

FACULTY OF ELECTRICAL ENGINEERING, MECHANICAL ENGINEERING AND NAVAL ARCHITECTURE

DETAILED PROPOSAL OF THE STUDY PROGRAMME

GRADUATE UNIVERSITY STUDY IN INFORMATION AND COMMUNICATION TECHNOLOGY

1.1. List ofmandatory and elective courses

Studyprogramme module: WIRELESS COMMUNICATIONS - 241

	List ofcourses									
Year of study	:1.									
Semester:I.										
CTATUC	CODE	COLIDOR	НО	URS I	N SEI	MEST	ER*	FOTO		
STATUS	CODE	COURSE	L	S	AE	LE	DE	ECTS		
	FELJ01	Digital telecommunications	45	0	15	15	0	6		
Mandatory	FELJ28	Radars	30	0	0	30	0	5		
	* L = lecture	es, S = seminars, AE = auditoryexcercise, LE = labora	atoryex	cercise	, DE =	design	excerci	se		

		List ofcourses						
Year of study	:1.							
Semester:II.								
OTATUO	CODE	COLIDOR	НО	URS I	N SEI	ИEST	ER*	FOTO
STATUS	CODE	COURSE	L	S	AE	LE	DE	ECTS
	FELJ24	Bioelectromagnetics	30	0	0	30	0	5
Mandatory	FELJ33	Antennas	30	0	15	15	0	6
	* L = lectures	S, S = S seminars, $S = S$	atoryex	ercise	, DE =	design	excerci	se

		List ofcourses									
Year of study	:2.										
Semester:III.											
CTATUC	STATUS CODE COURSE HOURS IN SEMESTER* ECTS										
STATUS	L	S	AE	LE	DE	ECTS					
	FELH25	Electromagnetic compatibility	45	0	15	15	0	6			
	FELJ26	Electromagnetic ecology and dosimetry	30	0	0	15	0	4			
Mandatory	FELJ22	Measurements in wireless systems	30	0	15	15	0	5			
	FELJ36	Systems for wireless transmission of energy	30	0	0	30	0	5			
FELH41 Medical electronic devices 30 0 0 30 0 5											
* L = lectures, S = seminars, AE = auditoryexcercise, LE = laboratoryexcercise, DE = design excercise											

Studyprogramme module:: TELECOMMUNICATIONS AND INFORMATICS - 242

		List ofcourses						
Year of study	:1.							
Semester:I.								
CTATUC	CODE	COLIDOR	НО	URS I	N SEI	MEST	ER*	ГОТО
STATUS	CODE	COURSE	L	S	AE	LE	DE	ECTS
	FELJ01	Digital telecommunications	45	0	15	15	0	6
Mandatory	FELJ28	Radars	30	0	0	30	0	5
	FELJ02	Radio communications	30	0	15	15	0	5
	* L = lectures, S = seminars, AE = auditoryexcercise, LE = laboratoryexcercise, DE = design excercise							

	List ofcourses										
Year of study	:1.										
Semester:II.											
	HOURS IN SEMESTER*										
STATUS	CODE	COURSE	L	S	AE	LE	DE	ECTS			
	FELJ12	Algorithms	30	0	15	15	0	5			
	FELJ14	Mobile communications	30	0	15	15	0	5			
	* L = lectures, S = seminars, AE = auditoryexcercise, LE = laboratoryexcercise, DE = design excercise										

		List ofcourses										
Year of study	Year of study:2.											
Semester:III.												
CTATUC	STATUS CODE COURSE HOURS IN SEMESTER* ECTS											
STATUS	CODE	COURSE	L	S	AE	LE	DE	ECIS				
	FELH30	Local and access networks	30	0	0	30	0	5				
Mandatani	FELJ24	<u>Bioelectromagnetics</u>	30	0	0	30	0	5				
Mandatory	FELH41	Medical electronic devices	30	0	0	30	0	5				
	FELJ20	Multimedia systems	30	0	0	30	0	5				
	FELJ22	Measurements in wireless systems	30	0	15	15	0	5				
Elective FELJ36 Systems for wireless transmission of energy 30 0 0 30 0 5												
	* L = lecture	es, S = seminars, AE = auditoryexcercise, LE = labor	atoryexo	cercise	, DE =	design	excerci	se				

1.2. Course description

Course teacher Joško Radić, Ph.D., Associate Professor Credits (ECTS) 6	NAME OF THE COURSE	DIGITAL TELECOMMUNICATIONS								
Associate Professor Associate teachers Associate teachers Petar Solié, Ph.D., Assistant Professor Course objectives Course objectives Course objectives Course enrolment requirements and entry competences required for the course (4 to 10 learning outcomes) Extending outcomes expected at the level of the course (4 to 10 learning outcomes) Course expected at the level of the course (5 learning outcomes) Course expected at the level of the course (5 learning outcomes) Course expected at the level of the course (5 learning outcomes) Course expected at the level of the course (5 learning outcomes) Course expected at the level of the course (5 learning outcomes) Course content broken down in declaration of communication system such respective to the parameters of the course (5 learning outcomes) Course content broken down in detail by weekly class schedule (syllabus) Course content broken down in detail by weekly class schedule (syllabus) Associate Professor Type of instruction (number of hours) Percentage of application of e-learning of papelication of e-learning of an adjust a simple communication system Course content broken down in declaration of analytical models necessary to understand the effects and the ef	Code	FELJ01	Year of study	1.						
Associate teachers Assistant Professor (number of hours) 45 0 15 15 0 Course objectives Training students for: - Understanding the structure of a digital communication system - Application of analytical models necessary to understand the effects and the design of digital communication system - Acquiring knowledge about the ways of realization of communication networks Course enrolment requirements and entry competences required for the course (4 to 10 learning outcomes expected at the leve of the course (4 to 10 learning outcomes) Students will be able to: 1. Compare different systems with redundant coding 2. Analyze the properties of communication systems with redundant coding applied 3. Assistant of the course of the course of the course of the corresponding ARQ system with respect to the parameters of the communication channel 5. Select the corresponding ARQ system with respect to the parameters of the communication channel 6. Identify the topology of the communication network and describe ways of switching in the network 7. Multistage switch design Course content	Course teacher		Credits (ECTS)	6						
Course objectives Training students for: Understanding the structure of a digital communication system Application of analytical models necessary to understand the effects and the design of digital communication system summer and entry competences required for the course Learning outcomes expected at the level of the course (4 to 10 learning outcomes) Explanation of the representation in a digital communication system 5. Select the corresponding ARQ system with respect to the parameters of the communication channel 6. Identify the topology of the communication network and describe ways of switching in the network 7. Multistage switch design Course content Broken down in detail by weekly class schedule (syllabus) Course content broken down in detail by weekly class schedule (syllabus) Course content BCH and Read-Solomon codes, turbo coding ARQ system, FEC systems, encryptionandprotocols, The topologyofthe network. networkinggroupsandsignaling 3 2 Circuitswitching, multistageswitching 3 2 Circuitswitching, multistageswitching 3 2 Circuitswitching 9. Spatialandtemporalswitching 9. Spatialandtempor	Associate teachers			-						
Training students for: - Understanding the structure of a digital communication system - Application of analytical models necessary to understand the effects and the design of digital communication systems - Implement and analyse a simple communication system - Acquiring knowledge about the ways of realization of communication networks Course enrolment requirements and entry competences required for the course Students will be able to: 1. Compare different systems with redundant coding 2. Analyze the properties of communication systems with redundant coding applied 3. Design transceiver filters for transmission without ISI 4. Explanation of the role of synchronization in a digital communication system of the course of the course of the corresponding ARQ system with respect to the parameters of the communication channel 6. Identify the topology of the communication network and describe ways of switching in the network 7. Multistage switch design Course content Real channelsEqualisation Nyquistfilters, correlationfilters, Linearandnon-linearequalization, Nyquistsignalingfilters, Sinchandserial, synchronousandasynchronous, simple wanduplevtransmission, Synchronizationofdigitalsignals (clock, theframeandcarrier) 3. 2. Echocancellation, scrambling, Parallelandserial, synchronousandasynchronous, simple wanduplevtransmission, Synchronizationofdigitalsignals (clock, theframeandcarrier) 3. 2. Echocancellation, scrambling, Parallelandserial, synchronousandasynchronous, simple wanduplevtransmission, Synchronizationofdigitalsignals (clock, theframeandcarrier) 3. 2. Echocancellation, scrambling, Parallelandserial, synchronousandsynchronous, simple wanduplevtransmission, Synchronizationofdigitalsignals (clock, theframeandcarrier) 3. 2. Echocancellation, scrambling, Parallelandserial, synchronousandsynchronous, simple wanduplevtransmission, Synchronizationofdigitalsignals (clock, theframeandcarrier) 3. 2. Echocancellation, scrambling, Parallelandserial, synchronousandsynchronous, simple wanduple wanduple wanduple wandup	Status of the course									
Course objectives - Understanding the structure of a digital communication system - Application of analytical models necessary to understand the effects and the design of digital communication systems - Implement and analyse a simple communication system - Acquiring knowledge about the ways of realization of communication networks Course enrolment requirements and entity competences required for the course Students will be able to: 1. Compare different systems with redundant coding 2. Analyze the properties of communication systems with redundant coding applied 3. Design transceiver filters for transmission without ISI 5. Select the corresponding ARQ system with respect to the parameters of the communication channel 6. Identify the topology of the communication network and describe ways of switching in the network 7. Multistage switch design Course content broken down in detail by weekly class schedule (syllabus) Course content broken down in detail by weekly (salsabedule (syllabus) Course content broken down in detail by weekly class schedule (syllabus) ARQ system, FEC systems, encryptionandprotocols, 7 interopologyofthe network. networkinggroupsandsignaling 3 2 interiopologyofthe network. networkinggroupsandsignaling 3 2 inter		COURSE DESCRIPTION								
requirements and entry competences required for the course Learning outcomes expected at the level of the course (4 to 10 learning outcomes) Students will be able to: 1. Compare different systems with redundant coding 2. Analyze the properties of communication systems with redundant coding applied 3. Design transceiver filters for transmission without ISI 4. Explanation of the role of synchronization in a digital communication system 5. Select the corresponding ARQ system with respect to the parameters of the communication channel 6. Identify the topology of the communication network and describe ways of switching in the network 7. Multistage switch design Course content Real channelsEqualisation 3 2 Course content Real channelsEqualisation 3 2 Linearandnon-linearequalization, Nyquistsignalingfilters, 3 2 Echocancellation, scrambling, 3 2 Parallelandserial, synchronousandasynchronous, simplexandduplextransmission, 3 2 Synchronizationofdigitalsignals (clock, theframeandcarrier) 3 2 Redundantcoding, block, convolutionsandtrelliscodes, 3 2 First midterm exam BCH and Reed-Solomon codes, turbo coding ARQ system, FEC systems, encryptionandprotocols, 3 2 Thetopologyofthe network, networkinggroupsandsignaling 3 2 Routingandnumbering plan, typesofswitchingsystems 3 2 Circuitswitching, multistageswitching 3 2	Course objectives	 Understanding the structure Application of analytical design of digital community Implement and analysis 	 Understanding the structure of a digital communication system Application of analytical models necessary to understand the effects and the design of digital communication systems Implement and analyse a simple communication system 							
Learning outcomes expected at the level of the course (4 to 10 learning outcomes) Design transceiver filters for transmission without ISI Explanation of the role of synchronization in a digital communication system communication channel follothers. Select the corresponding ARQ system with respect to the parameters of the communication channel follothers. Course content broken down in detail by weekly class schedule (syllabus) 1. Compare different systems with redundant coding applied 2. Analyze the properties of communication systems with respect to the parameters of the communication channel 6. Identify the topology of the communication network and describe ways of switching in the network 7. Multistage switch design Course content Real channels Equalisation 3 2 Nyquistfilters, correlationfilters, 3 2 Linearandnon-linear equalization, Nyquist signaling filters, 3 2 Echocancellation, scrambling, 3 2 Parallelandserial, synchronous and asynchronous, 3 2 Synchronization of digital signals (clock, the frame and carrier) 3 2 Redundant coding, block, convolutions and trelliscodes, 3 2 First midterm exam BCH and Reed-Solomon codes, turbo coding ARQ system, FEC systems, encryption and protocols, 3 2 The topology of the network. network ing groups and signaling 3 2 Circuits witching, multistages witching 3 2 Spatial and temporals witching 3 2	Course enrolment requirements and entry competences required for the course	None	one							
Course content Nyquistfilters, correlationfilters, Linearandnon-linearequalization, Nyquistsignalingfilters, Echocancellation, scrambling, Parallelandserial, synchronousandasynchronous, simplexandduplextransmission, Synchronizationofdigitalsignals (clock, theframeandcarrier) Redundantcoding, block, convolutionsandtrelliscodes, First midterm exam BCH and Reed-Solomon codes, turbo coding ARQ system, FEC systems, encryptionandprotocols, Thetopologyofthe network. networkinggroupsandsignaling Routingandnumbering plan, typesofswitchingsystems Circuitswitching, multistageswitching Spatialandtemporalswitching Sa 2 Nyquistfilters, Sa 2 Linearandnon-linearequalization, Nyquistsignalingfilters, Sa 2 Chocancellation, scrambling, Clock, theframeandcarrier) Synchronizationofdigitalsignals (clock, theframeandcarrier) Synchronizationofdigitalsigna	Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	 Compare different systems with redundant coding Analyze the properties of communication systems with redundant coding applied Design transceiver filters for transmission without ISI Explanation of the role of synchronization in a digital communication system Select the corresponding ARQ system with respect to the parameters of the communication channel Identify the topology of the communication network and describe ways of switching in the network 								
Real channelsEqualisation 3 2 Nyquistfilters, correlationfilters, 3 2 Linearandnon-linearequalization, Nyquistsignalingfilters, 3 2 Echocancellation, scrambling, 3 2 Parallelandserial, synchronousandasynchronous, simplexandduplextransmission, 3 2 Synchronizationofdigitalsignals (clock, theframeandcarrier) 3 2 Redundantcoding, block, convolutionsandtrelliscodes, 3 2 First midterm exam BCH and Reed-Solomon codes, turbo coding ARQ system, FEC systems, encryptionandprotocols, 3 2 Thetopologyofthe network. networkinggroupsandsignaling 3 2 Routingandnumbering plan, typesofswitchingsystems 3 2 Circuitswitching, multistageswitching 3 2 Spatialandtemporalswitching 3 2		Course content			ŀ	L				
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Course content broken down in detail by weekly class schedule (syllabus) Echocancellation, scrambling, Parallelandserial, synchronousandasynchronous, simplexandduplextransmission, Synchronizationofdigitalsignals (clock, theframeandcarrier) Redundantcoding, block, convolutionsandtrelliscodes, First midterm exam BCH and Reed-Solomon codes, turbo coding ARQ system, FEC systems, encryptionandprotocols, Thetopologyofthe network. networkinggroupsandsignaling Routingandnumbering plan, typesofswitchingsystems Circuitswitching, multistageswitching Spatialandtemporalswitching 3 2 2 2 2 3 2 3 2 3 2 3 3 2 3 4 3 3 2 5 3 3 2 7 3 3 2 3 7 4 7 8 7 8 7 8 7 8 7 8 7 8 7 8 7 8 7 8		Nyquistfilters, correlationfile	ters,					2		
Course content broken down in detail by weekly class schedule (syllabus) Parallelandserial, synchronousandasynchronous, simplexandduplextransmission, Synchronizationofdigitalsignals (clock, theframeandcarrier) Redundantcoding, block, convolutionsandtrelliscodes, First midterm exam BCH and Reed-Solomon codes, turbo coding ARQ system, FEC systems, encryptionandprotocols, Thetopologyofthe network. networkinggroupsandsignaling Routingandnumbering plan, typesofswitchingsystems Circuitswitching, multistageswitching Spatialandtemporalswitching 3 2 2 2 2 3 2 3 2 3 3 2 3 3 2 4 3 3 3 2 5 3 3 3 2 7 5 6 7 7 8 7 8 7 8 7 8 7 8 7 8 7 8 7 8 7 8		Linearandnon-linearequaliz	zation, Nyquistsignalingfilte	ers,		3		2		
Simplexandduplextransmission, Synchronizationofdigitalsignals (clock, theframeandcarrier) Synchronizationofdigitalsignals (clock, theframeandcarrier) Redundantcoding, block, convolutionsandtrelliscodes, First midterm exam BCH and Reed-Solomon codes, turbo coding ARQ system, FEC systems, encryptionandprotocols, Thetopologyofthe network. networkinggroupsandsignaling Routingandnumbering plan, typesofswitchingsystems Circuitswitching, multistageswitching Spatialandtemporalswitching 3 2 Circuitswitching, multistageswitching Spatialandtemporalswitching 3 2 Spatialandtemporalswitching 3 2		Echocancellation, scrambli	ing,			3		2		
broken down in detail by weekly class schedule (syllabus) Synchronizationofdigitalsignals (clock, theframeandcarrier) Redundantcoding, block, convolutionsandtrelliscodes, First midterm exam BCH and Reed-Solomon codes, turbo coding ARQ system, FEC systems, encryptionandprotocols, Thetopologyofthe network. networkinggroupsandsignaling Routingandnumbering plan, typesofswitchingsystems Circuitswitching, multistageswitching Spatialandtemporalswitching 3 2 2 2 2 3 2 3 2 3 3 2 3 3 2 3 3 3 3	Course content					3		2		
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(syllabus) BCH and Reed-Solomon codes, turbo coding ARQ system, FEC systems, encryptionandprotocols, Thetopologyofthe network. networkinggroupsandsignaling Routingandnumbering plan, typesofswitchingsystems Circuitswitching, multistageswitching Spatialandtemporalswitching 3 2 Spatialandtemporalswitching 3 2	detail by weekly	Redundantcoding, block, c	onvolutionsandtrelliscodes	5,		3		2		
BCH and Reed-Solomon codes, turbo coding ARQ system, FEC systems, encryptionandprotocols, Thetopologyofthe network. networkinggroupsandsignaling Routingandnumbering plan, typesofswitchingsystems Circuitswitching, multistageswitching Spatialandtemporalswitching 3 2 Spatialandtemporalswitching 3 2		First midterm exam								
Thetopologyofthe network. networkinggroupsandsignaling 3 2 Routingandnumbering plan, typesofswitchingsystems 3 2 Circuitswitching, multistageswitching 3 2 Spatialandtemporalswitching 3 2	(cynabao)	BCH and Reed-Solomon c	odes, turbo coding							
Routingandnumbering plan, typesofswitchingsystems 3 2 Circuitswitching, multistageswitching 3 2 Spatialandtemporalswitching 3 2		ARQ system, FEC systems	s, encryptionandprotocols,			3		2		
Circuitswitching, multistageswitching 3 2 Spatialandtemporalswitching 3 2		Thetopologyofthe network.	networkinggroupsandsign	aling		3		2		
Circuitswitching, multistageswitching 3 2 Spatialandtemporalswitching 3 2		Routingandnumbering plar	n, typesofswitchingsystems	3		3		2		
						3		2		
Second midterm exam		Spatialandtemporalswitching	ng		3		2			
		Second midterm exam								

	List of laboratory exe	ercises						LE hours
	Eye pattern							2
	Equalisation							2
	Scrembling							2
	Channel coding: Bloo	ck codes	S					2
	Channel coding: Cor	volution	nal codes					2
	Optimum receiver							2
Format of instruction	 □ lectures □ seminars and wo □ exercises □ on line in entirety □ partial e-learning □ field work 	rkshops	i	□ mul	epender timedia oratory k with m (othe			
Studentresponsibiliti es	The presence on lec Performed all require				t least 7	0 % of the time	s sche	duled.
Screening student	Class attendance	1,8	Researc	ch		Practical traini	ng	
work (name the proportion of ECTS	Experimental work		Report			Individual work	(3
credits for eachactivity so that the total number of	Essay	ssay Seminar Laboratory exercises						
ECTS credits is equal to the ECTS	Tests	Tests 0,1 Oral exam Preparation for laboratory exercises						0,5
value of the course)	Written exam	0,1	Project			(Other)		
Grading and evaluating student work in class and at the final exam	During the semester final exams consist pass the midterm ex The midterm and fir passing grade is the each midterm exam the formula: Grade (%) = 0,8 * (0 M1, M2 - points at the laboratory (with com The final evaluation percentage Rating 50% to 61% is suffice 62% to 74% good (3 75% to 87% of very 88% 100% Excellen	of quest ams taken al examentation positive or the finds.5 * M1 ne mid-tipleted a is determined. Signal (2) good (4)	tions and se part. ns are ca e assessr inal exam + 0,5 * M erm expr all lab. Ex mined as	tasks. arried or nent of n. Grade 12) + 0,2 essed a tercises	In the fi ut as wr laborato e (in per 2 * L; as a pero) expres	nal exams stud itten tests. The ry exercises an centage) is forr centage, and L	requir d 50 % ned acc	rement for points on cording to
Required literature	Title Copies in the library Availability vi							
(available in the	J. Proakis: Digita	l Comm	nunication	n, IV. Ed	d			
library and via other media)	S. Benedetto: Pr with wireless app			ansmis	sion:			
	L. W. Couch II: D. Communication 3			9				
Optional literature (at the time of submission of study								

programme proposal)	
Quality assurance methods that ensure the acquisition of exit competences	 Evaluation of results in accordance with the above learning outcomes Feedback from students via surveys Self-evaluation of teachers Institutional and non-institutional evaluations
Other (as the proposer wishes to add)	

NAME OF THE COURSE	RADARS								
Code	FELJ28	Year of study	1						
Course teacher	Zoran Blažević, Ph.D., Full Professor	Credits (ECTS)	5	5					
Associate teachers	Maja Škiljo, Ph.D.	Type of instruction (number of hours)	L 30	S 0	AE 0	1E 30	DE 0		
Status of the course	Elective	Percentage of application of e-learning	0						
	COURSE	DESCRIPTION							
Course objectives	operation principle, and calculating and estimat differentiating between disadvantages visualization of possib	sing the knowledge about d the role of all main radar ting the basic radar signal specific radar types and p bilities and characteristics igating modern solutions in	subsystem param perceiving of sure	stems. neters ing the rveillar	ir adva	antage	s and		
Course enrolment requirements and entry competences required for the course	Finished the undergraduate					echno	logy		
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	certain radar subsysten - estimate and calculate - recognize the relation b - evaluate and perceive a	develop competencies in individual and team work in analyzing and designing certain radar subsystems							
Course content	Course content					Lh	ours		
broken down in	Introduction to radar syster	ns.					1		
detail by weekly class schedule	Basic principles of radar systems.						2		
(syllabus)	Parameters of radar signal						2		

	Radio wave propag		adar equa	tion an	d maxin	num range.	3	
	Radar cross section						3	
	Estimation of target	•	n parame	ters by	radar si	gnal.	2	
	Basic radar hardwa						2	
	Moving target indica	`	TI) radar	•			3	
	Doppler impulse rac						3	
	Synthetic aperture r	`	AR).				2	
	Meteorological rada						2	
	Ultra wideband (UW	/B) rada	ar.				2	
	Target tracking.						2	
	Clutter cancelation		systems				1	
	List of laboratory exe						LE hours	
	Transmission and ref network analyzer.	nsmission and reflection measurements of devices using vector work analyzer.						
	Radar principles- the	measu	rement o	ftarget	distance	Э.	6	
	Numerical simulation	of targe	et radar c	ross se	ection.		2	
	The measurement of	bistatio	radar cr	oss sec	tion.		2	
	SAR radar concept-	simulati	on and m	easure	ments.		4	
	MTI radar concept- s	imulatio	n and me	easurer	nents.		2	
	UWB radar concept-	simulat	ion and n	neasure	ements.		2	
	Group visit to HRM (Croatiar	n Navy) ir	Lora.			5	
	Group visit to Naval o	centre o	f electror	ics (PC	E) Split	•	5	
Format of instruction	 ☑ lectures ☐ seminars and word ☐ exercises ☐ on line in entirety ☐ partial e-learning ☒ field work 	rkshops		□ mul	epender Itimedia oratory k with n (othe			
Student responsibilities						0 % of the times sche	eduled.	
Screening student	Class attendance	1.5	Researc	h		Practical training		
work (name the proportion of ECTS	Experimental work		Report			Individual work		
credits for each activity so that the	Essay		Seminal essay	r	2	Laboratory exercises	1	
total number of ECTS credits is equal to the ECTS	Tests	0,5	Oral exa	am		Preparation for laboratory exercises		
value of the course)	Written exam		Project			(Other)		
Grading and evaluating student work in class and at the final exam	There is one midterm test and seminar essay. The midterm test is after 7 weeks lecturing and the seminar essays are presented during the next part of the semester. The midterm test consists of theoretical questions and numerical. Seminar essay includes individual work and work in groups, and the presentation of the results. The students that did not pass the test take part In the final exams and the presentation of the seminar essay is obligatory. The midterm test is carried out as written test Grade (in percentage) is formed according to the formula: $Grade(\%) = 0.1 \text{ NP} + 0.1 \text{ LV} + 0.4 \text{ (M + S)}$ the activities in percentage:						semester. inar essay esults. The esentation	
	NP - attenda	ance at	lectures,					

	 LV – laboratory assessment, M - test results, S- seminar essay 						
	Title	Number of copies in the library	Availability via other media				
Required literature (available in the library and via other	M. Škiljo:: Radari, predavanja		e-learning portal				
media)	Skolnik, M: Introduction to Radar Systems, McGraw-Hill, 1990.	1					
	Peebles, P. Z: "Radar Principles", John Wiley & Sons, 1998.	1					
Optional literature (at the time of submission of study programme proposal)	 Tait, P: "Introduction to Radar Target Recognition Zentner, E.: Antene i radiosustavi, Graphis Zagre 						
Quality assurance methods that ensure the acquisition of exit competences	Evaluation of results in accordance with the above learning outcomes Feedback from students via surveys Self-evaluation of teachers Institutional and non-institutional evaluations						
Other (as the proposer wishes to add)							

NAME OF THE COURSE	BIOELECTROMAGNETIC	cs								
Code	FELJ24	Year of study	1.							
Course teacher	Antonio Šarolić, Ph.D., Full Professor	Credits (ECTS)	5							
Associate teachers	Niko Ištuk, Teaching	Type of instruction	L	S	AE	LE	DE			
Associate teachers	Assistant	(number of hours)	30			30				
Status of the course	Elective	Percentage of application of e-learning	0							
	COURSE DESCRIPTION									
Course objectives		nan electrophysiology n therapeutic and diagnos ed interdisciplinary knowle			edical	applica	ations			
Course enrolment requirements and entry competences required for the course	None.									
Learning outcomes expected at the level	Students will be able to:									

of the course (4 to 10 learning outcomes)	 describe the cell structure describe the electrophysiology of excitable cells and tissues apply the electrophysiology knowledge for understanding the brain and heart function analyze the electric activity of heart and brain with applications in diagnostics link the electrophysiology principles to the function of other bodily organs and to potential biomedical applications 								
	Course content	a. app					L hours	AE hours	
	Introduction and hist	ory.					2	0	
	Structure of neuron a	and mus	scle cells.				2	0	
	Membrane potential.						2	0	
	Axon as transmissio	n line (c	able).				2	0	
Course content	Membrane activation. 2								
broken down in detail by weekly	Synapses, receptors and brain. 2								
	Heart. 2								
class schedule (syllabus)	Volume source. Volu	Volume source. Volume conductor. 2							
(0)	Electrocardiography (ECG). 2							0	
	Electroencephalograhpy (EEG). 2							0	
	Electrophysiology of	the eye	. Electrod	dermal	reaction	l.	2	0	
	Other diagnostic and electromagnetics. Ma						2	0	
(Visit to Medical School companies related to				plit. Visi	t to	2	0	
	List of laboratory or o	design e	exercises					LE hours	
	Membrane potential.							4	
	Axon as transmissior	ı line (ca	able).					2	
	Membrane activation							4	
	Synapses, receptors	and bra	in.					2	
	Electrocardiography	(ECG).						2	
	Electroencephalogra	hpy (EE	G).					2	
	Electrodermal reaction	n.						2	
	Other diagnostic and electromagnetics. Ma							2	
_	Visit to Medical Scho related to the course		Universi	ty of Sp	olit. Visit	to companie	es	6	
	⊠ lectures			□inde	nonder	et accianmen	+o		
	⊠ seminars and wor	rkshops			epender timedia	nt assignmen	ıs		
Format of instruction	⊠ exercises				oratory				
T Office of mondone	☐ <i>on line</i> in entirety				k with m	nentor			
	□ partial e-learning⋈ field work				(othe				
Student responsibilities	Student is required to least 70% of the sch the amount of 100% laboratory exercises	edule. S of the s	Student is	require	ed to att	end the labo	ratory exe	ercises in	
Screening student	Class attendance	1	Researc	:h		Practical tra	ining		
work (name the proportion of ECTS	Experimental work	0,5	Report			Laboratory 6	exercises	0,5	

	1	1	T	1	1		1			
credits for each activity so that the	Essay		Seminar essay	1	Individual work	(1			
total number of ECTS credits is	Mid-exam	0,5	Oral exam		(Other)					
equal to the ECTS value of the course)	Written exam	0,5	Project		(Other)					
Grading and evaluating student work in class and at the final exam	the middles of the semester, while the second will be held after the lectures an exercises are completed, schedules to be agreed with the students. The first mid-exam is based on the first half of the course material. The second midexam is based on the first second half of the course material. To pass at each mid-exam, min. 50% of points must be earned from the part of the exam containing numerical problems (material from auditory exercises) and min 50% of points must be earned from the part of the exam containing theory (material from the lectures). To earn the right to approach the second mid-exam, min. 30% of points must be earned from the part of the first mid-exam containing numerical problems (material from auditory exercises) and min. 30% of points must be earned from the part of the first mid-exam containing theory (material from the lectures). If a student earns the positive grades on both mid-exams, he/she is considered thave passed the whole exam with the grade calculated as average from both midexams. At the first exam term, students may choose to take the exam containing only the half of the material that they haven't passed at mid-exams. At all other exam terms, students must take the whole exam, containing all the cours material. Approaching the exams is subject to fulfilling the requirements on studer responsibilities. The overall point percentage defining the overall grade is calculated as the average of points earned in all exam questions, corrected by the result of oral verification: Percentage -> Grade 50% - 62,4% -> sufficient (2) 62,5% - 74,9% -> good (3) 75% - 87,4% -> very good (4) 87,5% - 100% -> excellent (5) Final grade can be supplemented by performing practical project work involving individual and experimental work, in agreement with the teacher. Exam terms: according to the academic year calendar									
		Title			Number of copies in the library	Availabi other r	_			
Required literature	 Jaakko Malmivud Bioelectromagne Applications of B Fields, Oxford U 1995. 	etism - P Bioelectri niversity								
(available in the library and via other media)	Handbook of bio electromagnetic Bioengineering a Electromagnetic and Ben Greene	fields (thand Biop Fields, I								
	Handbook of bio electromagnetic and Medical Asp Ed. Frank S. Bar CRC Press, 200	logical e fields (the ects of l	effects of nird edition): Biol Electromagnetic	ogical Fields,						
Optional literature (at the time of	Šantić, A: Biome	× ··· · · · · · · · · · · · · · · · · ·								

submission of study programme proposal)	The Biomedical Engineering Handbook (Second Edition), Ed. Joseph D. Bronzino, CRC Press, 2000.
Quality assurance methods that ensure the acquisition of exit competences	Surveys providing student feedback
Other (as the proposer wishes to add)	

NAME OF THE COURSE	ANTENNAS									
Code	FELJ33	Year of study	1.							
Course teacher	Antonio Šarolić, Ph.D., Full Professor	Credits (ECTS) 6								
Associate teachers	Niko Ištuk, Teaching Assistant	Type of instruction (number of hours)	S	AE 15	LE 15	DE				
Status of the course	Obligatory	Percentage of application of e-learning	0							
COURSE DESCRIPTION										
Course objectives	Training students for: - understanding the phenomena of radiation - analysis of antennas as radiating structures - application of antennas in wireless communication systems									
Course enrolment requirements and entry competences required for the course	None.	None.								
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	 elaborately assess the calculate the electroma structures 	 utilize the antenna parameters as the basis for antenna application in ICT elaborately assess the applicability of a certain antenna for specific purpose calculate the electromagnetic field in the surrounding of simple antenna structures analyze the parameters of linear antennas 								
Course content broken down in	Course content				or S hours		AE ours			
detail by weekly class schedule	Introduction. Antenna parameters. Polarization. Radiation pattern.						1			
(syllabus)	Directivity. Gain. Antenna i	mpedance. Effective area.			2		1			

	Effective length. Ant parameters. Friis eq		ctor. Rela	ations li	nking th	e antenna	2	1	
	Elementary electrica	al dipole	(EED). F	ield arc	und the	EED.	2	1	
	Radiated power and EED.	l radiatio	n resista	nce of I	EED. Ef	ficiency of	2	1	
	Zones surrounding t	he ante	nna – ne	ar and f	ar field.		2	1	
	Resonant dipoles. H	lalfwave	dipoles.	Fullwa	e dipol	es.	2	1	
	Electrically short dip	ole and	unipole.				2	1	
	Mutual impedance of	of dipole:	S.				2	1	
	Antenna array. Unifo	orm line	ar antenn	a array			2	1	
	Array with uniform a	mplitude	e distribut	tion.			2	1	
	Arrays with non-unif	orm am	plitude di	stributio	n.		2	1	
	Practical examples	of anten	na install	ations i	n use –	field trip.	2	1	
	List of laboratory or	design e	exercises					LE hours	
	Introduction. Antenna Directivity. Gain. Ant						n.	2	
	Radiated power and Zones surrounding th					iciency of E	ED.	2	
	Resonant dipoles. Hadipole and unipole.	alfwave	dipoles.	Fullwav	e dipole	s. Electrical	ly short	2	
	Mutual impedance of array.	f dipoles	. Antenn	a array.	Uniforn	n linear ante	enna	2	
	Array with uniform amplitude distribution. Arrays with non-uniform amplitude distribution.								
	Practical examples of antenna installations							1	
Format of instruction	 ☑ lectures ☐ seminars and wo ☐ exercises ☐ on line in entirety ☐ partial e-learning ☒ field work 	rkshops		□ mul ⊠ labo	epender Itimedia oratory k with n (othe		nts		
Studentresponsibiliti es	Student is required to least 70% of the sch the amount of 100% laboratory exercises	edule. So of the s	Student is	require	ed to att	end the labo	oratory ex	ercises in	
Screening student	Class attendance	2	Researc	 :h		Practical tra	aining	0,5	
work (name the proportion of ECTS	Experimental work	0,5	Report			Laboratory	exercises	0,5	
credits for eachactivity so that the total number of	Essay		Semina essay	r		Individual v	vork	1	
ECTS credits is	Mid-exam	0,5	Oral exa	am		(Oth	ner)		
equal to the ECTS value of the course)	Written exam	0,5	Project		0,5	(Oth	ier)		
Grading and evaluating student work in class and at the final exam									

During the semester, two mid-exams will be held. The first mid-exam will be held in the middles of the semester, while the second will be held after the lectures and exercises are completed, schedules to be agreed with the students.

The first mid-exam is based on the first half of the course material. The second midexam is based on the first second half of the course material.

To pass at each mid-exam, min. 50% of points must be earned from the part of the exam containing numerical problems (material from auditory exercises) and min. 50% of points must be earned from the part of the exam containing theory (material from the lectures).

To earn the right to approach the second mid-exam, min. 30% of points must be earned from the part of the first mid-exam containing numerical problems (material from auditory exercises) and min. 30% of points must be earned from the part of the first mid-exam containing theory (material from the lectures).

If a student earns the positive grades on both mid-exams, he/she is considered to have passed the whole exam with the grade calculated as average from both mid-exams.

At the first exam term, students may choose to take the exam containing only that half of the material that they haven't passed at mid-exams.

At all other exam terms, students must take the whole exam, containing all the course material.

Approaching the exams is subject to fulfilling the requirements on student responsibilities.

The overall point percentage defining the overall grade is calculated as the average of points earned in all exam questions, corrected by the result of oral verification:

Percentage -> Grade

50% - 62,4% -> sufficient (2)

62,5% - 74,9% -> good (3)

75% - 87,4% -> very good (4)

87,5% - 100% -> excellent (5)

Final grade can be supplemented by performing practical project work involving individual and experimental work, in agreement with the teacher.

Exam terms: according to the academic year calendar

Required literature	Title	Number of copies in the library	Availability via other media			
(available in the library and via other media)	E. Zentner: Antene i radiosustavi, Graphis, Zagreb 2001.					
media)	Constantine A. Balanis: AntennaTheory: Analysisand Design, Wiley, 1997.					
Optional literature (at the time of submission of study programme proposal)	V. Roje: Antene I dio, skripta, Sveučilište u Splitu 1981. Handbook of antennas in wireless communications, CRC Press, 2002.					
Quality assurance methods that ensure the acquisition of exit competences	Surveys providing student feedback					
Other (as the proposer wishes to add)						

NAME OF THE									
COURSE	ELECTROMAGNETIC CO	OMPATIBILITY							
Code	FELH25	Year of study	2.						
Course teacher	Dragan Poljak, Ph.D., Full Professor Antonio Šarolić, Ph.D., Full Professor	Credits (ECTS)	6						
Associate toochers	Niko Ištuk, Teaching	Type of instruction	L	S	AE	LE	DE		
Associate teachers	Assistant	(number of hours)	45		15	15			
Status of the course	Obligatory	Percentage of application of e-learning	0						
	COURSE	DESCRIPTION							
Course objectives	 Training students for: understanding the electromagnetic phenomena in circuits, devices and systems application of acquired knowledge to prevent electromagnetic interference from circuits, devices and systems application of acquired knowledge to improve immunity of circuits, devices and systems to electromagnetic disturbances 								
Course enrolment requirements and entry competences required for the course	None.								
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	compatibility - calculate electromagned disturbance voltages in analyze the conducted design filters for rejection analyze shielding and estandards and regulation analyze electromagnet with concentrated para	grounding of electrical dev ic compatibility by measure	ntenna lity of e rices ar ements and sy eters a	struct lectricand circum in acconstems nd tran	ures, al dev uits cordar using nsmiss	as wel ices nce wit mode sion lir	l as h ls es		
	Course content				L		λE		
	Introduction to electromagr	netic compatibility			hours 3	nc	ours 1		
	Electronic components and				3		1		
	Radiated emissions and su	•			3		1		
Course content broken down in	Conducted emissions and	• •			3		1		
detail by weekly	Filtering.	1 7			3		1		
class schedule	Shielding.			3		1			
(syllabus)	Grounding.				3		1		
	Measurements in electrom	agnetic compatibility.			3		1		
	Electromagnetic compatibil regu- lations. Electromagneradiocommunication system	lity requirements, standard etic compatibility in	ds and		3		1		

	Historical overview of with concentrated pa			J. Low-f	requen	cy models	3	1
	High-frequency mod	dels with	distribute	ed para	meters.		3	1
	Analysis of wire ante	ennas ir	n EMC ap	plicatio	ns.		3	1
	Transmission line m	odels.					3	1
	List of laboratory or	design	exercises					LE hours
	Introduction to electro	omagne	etic compa	atibility.				1
	Electronic componer	nts and	their equi	valent c	ircuits.			1
	Radiated emissions	and sus	ceptibility	<u> </u>				1
	Conducted emission:	s and s	usceptibili	ity				1
	Filtering.							1
	Shielding.							1
	Grounding.							1
	Measurements in ele	ctroma	gnetic cor	mpatibil	ity.			1
	Electromagnetic com Electromagnetic com						ations.	1
	Historical overview o concentrated parame		modelling	. Low-fr	equenc	y models wit	h	1
	High-frequency models with distributed parameters.						1	
	Analysis of wire antennas in EMC applications.						1	
	Transmission line models.						1	
Format of instruction	 ☑ lectures ☐ seminars and wo ☑ exercises ☐ on line in entirety ☐ partial e-learning ☐ field work 	 □ seminars and workshops □ exercises □ on line in entirety □ partial e-learning □ independent assignments □ multimedia □ laboratory □ work with mentor □ (other) 					nts	
Studentresponsibiliti es	Student is required t least 70% of the sch the amount of 100% laboratory exercises	nedule. So of the s	Student is	require	ed to att	end the labo	ratory ex	ercises in
Screening student	Class attendance	2	Researc	h		Practical tra	ining	0,5
work (name the proportion of ECTS	Experimental work	0,5	Report			Laboratory 6	exercises	0,5
credits for eachactivity so that the total number of	Essay		Seminai essay	r		Individual w	ork	1
ECTS credits is	Mid-exam	0,5	Oral exa	am		(Othe	er)	
equal to the ECTS value of the course)	Written exam	0,5	Project		0,5	(Othe	er)	
Grading and evaluating student work in class and at the final exam	During the semester the middles of the sexercises are compl. The first mid-exam is exam is based on the To pass at each mid exam containing nut 50% of points must from the lectures).	semeste leted, so s based ne first s d-exam, umerical	er, while the chedules to the dules to the firecond hamin. 50% of the firecond hamin. 50% of the firecond hamin. 50% of the firecond hamin.	the sector be acted to be acte	ond will greed wo of the co course nts mus erial fro	I be held after the studer ourse material. It be earned on auditory e	er the leants. al. The selfrom the exercises	econd mid- part of the and min.

To earn the right to approach the second mid-exam, min. 30% of points must be earned from the part of the first mid-exam containing numerical problems (material from auditory exercises) and min. 30% of points must be earned from the part of the first mid-exam containing theory (material from the lectures).

If a student earns the positive grades on both mid-exams, he/she is considered to have passed the whole exam with the grade calculated as average from both mid-exams.

At the first exam term, students may choose to take the exam containing only that half of the material that they haven't passed at mid-exams.

At all other exam terms, students must take the whole exam, containing all the course material.

Approaching the exams is subject to fulfilling the requirements on student responsibilities.

The overall point percentage defining the overall grade is calculated as the average of points earned in all exam questions, corrected by the result of oral verification:

Percentage -> Grade

50% - 62,4% -> sufficient (2)

62,5% - 74,9% -> good (3)

75% - 87,4% -> very good (4)

87,5% - 100% -> excellent (5)

Final grade can be supplemented by performing practical project work involving individual and experimental work, in agreement with the teacher.

Exam terms: according to the academic year calendar

Required literature	Title	Number of copies in the library	Availability via other media					
(available in the library and via other	Clayton R. Paul: Introduction to ElectromagneticCompatibility, Wiley, 2006.							
media)	Dragan Poljak: "Advanced modelingincomputationalelectromagneticcompat ibility", WileyInterscience, 2007.							
Optional literature (at the time of submission of study programme proposal)	Tesche, F.M.: Ianoz, M.V., Karslsson, T.: EMC	 HandbookofElectromagneticCompatibility, ed. R. Perez, Academic Press, 1995. Tesche, F.M.: Ianoz, M.V., Karslsson, T.: EMC AnalysisMethodsandComputationalModels, John Wiley&Sons, 1997. 						
Quality assurance methods that ensure the acquisition of exit competences	Surveys providing student feedback							
Other (as the proposer wishes to add)								

NAME OF THE COURSE	ELECTROMAGNETIC EC	COLOGY AND DOSIMETE	RY								
Code	FELJ26	Year of study	2								
Course teacher	Dragan Poljak, Ph.D., FullProfessor	Credits (ECTS)	4								
Associate teachers	Anna Šušnjara, TeachingAssistant	Type of instruction (number of hours)	30	S 0	AE 0	LE 15	DE				
Status of the course	Obligatory	Percentage of application of e-learning	0								
COURSE DESCRIPTION											
Course objectives	Training students for: - Understandingandapplyfundamentalprinciplesofelectromagneticandthermaldo simetry, - Assessmentof human exposure to lowfrequencyandhighfrequencyelectromagneticfields - Permanentadoptinganddeepeningknowledgeintheareaofbioelectromagnetism - Applicationofnationalandinternationalregulations for theassessmentof human exposure to non-ionisingradiation										
Course enrolment requirements and entry competences required for the course	- Electromagnetic fields, Electromagnetic waves										
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	 Applymethods for them Applymethods for thec Analyzethelevelofthe ionizingradiationusingr Mathematicallyformula nwirestructures. Analyzesimpletransmis Computefundamentalpels. Use commei 	nationalandinternationalreg tesimplecasesofelectroma ssionlines, groundingsyste varametersofinternaldosim	and HF d HF fie exposur gulations gneticw msanda etrybym	elds re s vavear antenr neans	to ndradi nas ofsimp						
	Course content				L hours		\E ours				
	Electrosmog: electro lonisingandnon-ionisingrad	omagneticpollutionoftheenv liation.	vironme	nt.	2						
Course content broken down in	Couplingmechanismsofele body. Biol Lowfrequencyandhighfrequencyandhighfrequenidemiological and statistic	ogicaleffectsofelectromagruencyeffects.	hum neticfield		2						
detail by weekly class schedule (syllabus)	Fundamentalquantitiesofel currentdensity, inducedel (SAR), specificabsorption(ectricfield, specificabsorp		ate	2						
	Guidelines for protection and international regulations leves. Protection measures		Nation refere		2						
	Methodsoftheoreticalandes and internal field dosimetry.	perimentaldosimetry.	Incide	ent	2						

	Incident fielddosii Calculationandmeas powerlinesandsubsta	uremen	tof LF e	electricf		cterization. cposure to	2	
	Incident fielddosim electromagneticfield mobilephones, base	. Exp	osure		easuren RFID	nentof HF antennas,	2	
	Classificationofmode Simplifiedandanaton		for lymodels.		interna	ldosimetry.	2	
	LF El Electromagneticmod lowfrequencies.		agneticmo hebody.			LF posure to	2	
	HF Electromagnetinon-ionisingradiation		ng. The	eyeand	lbrainex	posure to	2	
	The human bodyexp	osure to	transien	tradiati	on.		2	
	Thermalresponseoftl electromagneticradia to theeyeandbraindu	he hi ation vis	uman okih frek	bodyex vencija.	posed Therm	to HF alresponse	2	
Biomedicalapplicationsofelectromagneticfields. 2 Electricalstimulationofnerves. Laser radiationoftheeye. Methodsofthe human brainstimulation. Transcranialmagneticstimulation.							2	
	List oflaboratoryor de							LEhours
	Human exposure to non-ionising EM radiation (frequenciesup to 10 – simulationmodels							2
	Human exposure to r – simulationmodels	on-ionis	sing EM r	adiatior	n (freque	enciesabove	e 10 MHz)	2
	Measureequipmental EM fields	ndmetho	ods for th	easses	smento	f human ex	posure to	3
	Measurementof LF e	lectricfie	elds					2
	Measurementof LF m	nagnetic	fields					2
	Measurementof HF E	M fields	S					2
	EM fieldcalculationin	thevicini	tyof base	station	ns			2
Format of instruction	⊠lectures □seminars and work ⊠exercises □ on linein entirety □partial e-learning □field work			□mult ⊠labo □work	imedia ratory with m (othe	r)		
Studentresponsibiliti es	The presence on lec Performed all require				t least 7	0 % of the	times sche	eduled.
Screening student	Class attendance	1,8	Researc	:h		Practical tr	aining	
work (name the proportion of ECTS credits for	Experimental work		Report			(Oth	ner)	1,8
eachactivity so that the total number of	Essay		Seminar essay	•		(Oth	ner)	0,1
ECTS credits is equal to the ECTS	Tests 0,1 Oral exam		ım	(Other)		0,1		
value of the course)	Written exam	0,1	Project			(Other)		
Grading and evaluating student	There are two midte lecturing and the sec in duration) consists numerical problem)	cond on s of 3	e is after questions	the nex	xt 6 wee	ks. Each maing theore	idterm tes tical part	t (120 min and short

work in class and at the final exam		rade is the positive assessment of laboratory exercises and 50 % points on each nidterm. Grade (in percentage) is formed according to the formula:							
	Grade(%) = 0,5 (M1 + M	12)							
	where M1 and M2 are the midterm test results, and is percentage score:	ere M1 and M2 are the midterm test results, and is determined through following centage score:							
	Percentage score: Grade:								
	From 50% to 62% sufficient (2) From 63% to 75% good (3) From 76% to 88% very good (4) From 89% to 100% excellent (5)								
	Students who do not pass midterm exams are oblige duration) in winter/fall examination period. Final test containing theoretical part and short numerical proloproblems. The requirement for passing grade isformedaccording to the described procedure. The carried out as written tests.	st consists of blem) and 2 is 50 % po	4questions(each longer numerical ints.Final grade						
Required literature	Title Number of copies in the library Availability other medi								
(available in the library and via other media)	D.Poljak, <i>Teorija elektromagnetskih polja s</i> primjenama u inženjerstvu, Šk. knjiga Zagreb, 2014.								
modia	D. Poljak: <i>Izloženost ljudi elektromagnetskom zračenju</i> , Kigen, Zagreb, 2007.								
Optional literature (at the time of submission of study programme proposal)	WileyInterscience, New York 2007. 2. D. Poljak: Human Exposure to Electron Southampton- Boston, 2003 3. R.W.Y. Habash, ElectromagneticFieldsandRa	 D. Poljak, AdvancedModelinginComputationalElectromagneticcompatibility, WileyInterscience, New York 2007. D. Poljak: Human Exposure to Electromagnetic Fields, WIT Press, Southampton- Boston, 2003 R.W.Y. Habash, ElectromagneticFieldsandRadiation, Marcel Dekker, 2002. D. Poljak: Exposure of Humans to Electromagnetic Radiation, SoftCOM 							
Quality assurance	 Evaluation of results in accordance with the above learning outcomes Feedback from students via surveys Self-evaluation of teachers 								
methods that ensure the acquisition of exit competences	I								

NAME OF THE COURSE	MEASUREMENTS IN WII	RELESS SYSTEMS						
Code	FELJ22	Year of study	2					
Course teacher	Zoran Blažević, Ph.D., Full Professor	Credits (ECTS)	5					
Associate teachers	Maja Škiljo, Ph.D.	Type of instruction (number of hours)	S 0	AE 15	LE 15	DE 0		
Status of the course	Obligatory: 241 Elective: 242	. ()						
	COURSI	E DESCRIPTION						
Course objectives	various radio systems,	radio propagation in differ					۱.	
Course enrolment requirements and entry competences required for the course		applying empirical and statistical models for radio-channel characterization. Finished the undergraduate study of Communications and Information Technology						
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - calculate radio-channel parameters, - perform measurements and analysis of fixed and mobile radio systems parameters - statistically characterize radio propagation of arbitrary radio-systems on the base of measurements, - Apply various channel models							
	Course content		L hours		\E ours			
	Introduction to Measureme	ents in Wireless Systems.			1		1	
	Fixed radio-links channel p	parameters. Fading			2		1	
	Ground radio links planning		2		2			
	Fading in mobile radio cha	nnels.			2		1	
	Mobile radio channel parameters.						1	
	Propagation path-loss models. Hata-Okumura model.						1	
0	First midterm exam							
Course content broken down in detail by weekly	Statistical channel models with Maxwell theory based		arison		2		1	
class schedule (syllabus)	Satellite radio-channels. Si measurements (Loo mode				4		1	
,	Wide-band channel param	eters. Wide-band measure	ements.		4		3	
	Wide-band channel models	s based on measurements	S.		2		1	
	Wide-band indoor radio ch		3		1			
	Second midterm exam							
	List of laboratory exercises	3				LE I	nours	
	Antenna measurements by Measurements calibration.	Vector Network Analyser	measu	remen	its.		3	
	Narrow-band channel meas	surements at various frequ	encies				3	
	Wide-band channel measu	rements					3	

	Wide-band indoor ch	annel m	neasurem	ents			3	
	Radio-links planning	by using	g measur	ed data and so	ftware.		3	
Format of instruction	⋈ exercises□ on line in entirety□ partial e-learning	 □ seminars and workshops □ multimedia □ multimedia □ laboratory □ work with m 				mentor		
Studentresponsibiliti es	The presence on lec Performed all labora				70 % of the time	es sche	duled.	
Screening student	Class attendance	2,0	Researc	ch	Practical traini	ng		
work (name the proportion of ECTS	Experimental work		Report		Individual work	K	1.5	
credits for eachactivity so that the total number of	Essay		Seminal essay	r	Laboratory exe	ercises	0,8	
ECTS credits is equal to the ECTS	Tests	0,5	Oral exa	am	Preparation fo laboratory exe		0,2	
value of the course)	Written exam		Project		(Other)			
Grading and evaluating student work in class and at the final exam	lecturing and the sectests consists of theoretests consists of theoretests consists of theoretests carried out as writtent assessment of labor final exam. Grade (in the activities in percent activities activit	oretical of take parter tests ratory expression percer Grade (% entage: ance at later)	questions out In the s. The re exercises a intage) is f b) = 0,1 N lectures, essment,	s and numerica final exams. The equirement for and 40 % point formed accordi P + 0,1 LV + 0	I. The students ne midterm and passing grade is on each midting to the formul, 4 (M1 + M2)	that did I final e e is the erm ex	d not pass exams are e positive	
	Title			Number of copies in the library		Availability via other media		
Required literature (available in the	Z. Blažević; Mjero predavanja	enja u b	ežičnim :	sustavima,			earning oortal	
library and via other media)	M. Patzold: "Mob 2002.	ile Fadi	ngChann	els", Wiley,	1			
	Doble, J.: "Introduction to Radio Propagation for Fixedand Mobile Communications", Artech House Boston - London, GB, 1996.							
Optional literature (at the time of submission of study programme proposal)	G. H. Bryant: "PrZentner, E.: Ante	•				blishinç	յ, 1993.	
Quality assurance methods that ensure the acquisition of exit competences	Evaluation of resFeedback from sSelf-evaluation cInstitutional and	students of teach	s via surv ers	eys	ove learning out	comes		

NAME OF THE COURSE	SYSTEMS FOR WIRELE	SS TRANSMISSION OF E	NERG	Υ					
Code	FELJ36	Year of study	2						
Course teacher	Zoran Blažević, Ph.D., Full Professor	Credits (ECTS)	5						
Associate teachers	Maja Škiljo, Ph.D.	Type of instruction (number of hours)	S 0	AE 0	LE 30	DE 0			
Status of the course	Elective	Percentage of application of e-learning	0						
	COURS	E DESCRIPTION							
Course objectives	transmission of energy designing of radio system design of radio system	c principles of and problem /, tem for near-field transmiss n for far-field power transmi is of wireless energy syste	sion of	energy	У	wireles	SS		
Course enrolment requirements and entry competences required for the course	Finished the undergraduate study of Communications and Information Technology.								
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	- calculate and estimate	ergy transmission technique wireless energy transmissenission system schemes fo	sion sys			eters,			
	Course content				L hours		\E ours		
	Introduction. Historical per transmission.	spective of radio and wirele	ess		2				
Course content broken down in detail by weekly	Principles and techniques for radio-transmission of energy. Transformers and resonant transformers (Tesla Coil), and electrically small antennas.								
class schedule (syllabus)	Antenna scattering matrix. Coupled-Mode Theory and Spherical Mode Theory-Antenna Model application to wireless transmission of energy systems.								
	Rectennas.								
	Near-field energy and pow transformer.	er transmission. Resonant			4				

	Far-field power trans	sfer.					4		
	Ground energy trans		ar-field sy	/stems c	oncept		3		
	Satellite energy trans	sfer sys	tem conc	ept			3		
	Norms and standard standard.	ls for wi	reless en	ergy trar	nsfer. Q	i	2		
	Electromagnetic Comp	atibility o	of wireless	energy t	ransfer s	systems.	2		
		Interference problem between radio-communications systems and radio systems for wireless energy transfer.							
	Midterm exam								
	List of laboratory exe	ercises						LE h	ours
	Measurements and a antennas	adjustme	ents of in	ductively	fed ele	ctrically sm	nall	8	3
	Measurements of tra Oscilloscope	nsfer pe	erformand	es by S	pectrum	n Analyser,	and by	8	3
	Measurements of tra	nsfer pe	erformand	es by V	ector Ne	etwork Ana	lyser	6	6
	Tesla Coil Measurem	nents.		1				3	3
Format of instruction	 ☑ lectures ☐ seminars and work ☐ exercises ☐ on line in entirety ☐ partial e-learning ☒ field work 	 □ seminars and workshops □ exercises □ on line in entirety □ partial e-learning □ independent assignme □ multimedia □ laboratory □ work with mentor □ (other) 					nts		
Studentresponsibiliti es	The presence on lec Performed all labora				least 70	0 % of the t	imes scl	heduled	.k
Screening student	Class attendance	1.5	Researc	ch		Practical tra	aining		
work (name the proportion of ECTS	Experimental work		Report			Individual work			2
credits for eachactivity so that the total number of	Essay		Seminal essay	ſ		Laboratory exercises		es	0,8
ECTS credits is equal to the ECTS	Tests	0,5	Oral exa	am			Preparation for aboratory exercises		0,2
value of the course)	Written exam		Project			(Oth	ner)		
Grading and evaluating student work in class and at the final exam	of theoretical questic midterm exams take out as written tests. Iaboratory exercises rest of the grade depercentage) is formed the activities in percentage. NP - attendate to the test rest in the activities in percentage.	There are one midterm and one final exam. Both midterm test and final test consist of theoretical questions and numerical problems. The students that did not pass the midterm exams take part In the final exams. The midterm and final exams are carried out as written tests. The requirement for passing grade is the positive assessment of aboratory exercises, 40 % points on the midterm exam or the final exam, and the rest of the grade depends on the seminary work presented by the student. Grade (in percentage) is formed according to the formula: Grade(%) = 0,1 NP + 0,1 LV + 0,4 (M + S) The activities in percentage: NP - attendance at lectures, NP - test results., M - test results., S - seminary work results and presentation						s the arried ent of d the	
Required literature (available in the		Title	- <u>-</u> -			Number copies i the libra	n Ava	ilabilit her me	

library and via other media)	Ki Young Kim (editor), "Wireless Power Transfer-PrinciplesandEngineeringExplorations", InTech, January 2012.		e-learning portal			
	Volakis J., C. C. Chen and K. Fujimoto, "Smallantennas: miniaturizationtechniquesandapplications", New York, McGraw-Hill, 2010.		e-learning portal			
	Special issue "Solar Power Satellite and Wireless Power Transmission", IEEE Microwave Magazine, Vol. 3, No. 4, December 2002.	1				
Optional literature (at the time of submission of study programme proposal)	 Lee J. and S. Nam, "Fundamental aspects of near for wireless power transfer", IEEE Trans. Antenna 3442-3449, 2010. P. Sample, D. T. Meyer, J. R. Smith: Analysis, expadaptation of magnetically coupled resonators for Transactions on Industrial Electronics, Vol. 58, No. N. Tesla, A. Marinčić: Colorado Springs Notes, No. Carol Gray Montgomery, Robert Henry Dickeand "Principlesofmicrowavecircuits", McGraw-Hill Boo 	perimental res wireless powe 2, 2, 2010, p.p. blit, Beograd, Edward M. Pu	L 58, No. 12, ults, and range er transfer, IEEE 544-554. 1978. ircell,			
Quality assurance methods that ensure the acquisition of exit competences	 Evaluation of results in accordance with the above learning outcomes Feedback from students via surveys Self-evaluation of teachers Institutional and non-institutional evaluations 					
Other (as the proposer wishes to add)						

NAME OF THE COURSE	MEDICAL ELECTRONIC DEVICES									
Code	FELH41 Year of study 2.									
Course teacher	Antonio Šarolić, Ph.D., Full Professor Ivan Marinović, Ph.D., Full Professor	Credits (ECTS)	5							
Associate teachers	Niko Ištuk, mag. ing. el.	Type of instruction	L	S	ΑE	LE	DE			
		(number of hours)	30			30				
Status of the course	Elective	Percentage of application of e-learning	0							
	COURSE	DESCRIPTION								
Course objectives	COURSE DESCRIPTION - learning the types, realizations and application areas of electronic/communication/information technology in medical domain - knowledge on therapeutic, diagnostic and control medical electronic devices understanding the specifics of functional and safety requirements for medical electronic devices									

	 understanding and application of success criteria for medical device innovation and development 								
Course enrolment requirements and entry competences required for the course	None.	None.							
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	 analysis and development of med use the knowledge of human physical analysis and development of medic analyze the components of medic human body medical electronic deconceive the electronic circuits for characterize a medical electronic 	employ their knowledge on electronic/communication/information technology for analysis and development of medical devices use the knowledge of human physiology, especially electrophysiology, for analysis and development of medical devices analyze the components of medical electronic devices and their interaction with human body medical electronic devices conceive the electronic circuits for application in a medical device characterize a medical electronic device from the aspect of safety critically assess the success of innovation and development of a medical device							
	Course content		L hours	AE hours					
	Basics of human electrophysiology ar	nd electrophysiology	2	0					
	Measurement medical electronic devi	ices	2	0					
	Diagnostic medical electronic devices	3	2	0					
	Therapeutic medical electronic device	es	2	0					
	Electronic circuits and components in	6	0						
	Circuits and devices for electric and r frequencies	magnetic stimulation at low	2	0					
	Circuits and devices for thermal proce		2	0					
	Electrical safety aspects and electron aspects of medical electronic devices		2	0					
Course content broken down in	Control and auxiliary medical electror Theranostic medical electronic device therapeutics and diagnostics in innov methods	2	0						
detail by weekly class schedule (syllabus)	Translational resaerch and developm from lab to clinics (from the workbend Assessment of clinical and economic technology (Health Technology Asset	2	0						
	Clinical studies: principles and impler of medical devices	2	0						
	List of laboratory or design exercises			LE hours					
	Basics of human electrophysiology			2					
	Amplifier circuits			4					
	Electrostimulator circuits			4					
	Noise and disturbance suppression in	electronic devices		2					
	Electromagnetic compatibility testing			2					
	Electrical safety testing								
	Measurements of dielectric properties of		000	2					
	Measurement, diagnostic and therape field trip (visit to medical establishmer		ces –	8					
Format of instruction	 ☑ lectures ☑ seminars and workshops ☑ exercises ☐ on line in entirety 	 □ independent assignmen □ multimedia ⋈ laboratory □ work with mentor 	ts						
	☐ partial o loanning ☐ field work	□ partial e-learning □ (other)							

Studentresponsibiliti es		Student is required to attend the lectures and auditory exercises in the amount of at least 70% of the schedule.							
Screening student work (name the	Class attendance	1	Research		Practical traini	ng			
proportion of ECTS	Experimental work	0,5	Report		Laboratory exe	ercises	0,5		
credits for eachactivity so that the total number of	Essay		Seminar essay	1	Individual work	<	1		
ECTS credits is	Mid-exam	0,5	Oral exam		(Other)				
equal to the ECTS value of the course)	Written exam	0,5	Project		(Other)				
Grading and evaluating student work in class and at the final exam	Marinović (1/3 of led	ectures are given in collaboration of prof. Šarolić (2/3 of lecture hours) and prof. Marinović (1/3 of lecture hours). Exam: presentation and defense of the seminar essay							
		Number of copies in the library	copies in Availability Via						
Required literature (available in the library and via other	Ante Šantić: Biomedicinska elektronika, Školska knjiga, Zagreb, 1995.								
media)	Jaakko Malmivuo & Robert Plonsey: Bioelectromagnetism - Principles and Applications of Bioelectric and Biomagnetic Fields, Oxford University Press, New York, 1995.								
Optional literature (at the time of submission of study programme proposal)	- Handbook of biological effects of electromagnetic fields (third edition): Bioengineering and Biophysical Aspects of Electromagnetic Fields, Ed. Frank S. Barnes and Ben Greenebaum, CRC Press, 2007 Handbook of biological effects of electromagnetic fields (third edition): Biological and Medical Aspects of Electromagnetic Fields, Ed. Frank S. Barnes and Ben Greenebaum, CRC Press, 2007.								
Quality assurance methods that ensure the acquisition of exit competences	,	Surveys providing student feedback							
Other (as the proposer wishes to add)									

NAME OF THE	RADIO COMMUNICATIO	NS .							
COURSE			<u> </u>						
Code	FELJ02	Year of study	1.						
Course teacher	Zoran Blažević, Ph.D., Full Professor	Credits (ECTS)	5						
Associate teachers	Maja Škiljo, Ph.D.	Type of instruction (number of hours)	30	S 0	AE 15	LE 15	DE 0		
Status of the course	Obligatory	Percentage of application of e-learning	0						
	COURS	E DESCRIPTION							
Course objectives	radio-propagation, radio-channel physica	plication of basic principles I phenomena modelling, nd deepening of knowledg					h		
Course enrolment requirements and entry competences required for the course		engineering. Finished the undergraduate study of Communications and Information Technology							
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	 Students will be able to: define the fundamental phenomena, the quantities and the laws of Earth radio-propagation, apply fundamental laws of radio-propagation and model basic radio-channels, calculate and estimate basic radio-channel parameters, apply channel models for radio-signal quality estimation apply basic methods of radio-channel measurements 								
	Course content				L hours		AE ours		
	Introduction to Radio Com radio engineering. SI units		1		-				
	Radiowave propagation. S Atmosphere.		2		1				
	Radio-antenna parameters	and effective isotropic radia	ted pow	er.	2		2		
	Free space radiowave pro	pagation. Radio-gain.			2		1		
0	Propagation by Troposphe	ere			1		1		
Course content broken down in	Effective Earth Radius Mo	del and Flat Earth Model. [Ducting.		3		1		
detail by weekly	Radio-horizon by refraction	n. Influence of Earth curva	ture		2		1		
class schedule	Tropospheric loss by hydro	ometeors and gasses			1		1		
(syllabus)	Propagation by Ionosphere	9			3		1		
	First midterm exam								
	Propagation by diffraction. Knife-Edge Model.	٦.	4		1				
	Approximate methods for multiple diffraction loss estimation						2		
	Geometrical Theory of Diff	raction. Keller's law of diffr	action.		1		1		
	Propagation by reflection. Ground roughness influence		4		1				
	Interference by direct and ground reflected wave. Power law.								

	Second midterm exa							
	List of laboratory exe							LE hours
	Introduction to labora		trumante	device	e and of	her equipm	ent	2
	Reflection parameter			-	23 4114 01	iloi equipii	iciti	4
	Transmission parameter							4
	Measurements of rac				n analys	er		3
		oftware estimations of diffraction loss						
Format of instruction	 ☑ lectures ☐ seminars and workshops ☑ exercises ☐ on line in entirety ☐ partial e-learning ☑ field work ☐ independent ☐ multimedia ☒ laboratory ☐ work with me ☐ (other) 			entor	nts	2		
Studentresponsibiliti es	The presence on lec Performed all labora					0 % of the t	imes sch	eduled.
Screening student	Class attendance	2,0	Researc	h		Practical tra	aining	
work (name the proportion of ECTS	Experimental work		Report			Individual v	vork	1.5
credits for eachactivity so that the total number of ECTS credits is equal to the ECTS	Essay		Seminal essay			Laboratory exercises		0,8
	Tests	0,5			Preparation for laboratory exercises		0,2	
value of the course)	Written exam		Project			(Oth	ier)	
Grading and evaluating student work in class and at the final exam	There are two midte lecturing and the set tests consist of theo the midterm exams carried out as writt assessment of labor final exam. Grade (in the activities in percentage) NP - attendage LV - laborate M1, M2 - test	cond on retical qualitate parter tests attern extende (% entage: ance at longer extended).	e is after juestions rt In the secretises antage) is followed by the contract of the contract	the neighborn and nutifinal executive mand 40 formed P + 0,1	xt 6 wee imerical. ams. Th nent for % points accordir	ks. Each m The studer e midterm passing gr s on each n g to the for 4 (M1 + M2	idterm teants that diand final rade is thindterm emula:	st and final d not pass exams are ne positive
		Title)			Number copies i the libra	n Avail	ability via er media
Required literature (available in the library and via other	I. Zanchi, Z. Blaž predavanja, FES		adiokomu	nikacije	Э,			earning portal
media)	Boithias, L.: Rad Oxford Academic		Propaga	tion, No	orth	1		
	 Zentner, E.: Radiokomunikacije, Školska knjiga - Zagreb, 1980. 					2		
Optional literature (at the time of submission of study programme proposal)	 Zentner, E.: Ante Parsons, J. D.: " Publishers - Lond Doble, J.: "Introd Communications 	The Mob don, GB uction to	oile Radio , 1992. o Radio F	Propa Propaga	gation C	hannel", Pe	/lobile	988
Quality assurance methods that ensure	Evaluation of resFeedback from s				the abov	e learning	outcomes	3

the acquisition of exit competences	 Self-evaluation of teachers Institutional and non-institutional evaluations
exit competences	- Institutional and non-institutional evaluations
Other (as the	
proposer wishes to	
add)	

NAME OF THE COURSE	ALGORITHMS							
Code	FELJ12	Year of study	1.					
Course teacher	Matko Šarić, Ph.D., Assistant Professor	Credits (ECTS)	5					
Associate teachers	Ante Topić, TeachingAssistant	Type of instruction (number of hours)	S 0	AE 15	LE 15	DE 0		
Status of the course	Obligatory	Percentage of application of e-learning						
COURSE DESCRIPTION								
Course objectives	memory)	Design of efficient algorithms and analysis of algorithms properties (speed and memory) Adopting the practical knowledge about sorting algorithms and graph-based						
Course enrolment requirements and entry competences required for the course	BsC degree.							
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	- explain and apply diffe	Analyze the execution time of the algorithm explain and apply different sorting algorithms explain and apply graph-based algorithms						
	Course content						\E ours	
	Introduction. What are algorithms. Analyzing algorithms in Example D-2 maximum						0	
Course content	Analyzing of the loops. Solving of summations. Solving 2-D maximum - method of crossing the plane.						0	
detail by weekly	Asymptotic notation. Limited rule.						0	
class schedule (syllabus)	The technique of divide and execution time analysis).	d rule. Mergesort (pseudo	code,		3		0	
	Recursion (search pattern, Master theorem.	iteration, recursion tree m	ethod).		3		0	
	Heap data structure. Heap analysis).	sort (pseudocode, execution	on time)	3		0	

	Quicksort (pseudocode, execution time analysis)						3	0
	The lower limit of so linear time. (counting				on time.	Sorting by	3	0
	The algorithms base definitions).	ed on gra	aphs (ba	sic cond	epts an	d	3	0
	Graph representation using the adjacency matrix and adjacency list. BFS algorithm.							0
	All pairs shortest pat Warshall algorithm.	ths. Dyn	amic pro	grammi	ing. Floy	rd-	3	0
	Longest common su	bseque	nce. Mat	ce. Matrix chain multiplication				0
	Decision problems. Verification. NP com and Hamiltonian cyc	pletene					3	0
	List of laboratory or	design e	exercises					LE hours
	Analysis of typical ru	nning tir	mes					2
	Solving of summation	ns						2
	Recursions							2
	Merge sort I							2
	Merge sort II	Merge sort II						
	Heap sort							2
	Quicksort							2
	Linear time sorting algorithms							2
	Graph representation	1				2		
	BFS algorithm	3FS algorithm						
	Floyd-Warshall algorithm							2
	Longest common subsequence							2
	Matrix chain multiplic	ation						2
	☑ lectures☐ seminars and workshops☐ multimedia				t assignme	nts		
Format of instruction	⊠ exercises			⊠ labo	aboratory			
	□ on line in entirety			□ wor	k with m	entor		
	□ partial e-learning □ field work □ (other)							
Studentresponsibiliti	I licia work							
es								
Screening student work (name the	Class attendance	2,0	Researc	ch		Practical tra	aining	
proportion of ECTS	Experimental work		Report			Individual v	work	2,2
credits for eachactivity so that	Essay		Semina essay	r		Laboratory	exercises	0,5
the total number of ECTS credits is equal to the ECTS	Tests	0,2	Oral exa	am		Preparation for laboratory exercises		
value of the course)	Written exam	0,1	Project			(Oth	ner)	
Grading and evaluating student work in class and at the final exam	There are two midte lecturing and the se consist of theoretica that did not pass th carried out as writt	cond or I questic e midte	ne is afte ons and r rm exam	r the ne numeric s take	ext 6 we al proble part. Th	eks. Midter ems. In the f e midterm	m test an final exam and final	d final test s students exams are

	assessment of laboratory exercises and 50 % points on each midterm exam or the final exam. Grade (in percentage) is formed according to the formula: Grade(%) = 0,5 (M1 + M2)						
	the activities in percentage:	•					
	M1, M2 – test results.						
	The final grade is defined in the next way:						
	50% do 63% sufficient (2)						
	64% do 77% good (3)						
	78% do 91% very good (4)						
	92% do 100% excellent (5)						
	Title	Number of copies in the library	Availability via other media				
Required literature (available in the	Individual work		e-learning portal				
library and via other	Laboratory exercises						
media)	Preparation for laboratory exercises						
Optional literature (at the time of submission of study programme proposal)	T.Cormen, C.Leiserson, R.Rivest, C.Stein: "Introduct secondedition, thirdprinting, McGraw-Hill, 2002	ion to Algorith	ms",				
Quality assurance methods that ensure the acquisition of exit competences	 Evaluation of results in accordance with the above learning outcomes Feedback from students via surveys Self-evaluation of teachers Feedback from students who have already obtained BsC degree 						
Other (as the proposer wishes to add)							

NAME OF THE COURSE	MOBILE COMMUNICATION	ons						
Code	FELJ14	Year of study	1.					
Course teacher	Zoran Blažević, Ph.D., Full Professor	Credits (ECTS)	5					
Associate teachers	Maja Škiljo, Ph.D.	Type of instruction (number of hours)	L 30	S 0	AE 15	LE 15	DE 0	
Status of the course	Obligatory: 241 Elective: 242	Percentage of application of e-learning	0					
	COURSE	DESCRIPTION						
Course objectives	Training students for: - understanding and application of basic principles of radio-networks, - physical OSI layer of cellular radio-networks calculation and analysis, - mobile radio networks analysis.							
Course enrolment requirements and entry competences required for the course	Finished the undergraduate	inished the undergraduate study of Communications and Information Technology						
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: Calculate optimal radio system configuration in sense of selecting digital modulation and coding, model and perform basic calculation of cellular networks: base stations power and interference budget calculate and analyse (narrow- and wide-band) radio-channel parameters, conduct and analyse radio-channel measurements							
	Course content						\E ours	
	Introduction to Mobile Communications.						1	
	Classification of digital radio-channels.						1	
	Digital radio system performances.						2	
	Systems with bandwidth limitation.						1	
	Power limited systems.						1	
Course content	Power limited and bandwidth limited systems. Channel coding.						1	
broken down in	Direct Sequence-Spread Spectrum Systems						1	
detail by weekly class schedule	Cellular radio systems. Co- interference.	channel and adjacent char	nnel		2		1	
(syllabus)	Path-loss law. Base station	n ling budget. Multipath red	eption.		2		2	
	First midterm exam							
	Cell radio-coverage calcula	Cell radio-coverage calculation.					1	
	Mobile propagation channel analysis.							
	Mobile propagation channe	el analysis.			2		1	
	Mobile propagation channel Radio channel measureme				2		1	
		ents.	d chann	iel				
	Radio channel measureme Propagation channel class	ents.	d chann	el	2		1	
	Radio channel measureme Propagation channel class coherence bandwidth.	ents. ification. Delay-spread and	d chann	el	2		1	
	Radio channel measureme Propagation channel class coherence bandwidth. Second midterm exam	ents. ification. Delay-spread and		el	2	LE	1	

	Analog and digital modulation simulations							2
	Multipath fading char	nnels sir	nulations					2
	Adjacent and co-chann	el interfe	rence in c	ellular sy	/stems si	imulations by Sim	nulink	2
	COST 207 and GSM	/EDGE	channel i	nodels	by Matla	ab		2
Format of instruction	 ☑ lectures ☐ seminars and wo ☑ exercises ☐ on line in entirety ☐ partial e-learning ☑ field work 	□ seminars and workshops □ seminars and workshops □ multimedia □ laboratory □ work with mentor □ (other)				·		
Studentresponsibiliti es	The presence on lec Performed all labora				t least 7	0 % of the times	s sched	uled.
Screening student	Class attendance	Class attendance 2,0 Research Practical training				ng		
work (name the proportion of ECTS	Experimental work		Report			Individual work		1.5
credits for eachactivity so that the total number of	Essay		Seminal essay	•		Laboratory exe	rcises	0,8
ECTS credits is equal to the ECTS	Tests	0,5	Oral exa	ım		Preparation for laboratory exer		0,2
value of the course)	Written exam		Project			(Other)		
Grading and evaluating student work in class and at the final exam	lecturing and the set tests consist of theo the midterm exams carried out as writt assessment of labor final exam. Grade (in the activities in perceival examted as the control of the activities in perceival examted as the control of the activities in perceival examples and the control of the activities in perceival examples and the control of the co	There are two midterms and final exams. The first midterm exam is after 7 weeks of lecturing and the second one is after the next 6 weeks. Each midterm test and final tests consist of theoretical questions and numerical. The students that did not pass the midterm exams take part In the final exams. The midterm and final exams are carried out as written tests. The requirement for passing grade is the positive assessment of laboratory exercises and 40 % points on each midterm exam or the final exam. Grade (in percentage) is formed according to the formula: Grade(%) = 0,1 NP + 0,1 LV + 0,4 (M1 + M2) the activities in percentage: NP - attendance at lectures, LV - laboratory assessment, M1, M2 - test results.						and final not pass ams are positive
	Title			Number of copies in the library		oility via media		
Required literature (available in the	 Z. Blažević: Mobilne komunikacije, predavanja, FESB 					rning rtal		
library and via other media)	 I. Zanchi, Z. Blaž predavanja, FES 		adiokomu	nikacije	,			rning rtal
	David Parson.: T Channel, Pentec					2		
Optional literature (at the time of submission of study programme proposal)	R. Steele: "Mobil IEEE Press, Pisc Vijag, K. Garg, J. Systems, Prentice	ataway oseph, E	, USA, 19 E. Wilkes	92. : Wirele:				
Quality assurance methods that ensure	Evaluation of resFeedback from s				the abo	ve learning outo	comes	

the acquisition of exit competences	Self-evaluation of teachersInstitutional and non-institutional evaluations
Other (as the proposer wishes to add)	

NAME OF THE COURSE	LOCAL AND ACCESS N	ETWORKS						
Code	FELH30	Year of study	2.					
Course teacher	Josip Lörincz, Ph.D., Assistant Professor	Credits (ECTS)	5					
Associate teachers	Dinko Begušić, Ph.D., Full Professor	Type of instruction (number of hours)	L S AE LE D 30 0 0 30 0					
Status of the course	- Obligatory (university graduate programme, 242)	Percentage of application of e-learning	10%					
COURSE DESCRIPTION								
Course objectives	Training students for: - knowledge and understanding of the fundamental concepts of local and access networks, - knowledge of the characteristics of the medium for the transmission of information in local and access network (metal wires, optical fibre and wireless transmission), - capability to configure local and access networks and network devices, - qualification for participation in the design and maintenance of local and access networks, - permanent acquisition of knowledge in the field of new technologies used in local access networks.							
Course enrolment requirements and entry competences required for the course	Knowledge of basic concepts and technology in the area of data information transfer and communication protocols. Knowledge of basic computer skills. Knowledge of English language.							
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - define basic terms and concepts of local and access networks, - evaluate and implement protocols, systems and techniques for transmission of information in local and access networks based on different transmission medias including metal wires, optical fibre and wireless transmission, - configure local and access networks and network devices, - participate in the design and maintenance of local and access networks, - permanently acquire knowledge about new technologies in the area of local access networks.							
Course content	Course content				L hours		\E ours	
broken down in detail by weekly	Introduction. Standards.						2	
	The division of the LAN ne	twork according to differer	t criter	ia.			2	

class schedule	Local area networks of type Ethernet.					
(syllabus)	Local area networks of type: Token ri	ng, Token bus, FDDI,		2		
	Gigabit Ethernet, switched LAN			2		
	Networks: ATM, ATM LAN			2		
	Virtual Private Networks-VPN			2		
	Wireless Communication Systems-general, cellular (mobile) systems					
	Wireless LAN (WLAN) networks			2		
	Broadband access networks-general					
	xDSL technology: HDSL, ADSL, VDSL					
	Fiber optical networks: FTTx technology	ogy		2		
	HFC technology, WiMAX technology			2		
	List of laboratory or design exercises			LEhours		
	Exercise 1.: Introduction - basics Rive	erbed Modeler simulator		2		
	e role of Switch in LAN Eth	ernet	2			
	Exercise 3.: Local Area Network - a n with different users, terminals and ser		etwork	2		
	Exercise 4.: ATM (cell switching technology based on connection oriented connections)					
	Exercise 5.: RIP protocol (Routing protocol based on an link algorithm state)					
	exercise 6.: TCP Transmission Control Protocol (Trusted protocol based n pre-established links)					
	Exercise 7.: The methods of sorting (queuing, waiting to transmit or discard packets)					
	Exercise 8.: The wireless local area network (media access control for mobile station)					
	Exercise 9.: Mobile wireless networks (wireless cellular networks with mobile devices)					
	Exercise 10.: OSPF routing protocol based on an link-state algorithm					
	Exercise 11.: Border Gateway Protocol (BGP) - (Routing data traffic between different administrative domains)					
	Compensation exercises					
	⊠ lectures	☐ independent assignme				
	☐ seminars and workshops	□ multimedia	1113			
Format of instruction	□ exercises	⊠ laboratory				
T Office of motivation	□ on line in entirety	⊠ work with mentor				
	☐ partial e-learning	□ (other)				
	☐ field work	, ,				
Studentresponsibiliti es	 Theconditions for overallpositiveasse positive assessment of laborator minimum presence during 70% of presence on laboratory exercises time in a semester, minimum 50% points at each mice 	y exercises (above 50 %) f overall class teaching time during 100% of overall lal	boratory ex	kercise		
	commission exam).	oa. o.a. (or oor		-		

Screening student	Class attendance	1,0	Research		Practical training	na			
work (name the	Experimental work	.,0	Report		Independent w		2,2		
proportion of ECTS credits for eachactivity so that	Essay		Seminar essay		Laboratory exe		1,0		
the total number of ECTS credits is equal to the ECTS	Tests		Oral exam		Preparation for Laboratory exe		0,5		
value of the course)	Written exam	0,3	Project		(Other)				
Grading and evaluating student work in class and at the final exam	will be after 8 weeks and 2nd of the final they did not pass of (correctional) exam, Rating (%) = 0.1PL - PL - presence on the LA- grades from lab M1, M2- the 1st and percentage), The final grade is depercentage Rating 50% to 61% is suffice 62% to 74% good (375% to 87% of very 88% 100% Excellen Independently on reand 4th final (correct the case of organiza curricula content. Re(commission) exam Examinations: 1st Final exam 2nd Final exam 2nd Final (correctional 4th Final 4th Final (correctional 4th Final	The final grade is determined as follows: percentage Rating 50% to 61% is sufficient (2) 62% to 74% good (3) 75% to 87% of very good (4) 88% 100% Excellent (5) Independently on results obtained during the 1st or 2nd mid-term exams, on the 3nd and 4th final (correctional) exams students take exam of entire curricula content. In the case of organization of commission exam, students also take exam of entire curricula content. Requirements related to the admission on final and correctional (commission) exam is a positive assessment of laboratory exercises. Examinations: 1st Final exam							
	100 di 100	Title		Δ.	Number of copies in the library	Availab other i			
Required literature	Milutin Kapov, Jo Networks", FESE script					e-leai por			
(available in the library and via other media)	Josip Lorincz, "Ir laboratory exercinetworks", FESE	ises in lo 3 Split, in	ocal and access nternal script, 20	15.		e-lea por	-		
	Alen Bažant and of the network",				5				
	M. Vrdoljak and Technologies", F softcore library S	ESB Sp	olit, HT TKC Split		5				

Optional literature (at the time of submission of study programme proposal)	 M. Jose ., M. Caballero and others, "SDH / SONET, ATM, xDSL and Synchronization Networks", Artech House, Boston, London, 2003. Alex Gillespie: "Broadband Access Technology Interfaces and Management, Artech House, Boston, London, 2000. Annabel Z. Dodd, "Telecommunications", Algorithm, Zagreb 2002.
Quality assurance methods that ensure the acquisition of exit competences	 Evaluation of results in accordance with the above learning outcomes Feedback from students via surveys Self-evaluation of teachers Institutional and non-institutional evaluations Feedback from graduated students about the relevance of the course content
Other (as the proposer wishes to add)	

NAME OF THE COURSE	BIOELECTROMAGNETIC	cs							
Code	FELJ24	Year of study	1.						
Course teacher	Antonio Šarolić, Ph.D., Full Professor	Credits (ECTS)	5						
Associate teachers	Niko Ištuk, Teaching Assistant	Type of instruction (number of hours)	L 30	S	AE	LE 30	DE		
Status of the course	Elective	Percentage of application of e-learning	0			30			
	COURSE DESCRIPTION								
Course objectives	- acquiring knowledge o	Training students for: understanding the human electrophysiology acquiring knowledge on therapeutic and diagnostic methods application of specialized interdisciplinary knowledge in biomedical applications							
Course enrolment requirements and entry competences required for the course	None.								
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	 describe the electrophysic apply the electrophysic function analyze the electric act 	describe the cell structure describe the electrophysiology of excitable cells and tissues apply the electrophysiology knowledge for understanding the brain and heart function analyze the electric activity of heart and brain with applications in diagnostics link the electrophysiology principles to the function of other bodily organs and to							
Course content broken down in	Course content				L hours		\E ours		

detail by weekly	Introduction and biot	ory.					2	^
class schedule	Introduction and hist							0
(syllabus)	Structure of neuron and muscle cells. 2				0			
	Membrane potential. 2							0
	Axon as transmissio		abie).				2	0
	Membrane activation						2	0
	Synapses, receptors	s and bra	ain.				2	0
	Heart.						2	0
	Volume source. Volume		ductor.				2	0
	Electrocardiography	• •	-0)				2	0
	Electroencephalogra		•				2	0
	Electrophysiology of						2	0
	Other diagnostic and electromagnetics. M	agnetic	resonand	e imag	ing (MR	l).	2	0
	Visit to Medical School companies related to				plit. Vis	t to	2	0
	List of laboratory or	design e	exercises					LE hours
	Membrane potential.							4
	Axon as transmissio	n line (ca	able).					2
	Membrane activation.							
	Synapses, receptors and brain.							
	Electrocardiography (ECG).							
	Electroencephalograhpy (EEG).							2
	Electrodermal reaction.							
	Other diagnostic and therapeutic methods based on applied electromagnetics. Magnetic resonance imaging (MRI).							
	Visit to Medical School of the University of Split. Visit to companies related to the course topics.							6
	☑ lectures					_		
	⊠ seminars and wor	kshops			•	ıt assignmen	its	
Format of instruction	□ exercises				timedia			
Format of instruction	☐ <i>on line</i> in entirety			☑ laboratory☐ work with mentor				
	☐ partial e-learning			☐ work with mentor ☐ (other)				
	⊠ field work				(0011	51)		
Student responsibilities	Student is required the least 70% of the schithe amount of 100% laboratory exercises	edule. S of the s	Student is	require	ed to att	end the labo	ratory ex	ercises in
Screening student work (name the	Class attendance	1	Researc	h		Practical tra	aining	
proportion of ECTS credits for each	Experimental work	0,5	Report			Laboratory	exercises	0,5
activity so that the total number of	Essay		Seminal essay	ſ	1	Individual w	ork	1
ECTS credits is equal to the ECTS	Mid-exam	0,5	Oral exa	am		(Oth	er)	
value of the course)	Written exam	0,5	Project			(Oth	er)	
Grading and evaluating student work in class and at the final exam	During the semester the middles of the sexercises are compl	semeste	r, while t	he sec	ond wil	be held aft	er the le	

The first mid-exam is based on the first half of the course material. The second midexam is based on the first second half of the course material.

To pass at each mid-exam, min. 50% of points must be earned from the part of the exam containing numerical problems (material from auditory exercises) and min. 50% of points must be earned from the part of the exam containing theory (material from the lectures).

To earn the right to approach the second mid-exam, min. 30% of points must be earned from the part of the first mid-exam containing numerical problems (material from auditory exercises) and min. 30% of points must be earned from the part of the first mid-exam containing theory (material from the lectures).

If a student earns the positive grades on both mid-exams, he/she is considered to have passed the whole exam with the grade calculated as average from both mid-exams.

At the first exam term, students may choose to take the exam containing only that half of the material that they haven't passed at mid-exams.

At all other exam terms, students must take the whole exam, containing all the course material.

Approaching the exams is subject to fulfilling the requirements on student responsibilities.

The overall point percentage defining the overall grade is calculated as the average of points earned in all exam questions, corrected by the result of oral verification:

Percentage -> Grade

50% - 62,4% -> sufficient (2)

62,5% - 74,9% -> good (3)

75% - 87,4% -> very good (4)

87,5% - 100% -> excellent (5)

Final grade can be supplemented by performing practical project work involving individual and experimental work, in agreement with the teacher.

Exam terms: according to the academic year calendar

	Title	Number of copies in the library	Availability via other media
Required literature	 Jaakko Malmivuo & Robert Plonsey: Bioelectromagnetism - Principles and Applications of Bioelectric and Biomagnetic Fields, Oxford University Press, New York, 1995. 		
(available in the library and via other media)	Handbook of biological effects of electromagnetic fields (third edition): Bioengineering and Biophysical Aspects of Electromagnetic Fields, Ed. Frank S. Barnes and Ben Greenebaum, CRC Press, 2007.		
	 Handbook of biological effects of electromagnetic fields (third edition): Biological and Medical Aspects of Electromagnetic Fields, Ed. Frank S. Barnes and Ben Greenebaum, CRC Press, 2007. 		
Optional literature (at the time of submission of study programme proposal)	 Šantić, A: Biomedicinska elektronika, Školska knji The Biomedical Engineering Handbook (Second I Bronzino, CRC Press, 2000. 	•	
Quality assurance methods that ensure the acquisition of exit competences	Surveys providing student feedback		

Other (as the	
proposer wishes to	
add)	

NAME OF THE COURSE	MEDICAL ELECTRONIC	DEVICES								
Code	FELH41	Year of study	2.							
Course teacher	Antonio Šarolić, Ph.D., Full Professor Ivan Marinović, Ph.D., Full Professor	Credits (ECTS)	5							
Associate teachers	Niko Ištuk, mag. ing. el.	Type of instruction (number of hours)	L 30	S	AE	LE 30	DE			
Status of the course	Elective	Percentage of application of e-learning	0							
	COURS	E DESCRIPTION								
Course objectives	electronic/communicati - knowledge on therapeu - understanding the specielectronic devices	izations and application are on/information technology utic, diagnostic and control cifics of functional and safe dication of success criteria	in medic medical ty requir	elect emer	tronic nts for	medi	cal			
Course enrolment requirements and entry competences required for the course	None.									
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	 analysis and developm use the knowledge of hanalysis and developm analyze the componenthuman body medical econceive the electronic characterize a medical 	luman physiology, especia ent of medical devices ts of medical electronic dev	Ily electr vices and medica aspect o	ophy d thei I devi	siolog ir inter ice ety	y, for action	with			
	Course content				L		AE			
					hours	ho	ours			
0	Basics of human electroph		logy		2		0			
Course content broken down in	Measurement medical elec				2		0			
detail by weekly	Diagnostic medical electro				2		0			
class schedule	Therapeutic medical electr			_	2		0			
(syllabus)	Electronic circuits and com Circuits and devices for ele frequencies			ow	2		0			
	Circuits and devices for the	ermal procedures at high fr	equenci	es	2		0			

	Electrical safety asp aspects of medical e				c compa	atibility	2		0	
	Control and auxiliary Theranostic medical therapeutics and dia methods	y medica I electro	al electro	nic devi es – uni	ifying the	е	2		0	
	Translational resaer from lab to clinics (fr Assessment of clinic	rom the cal and e	workbend economic	ch to the efficac	e bedsid y of med	le).	2		0	
		echnology (Health Technology Assessment - HTA) Clinical studies: principles and implementation of clinical trials of medical devices								
	List of laboratory or	design e	exercises					LE	hours	
	Basics of human ele	ctrophys	siology						2	
	Amplifier circuits								4	
	Electrostimulator circ	cuits							4	
	Noise and disturband	ce suppi	ression ir	electro	nic devi	ices			2	
	Electromagnetic com	npatibilit	y testing						2	
	Electrical safety testi	ing							2	
	Measurements of die	elctric pr	operties	of tissue	es				2	
	Measurement, diagn field trip (visit to med				edical el	ectronic devi	ices –		8	
	⊠ lectures			☐ inde	nender	nt accionmen	ite			
Format of instruction	I independentI independentI multimedia				it assignine	11.3				
	□ exercises □ laboratory									
	III on line in entirety				pentor					
	□ partial e-learning □ (other)									
	⊠ field work				(otne	er)				
Student responsibilities	Student is required the least 70% of the sch		the lect	ires an	d audito	ry exercises	in the a	nou	nt of at	
Screening student work (name the	Class attendance	1	Researc	ch		Practical tra	ining			
proportion of ECTS	Experimental work	0,5	Report			Laboratory	exercise	S	0,5	
credits for each activity so that the total number of	Essay		Semina essay	r	1	Individual w	ork		1	
ECTS credits is	Mid-exam	0,5	Oral exa	am		(Othe	er)			
equal to the ECTS value of the course)	Written exam	0,5	Project			(Othe	er)			
Grading and evaluating student work in class and at the final exam	Lectures are given in Marinović (1/3 of lec Exam: presentation	ture hou	urs).		-		hours) a	and	orof.	
		Title	•			Number of copies in the librar	n Avai		lity via nedia	
Required literature (available in the library and via other	Ante Šantić: Biomed knjiga, Zagreb, 1995		elektroni	ka, Ško	lska					
media)	Jaakko Malmivuo & Bioelectromagnetisr of Bioelectric and Bi University Press, Ne	n - Princ omagne	ciples and tic Fields							
Optional literature (at the time of submission of study	- Handbook of bio Bioengineering a Barnes and Ben (nd Bioph	ysical As	pects of	Electror				S.	

programme proposal)	 Handbook of biological effects of electromagnetic fields (third edition): Biological and Medical Aspects of Electromagnetic Fields, Ed. Frank S. Barnes and Ben Greenebaum, CRC Press, 2007. The Biomedical Engineering Handbook (Second Edition), Ed. Joseph D. Bronzino, CRC Press, 2000.
Quality assurance methods that ensure the acquisition of exit competences	Surveys providing student feedback
Other (as the proposer wishes to add)	

NAME OF THE COURSE	MULTIMEDIA SYSTEMS									
Code	FELJ20	Year of study	2.	2.						
Course teacher	Mladen Russo, Ph.D., Assistant Professor	Credits (ECTS)	5							
Associate teachers	Jelena Čulić, Teaching Assistant Martina Bašić, Teaching Assistant	Type of instruction (number of hours)	L S AE LE 30 0 0 30				DE 0			
Status of the course	Obligatory: 242 Elective: 241	Percentage of application of e-learning	0							
	COURSE DESCRIPTION									
Course objectives	 knowledge of the prope and video signals (inclu 	nedia systems and virtual erties and methods for gen iding 3D images and video ost important algorithms fo s	erating)	•			ŭ			
Course enrolment requirements and entry competences required for the course	None.									
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - describe the basic principles of human speech, hearing and vision - explain the basic principles of psychoacoustics and their application in compression of audio signals - demonstrate the frequency masking effect - define the most important algorithms for compression of speech, audio, image and video signals - demonstrate the basic mechanisms of JPEG compression									
Course content broken down in	Course content				L hours		AE ours			

detail by weekly class schedule (syllabus)	Introduction. History of multimedia sy Overview of multimedia software tool applications.		2	0			
	Audio signal. How humans hear and modelling.	speak. Speech	2	0			
	Generic compression techniques for specific algorithms (mp3).	audio signals. Audio	2	0			
	Speech specific algorithms (LPC, CE and applications in mobile telephony. encoding speech and audio signals.		2	0			
		Color in images and video signal. The perception of color (how people perceive electromagnetic radiation). Theory of mixing					
	Color models for image signal (RGB, models for video signal (YUV, YIQ, Y color models (HSB, HLS, HSV). Gam signal (resolution, depth, memory reg formats (gif, tiff, jfif, ps, bmp).	2	0				
	Basics of video and television. Analog Digital television and video. Video for requirements.		2	0			
	Image compression. JPEG modes.		2	0			
	Video compression: H.261. H.263.		2	0			
	Video compression: MPEG-1. MPEG	-2.	2	0			
	Video compression: MPEG-4.		2	0			
	Video compression: H.264.		2	0			
	Fundamentals of virtual reality. Histor vision. Software and hardware for virtual reality.		2	0			
				LE hours			
	Sound recording. Searching of voiced	and unvoiced speech. Pito	ch period.	2			
	Speech specific algorithms (LPC)			2			
	Frequency masking			2			
	3D sound			2			
	Image compression (JPEG)			2			
	Image compression (JPEG)			2			
	Image compression (JPEG)			2			
	MPEG – influence of I, P, B frames or	n video quality		2			
	Multimedia systems on mobile device	s (Android programming)		2			
	Multimedia systems on mobile device	s (Android programming)		2			
	Multimedia systems on mobile device	s (Android programming)		2			
	3D images			2			
	CAVE system			2			
Format of instruction	 ☑ lectures ☐ seminars and workshops ☑ exercises ☐ on line in entirety 	☐ independent assignme☐ multimedia☒ laboratory	nts				
	□ partial e-learning □ field work	☐ work with mentor☐ (other)					

Studentresponsibiliti es	The presence on lec Performed all require			east 70	% of the time	s schedule	d.
Screening student	Class attendance	3	Research	ŀ	Practical traini	ng	
work (name the proportion of ECTS	Experimental work		Report	I	ndividual work	<	1,7
credits for eachactivity so that the total number of	Essay		Seminar essay		(Other)		
ECTS credits is	Tests	0,2	Oral exam		(Other)		
equal to the ECTS value of the course)	Written exam	0,1	Project		(Other)		
Grading and evaluating student work in class and at the final exam	During a semester thare held according to from the complete of take the midterm that students take the test of the requirement for exam. Grade (in per Grade(%) = 0,5*M1-The final grade is de Percentage Grade 50% to 61% sufficie 62% to 74% good (75% to 87% very games) 88% to 100% exceller.	the ca course in nat they st from the passing centage +0,5*M2 etermine ent (2) (3)	lendar of classes. A f they do not have did not pass. At the complete course g grade is 50% poin e) is formed accordi 2; M1, M2 – midtern	t the file a position of the material of the	nal exam studitive grade on ake-up and cone ach midterm he formula:	ents take th the midter ommission	e test ms or exam
Required literature (available in the		Title	e		Number of copies in the library	Availabilit other me	
library and via other media)	H. Dujmić: Multin	1	e-learn portal	ing			
Optional literature (at the time of submission of study programme proposal)	Processing", Pre Rao, Bojkovic, M	ntice Ha Iilovano	vic: "Multimedia Co	mmun		_	
Quality assurance methods that ensure the acquisition of exit competences Other (as the	- Feedback from s	StandardsandNetworks", Prentice Hall, 2002 Evaluation of results in accordance with the above learning outcomes Feedback from students via surveys Self-evaluation of teachers Institutional and non-institutional evaluations					
proposer wishes to add)							

NAME OF THE COURSE	MEASUREMENTS IN WI	RELESS SYSTEMS						
Code	FELJ22	Year of study	2					
Course teacher	Zoran Blažević, Ph.D., Full Professor	Credits (ECTS)	5					
Associate teachers	Maja Škiljo, Ph.D.	Type of instruction (number of hours)	L 30	S 0	AE 15	LE 15	DE 0	
Status of the course	Obligatory: 241 Elective: 242	Percentage of application of e-learning	0					
	COURS	E DESCRIPTION						
Course objectives	various radio systems,	radio propagation in differ					۱.	
Course enrolment requirements and entry competences required for the course	Finished the undergraduat	Finished the undergraduate study of Communications and Information Technology						
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	 calculate radio-channe perform measurement parameters statistically characteriz base of measurements 	Students will be able to: - calculate radio-channel parameters, - perform measurements and analysis of fixed and mobile radio systems parameters - statistically characterize radio propagation of arbitrary radio-systems on the base of measurements, - Apply various channel models						
	Course content				L hours	_	\E ours	
	Introduction to Measureme	ents in Wireless Systems.			1		1	
	Fixed radio-links channel p	parameters. Fading			2		1	
	Ground radio links plannin	g and measurements			2		2	
	Fading in mobile radio cha	nnels.			2		1	
	Mobile radio channel para	meters.			2		1	
	Propagation path-loss mod	dels. Hata-Okumura mode	l		3		1	
	First midterm exam							
Course content broken down in detail by weekly	Statistical channel models with Maxwell theory based		arison		2		1	
class schedule (syllabus)	Satellite radio-channels. S measurements (Loo mode				4		1	
,	Wide-band channel param	eters. Wide-band measure	ements		4		3	
	Wide-band channel model	s based on measurements	3.		2		1	
	Wide-band indoor radio ch	annel modelling.			3		1	
	Second midterm exam							
	List of laboratory exercises	3				LE	nours	
	Antenna measurements by Measurements calibration.	Vector Network Analyser	measu	remen	ts.		3	
	Narrow-band channel meas	surements at various frequ	encies				3	
	Wide-band channel measu	rements					3	

Wide-band indoor channel measurements						3		
	Radio-links planning by using measured data and software.					3		
Format of instruction	 ☑ lectures ☐ seminars and workshops ☑ exercises ☐ on line in entirety ☐ partial e-learning ☒ field work 			 independent assignments multimedia laboratory work with mentor (other) 				
Student responsibilities	The presence on lectures in the amount of at least 70 % of the times scheduled. Performed all laboratory exercises required.					duled.		
Screening student	Class attendance	2,0	Researc	h	Practical traini	ng		
work (name the proportion of ECTS	Experimental work		Report		Individual work	Individual work		
credits for each activity so that the	Essay		Seminar essay		Laboratory exe	Laboratory exercises		
total number of ECTS credits is equal to the ECTS	Tests	0,5	Oral exa	ım		Preparation for laboratory exercises		
value of the course)	Written exam		Project		(Other)	(Other)		
Grading and evaluating student work in class and at the final exam	There are two midterms and final exams. The first midterm exam is after 7 weeks of lecturing and the second one is after the next 6 weeks. Each midterm test and final tests consists of theoretical questions and numerical. The students that did not pass the midterm exams take part In the final exams. The midterm and final exams are carried out as written tests. The requirement for passing grade is the positive assessment of laboratory exercises and 40 % points on each midterm exam or the final exam. Grade (in percentage) is formed according to the formula: Grade(%) = 0,1 NP + 0,1 LV + 0,4 (M1 + M2) the activities in percentage: NP - attendance at lectures, LV - laboratory assessment, M1, M2 - test results.						t and final d not pass exams are e positive	
	Title			Number of copies in the library	Availability via other media			
Required literature (available in the	Z. Blažević; Mjerenja u bežičnim sustavima, predavanja						earning oortal	
library and via other media)	M. Patzold: "Mobile Fading Channels", Wiley, 2002.				1			
	Doble, J.: "Introde Fixed and Mobile House Boston - L	r 1						
Optional literature (at the time of submission of study programme proposal)	G. H. Bryant: "PrZentner, E.: Ante	•			urements", IEE Publishing, 1993. agreb, 2001.			
Quality assurance methods that ensure the acquisition of exit competences	 Evaluation of results in accordance with the above learning outcomes Feedback from students via surveys Self-evaluation of teachers Institutional and non-institutional evaluations 							

NAME OF THE COURSE	SYSTEMS FOR WIRELE	SS TRANSMISSION OF E	NERG	Y				
Code	FELJ36	Year of study	2					
Course teacher	Zoran Blažević, Ph.D., Full Professor	Credits (ECTS)	5					
Associate teachers	Maja Škiljo, Ph.D.	Type of instruction (number of hours)	S 0	AE 0	LE 30	DE 0		
Status of the course	Elective	Percentage of application of e-learning						
	COURS	E DESCRIPTION						
Course objectives	Training students for: understanding of basic principles of and problemacy of systems for wireless transmission of energy, designing of radio system for near-field transmission of energy design of radio system for far-field power transmission calculation and analysis of wireless energy systems parameters							
Course enrolment requirements and entry competences required for the course	Finished the undergraduate study of Communications and Information Technology.							
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - analyse power and energy transmission techniques, - calculate and estimate wireless energy transmission system parameters, - designing basic transmission system schemes for given service							
	Course content		L hours		\E ours			
Course content broken down in detail by weekly class schedule (syllabus)	Introduction. Historical perspective of radio and wireless transmission.							
	Principles and techniques for radio-transmission of energy. Transformers and resonant transformers (Tesla Coil), and electrically small antennas.							
	Antenna scattering matrix. Coupled-Mode Theory and Spherical Mode Theory-Antenna Model application to wireless transmission of energy systems.							
	Rectennas.							
	Near-field energy and power transmission. Resonant transformer.							

Far-field power transfer.					4			
	Ground energy transfer by far-field systems concept					3		
	Satellite energy transfer system concept					3		
	Norms and standards for wireless energy transfer. Qi standard.					2		
	Electromagnetic Compatibility of wireless energy transfer systems.					2		
	Interference problem between radio-communications systems and radio systems for wireless energy transfer.					2		
	Midterm exam	Midterm exam						
		List of laboratory exercises						LE hours
	Measurements and a antennas	Measurements and adjustments of inductively fed electrically smale					all	8
	Measurements of transfer performances by Spectrum Analyser, a Oscilloscope Measurements of transfer performances by Vector Network Analyser.				and by	8		
					etwork Analy	yser	6	
	Tesla Coil Measuren	nents.						8
	⊠ lectures							
	☐ seminars and workshops			□ multimedia				
Format of instruction	□ exercises			□ Indiamodal □ Iaboratory				
	☐ on line in entirety			□ work with mentor				
	□ partial e-learning □ field work			(othe	(other)			
Student	The presence on led	tures in	the amo	unt of at	t loast 7	0 % of the ti	mas scha	dulad
responsibilities	Performed all labora				t least 7	0 70 01 1116 11	11163 30116	duled.
Screening student	Class attendance	1.5	Research Pra		Practical tra	ining		
work (name the proportion of ECTS	Experimental work		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		Individual w	ork	2	
credits for each activity so that the total number of	Essay		Seminar essay		Laboratory	aboratory exercises		
ECTS credits is equal to the ECTS	Tests	0,5	Oral exa	ım		Preparation laboratory e		0,2
value of the course)	Written exam		Project			(Othe	er)	
There are one midterm and one final exam. Both midterm test and final test consist of theoretical questions and numerical problems. The students that did not pass the midterm exams take part In the final exams. The midterm and final exams are carried out as written tests. The requirement for passing grade is the positive assessment of laboratory exercises, 40 % points on the midterm exam or the final exam, and the rest of the grade depends on the seminary work presented by the student. Grade (in percentage) is formed according to the formula: Grade(%) = 0,1 NP + 0,1 LV + 0,4 (M + S) the activities in percentage: NP - attendance at lectures, NP - test results., M - test results., S - seminary work results and presentation								
Required literature (available in the	Title copies i			Number of copies in the librar	1 Availa	ability via er media		

library and via other media)	Ki Young Kim (editor), "Wireless Power Transfer-Principles and Engineering Explorations", InTech, January 2012.	e-learning portal				
	 Volakis J., C. C. Chen and K. Fujimoto, "Small antennas: miniaturization techniques and applications", New York, McGraw-Hill, 2010. 		e-learning portal			
	Special issue "Solar Power Satellite and Wireless Power Transmission", IEEE Microwave Magazine, Vol. 3, No. 4, December 2002.	1				
Optional literature (at the time of submission of study programme proposal)	Lee J. and S. Nam, "Fundamental aspects of near-field coupling small antennas for wireless power transfer", IEEE Trans. Antennas Propag., Vol. 58, No. 12, 3442-3449, 2010. P. Sample, D. T. Meyer, J. R. Smith: Analysis, experimental results, and range adaptation of magnetically coupled resonators for wireless power transfer, IEEE Transactions on Industrial Electronics, Vol. 58, No. 2, 2010, p.p 544-554. N. Tesla, A. Marinčić: Colorado Springs Notes, Nolit, Beograd, 1978. Carol Gray Montgomery, Robert Henry Dicke and Edward M. Purcell, "Principles of microwave circuits", McGraw-Hill Book Company, Inc., USA, 1948.					
Quality assurance methods that ensure the acquisition of exit competences	Evaluation of results in accordance with the above learning outcomes Feedback from students via surveys Self-evaluation of teachers Institutional and non-institutional evaluations					
Other (as the proposer wishes to add)						