lea 6rade excellent ery goo ood (3) ass (2) ail (1)	evaluat Acti vity 5 5 es (in c st 50% t (5) d (4)	ing learn Mid- term exam 10 10 10 10 30 order to 5 points	pa for	outcomes Mid- term exam 2 10 10 10 10 30 ass the mid r each lea	Audii exerc 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	tory ises	Ora mi m/ex ome)	l part of dterms	Total 16 16 16 16 16 16 16 16 10 100 student
 3.9 Assessment criteria – analysis per learning outcomes 3.10 Specific features 	Outo Outo Outo Outo Outo Outo Outo not- relat Tota Grad must Point 89 - 76 - 63 - 50 - 0 In or	come 1 come 2 come 3 come 4 come 5 come ted ing of c tachiev ts G 100 e 88 v 75 g 62 p 49 fa der for	Ways of Atten dance 5 5 5 0utcome cre at lea Grade excellent ery goo ood (3) ass (2) ail (1) a stude	evaluat Acti vity 5 5 es (in c st 50% t (5) d (4)	ing learn Mid- term exam 10 10 10 10 30 order to 5 points	pa for	outcomes Mid- term exam 2 10 10 10 30 ass the mid r each lea	Audit exerci 4 4 4 4 4 4 4 4 4 4 4 4 0 4 cterm rning o	tory ises	Ora mi m/ex ome)	Il part of idterms 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Total 16 16 16 16 10 100 student
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 3.9 Assessment criteria – analysis per learning outcomes 3.10 Specific features related with taking the course 	Outo Outo Outo Outo Outo Outo Outo Outo	come 1 come 2 come 3 come 4 come 5 come ted ing of c achiev ts 6 100 e 88 v 75 g 62 p 49 fa der for e point ident d	Ways of Atten dance 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	evaluat Acti vity 5 5 es (in c st 50% t (5) d (4) nt to p ble for achie	ing learn Mid- term exam 10 10 10 10 30 order to 5 points ass the that leave a su	ing 1 pa for	outcomes Mid- term exam 2 10 10 10 10 30 ass the mid r each lea	Audit exerce 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	tory ises	Ora mi m/ex ome)	I part of dterms 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Total 16 16 16 16 10 100 student um of 50% utcome. If t midterm
 3.9 Assessment criteria – analysis per learning outcomes 3.10 Specific features related with taking the course 	Outo Outo Outo Outo Outo Outo Outo not- relat Tota Grad must Point 89 - 76 - 63 - 50 - 0 - In oro of th a stu exam	come 1 come 2 come 3 come 4 come 5 come ted ing of c tachiev ts 6 100 e 88 v 75 g 62 p 49 fa der for e point ident d n (minir	Ways of Atten dance 5 5 5 0utcome re at lea Grade excellent ery goo ood (3) ass (2) ail (1) a stude s availal oes not mum 50	evaluat Acti vity 5 5 s (in c st 50% t (5) d (4) nt to p ble for achie % of t	ing learn Mid- term exam 10 10 10 10 30 order to 5 points ass the that leave ve a su he tota	pa for	outcomes Mid- term exam 2 10 10 10 30 ass the mid r each lea urse, he / ing outco cient num umber of	Audii exerce 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	ust e r EAC f poir s), he	Ora mi m/ex ome) arn a CH lea hts ir / sh	I part of idterms 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Total 16 16 16 16 10 100 student um of 50% utcome. If t midterm t take the
 3.9 Assessment criteria – analysis per learning outcomes 3.10 Specific features related with taking the course 	Outo Outo Outo Outo Outo Outo Outo not- relat Tota Grad must Point 89 - 76 - 63 - 50 - 0 In oro of th a stu exam next	come 1 come 2 come 3 come 4 come 5 come ted ing of c c achiev ts 6 100 e 88 v 75 g 62 p 49 fa der for e point ident d n (minir midter	Ways of Atten dance 5 5 5 0utcome re at lea 6rade ery goo ood (3) ass (2) ail (1) a stude s availal oes not mum 50 rm exar	evaluat Acti vity 5 5 es (in c st 50% t (5) d (4) nt to p ble for achie % of t n. Ono	ing learn Mid- term exam 10 10 10 30 order to 5 points ass the that leave ve a su he tota ce achie	ing 1 pa for cou arn ffic l nu eve	outcomes Mid- term exam 2 10 10 10 30 ass the mid r each lea urse, he / hing outco cient num umber of ed points	Audit exerce 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 6 4 crm rning of ber of points in int	ust e r EAC f poir s), he erme	Ora mi m/ex ome) arn a H lea hts ir / sh ediate	I part of determs	Total 16 16 16 16 10 100 student um of 50% utcome. If t midterm t take the f for each
 3.9 Assessment criteria – analysis per learning outcomes 3.10 Specific features related with taking the course 	Outo Outo Outo Outo Outo Outo Outo Outo	come 1 come 2 come 3 come 4 come 5 come ted ing of c tachiev ts 6 100 e 88 v 75 g 62 p 49 fa der for e point ident d n (minir midter ning out	Ways of Atten dance 5 5 5 0utcome re at lea 6rade ery goo ood (3) ass (2) ail (1) a stude s availal oes not mum 50 cm exar ccome a	evaluat Acti vity 5 5 es (in c st 50% t (5) d (4) nt to p ble for achie % of t n. Ono re no	ing learn Mid- term exam : 10 10 10 30 order to 5 points ass the that leave ve a su he tota ce achie longer (ing 1 pa for con arn ffic l ni eve del	outcomes Mid- term exam 2 10 10 10 30 ass the mid r each lea urse, he / hing outco cient num umber of ed points leted unle	Audit exerce 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 6 4 5 6 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	ust e r EAC f poir s), he erme	Ora mi m/ex ome) arn a CH lea hts ir / sh ediate ent o	I part of dterms	Total 16 16 16 16 10 100 student um of 50% utcome. If t midterm t take the s for each to correct

		delet	ed and newl	y achieved points for	that learning outcome are er	ntered. The				
		final	grade is obt	ained on the exam p	period and is the sum of poi	nts earned				
		durin	ng classes. St	udents who did not	take the colloquium access	the written				
		and o	oral part of t	the exam where all le	earning outcomes are checke	ed, and are				
		requi	ired to subm	it a practical paper be	efore taking the exam.					
3.11 Studen	its obligations	Full-t	ime students	s are required to atte	nd at least 70% of the total n	umber of				
		nour	s of lectures	and exercises in orde	r to exercise the right to take	the exam.				
		Part-	time student	s are required to atte	and at least 30% of the total r	the even				
		If the	s of lectures	not fulfilled all the of	aligations set by the course h	ule exam.				
		ohlig	ed to attend	the lectures again an	d meet the conditions for tak	ring the				
		exam	exam.							
		Atter	 Idance can b	e offset by online tuit	ion, organised webinars and	added				
		assig	nments giver	n by teachers. One les	son lasts 45 minutes, and sev	veral hours				
		form	a teaching u	nit. Absence from on	e teaching unit is counted as	one				
		absei	nce. Delays a	nd apologies are reco	orded separately. In that case	, if the				
		stude	ent missed m	ore than 50% of class	ses, and has a justifiable					
		reaso	on/apology, t	he request should be	submitted to the Departmen	nt Council,				
		whic	h then decide	es on the justification	of student absences with the	2				
		oblig	atory opinior	n of the course leader						
3.12 Writte	n									
assignn	nents									
3.13 Requir	ed reading									
		1.	M. A. Laught Newnes, 200	on D.F. Warne: Electric	al Engineer's Reference Book, 1	6th Edition,				
		2.								
3.14 Additio	onal reading	1.								
		2.								
4 ADDITION	IAL COURSE INI	FORMA	ATION							
4.1 Quality	control	The c	quality of the	program, teaching p	rocess, teaching skills and lev	el of				
		mast	ery of the ma	aterial will be establis	hed by conducting a written	evaluation				
		base	d on questio	nnaires, and in other	standardised ways and in acc	ordance				
4.2. Countra at		with	the by-laws of	of the Polytechnic of I	Viedimurje in Cakovec.					
4.2 Contact	the teacher	Stude	ents can com	act the teacher durin	ig the office hours and during	r any day				
		durin	a working he	urs by coming in per	son or by landline. It is also n	ossible to				
		ask o	uestions by e	-mail, which will be a	answered in 48 hours at the L	atest. It is				
		desir	able for stud	ents to come as ofter	as possible for any possible	auestions				
		durin	ig the teache	r's office hours.	··· [··· · · · / [··· · ·					
4.3 Informa	tion about	lt is t	he obligatior	of each student to b	e regularly informed about tl	ne course.				
the cou	irse	All notifications about the classes or possible postponement of classes will be								
		poste	ed on the bul	letin board and on th	e website of the Polytechnic	at least 24				
		hours	s in advance.							
4.4 Course of	contribution	Analyze the basic elements of electrical engineering and their behavior in the								
to the s	study	circuits of DC and AC networks								
program										
5. ANALYSIS the course)	S OF COURSE TO	JPICS (the number	of hours is equal to t	ne number of lectures and e	xercises of				
				LECTURES						
Hours	Topic an	d desc	ription	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	01
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	01
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	01
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	02
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	02
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	03
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	03
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.	03
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	04
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	04

-		1		
23. & 24.	Three-phase system (star / triangle)	Discussion, lecture, PP presentation, case study	Explain and plot a 3- phase system	04
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)	05
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	05
29. & 30.	 midterm exam + oral part of midterms 	On its own	Outcome check O3, O4, O5	
	EXEI	RCISES/ SEMINARS		L
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	01
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	01
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	01
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	01, 02
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	02

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	02
13. & 14.	Electromagnetism (magnetic field, law of flow, magnetic flux)	Presentation, instructions, independent work, discussion	Apply the law of flow to solve problems	03
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	03
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	04
21. & 22.	El. alternating current circuits (operation and power of direct current)	Presentation, instructions, independent work, discussion	Calculate AC power and operation (vector representation)	04
23. & 24.	Three-phase system (star / triangle)	Presentation, instructions, independent work, discussion	Explain 3-phase system (vector representation), line and phase voltages	04
25. & 26.	Arduino platform	Presentation, instructions, independent work, discussion	Explain the application of the Arduino DC motor speed control platform	05
27. & 28.	Arduino platform	Presentation, instructions, independent work, discussion	Solve the task using the Arduino platform	05
29. & 30.	Repetition of materials for the 2nd intermediate exam	Presentation, instructions, independent work, discussion	Systematization and verification of outcomes O3, O4 and O5	