

#### UNIVERSITYOFSPLIT

# 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	COURSE	НО	ГСТС				
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	ercise	, DE =	design	excerci	se

		List ofcourses						
Year of study	:1.							
Semester:II.								
CTATUC	STATUS CODE COURSE					MEST	ER*	ГСТС
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, $S$ = seminars, $AE$ = auditoryexcercise, $LE$ = labora	atoryexo	ercise	, DE =	design	excerci	se

		List ofcourses						
Year of study	:2.							
Semester:III.								
OT ATUC							ER*	ГОТО
STATUS CODE COURSE		COURSE	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.								
	CODE	НО	ГОТО					
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, S = seminars, AE = auditoryexcercise, LE = labora	atoryex	ercise	DE =	design	excerci	se

		List ofcourses						
Year of study	:2.							
Semester:III.								
CTATUC	CODE	COLIDOR	НО	URS I	N SEI	MEST	ER*	FOTO
STATUS	CODE COURSE		L	S	AE	LE	DE	ECTS
	FELH30	Local and access networks	30	0	0	30	0	5
Mandatary	FELJ24	Bioelectromagnetics	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

NAME OF THE COURSE	DIGITAL TELECOMMUN	ICATIONS							
Code	FELJ01	Year of study	1.						
Course teacher	Joško Radić, Ph.D., Associate Professor	Credits (ECTS)	6						
Associate teachers	Petar Šolić, Ph.D., Assistant Professor	Type of instruction (number of hours)	L 45	S 0	AE 15	LE 15	DE 0		
Status of the course	Obligatory	Percentage of application of e-learning	0	U	10	10	0		
	COURS	E DESCRIPTION							
Course objectives  Course enrolment requirements and entry competences required for the course	<ul> <li>Application of analytical design of digital communication</li> <li>Implement and analysis</li> </ul>	ucture of a digital communi al models necessary to und unication systems e a simple communication about the ways of realization	derstan system	d the o	effects				
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.								
	Course content			ı	L		AE ours		
	Real channelsEqualisation	l			3		2		
	Nyquistfilters, correlationfil	ters,			3		2		
	Linearandnon-linearequaliz	zation, Nyquistsignalingfilte	ers,		3		2		
	Echocancellation, scrambl	ing,			3		2		
Course content	Parallelandserial, synchror simplexandduplextransmis	nousandasynchronous, sion,			3		2		
broken down in	Synchronizationofdigitalsig	nals (clock, theframeandc	arrier)		3		2		
detail by weekly class schedule	Redundantcoding, block, o	convolutionsandtrelliscodes	5,		3		2		
(syllabus)	First midterm exam								
	BCH and Reed-Solomon codes, turbo coding								
	ARQ system, FEC system		3		2				
	Thetopologyofthe network. networkinggroupsandsignaling								
	Thetopologyofthe network.	networkinggroupsandsign	aling		3		2		
							2		
	Thetopologyofthe network. Routingandnumbering plar Circuitswitching, multistage	n, typesofswitchingsystems			3 3				

	Second midterm exa	am							
	List of laboratory exe	ercises					l	LI	E hours
	Eye pattern								2
	Equalisation								2
	Scrembling								2
	Channel coding: Bloc	ck codes	8						2
	Channel coding: Con	volution	al codes						2
	Optimum receiver			ı					2
	⊠ lectures			  □ inde	ependen	t assignme	nts		
	seminars and wor	rkshops			timedia	J			
Format of instruction	⊠ exercises			⊠ labo	oratory				
	□ on line in entirety □ partial e-learning			□ wor	k with m	entor			
	☐ field work				(othe	r)			
Studentresponsibiliti	The presence on led	tures in	the amo	unt of a	t least 7	0 % of the t	times sc	hedu	ıled
es	Performed all require				r rough r	0 70 01 1110 1			
Screening student	Class attendance	1,8	Researc	h		Practical tr	aining		
work (name the proportion of ECTS	Experimental work		Report			Individual v	work		3
credits for eachactivity so that the total number of	Essay		Seminal essay	r		Laboratory exercise			0,5
ECTS credits is equal to the ECTS	Tests				Preparation laboratory		S	0,5	
value of the course)	Written exam	0,1	Project			(Oth	ner)		
Grading and evaluating student work in class and at the final exam	During the semester there are two mid-term exams and the final exam. Midfinal exams consist of questions and tasks. In the final exams students the pass the midterm exams take part.  The midterm and final exams are carried out as written tests. The require passing grade is the positive assessment of laboratory exercises and 50 % each midterm exam or the final exam. Grade (in percentage) is formed active formula:  Grade (%) = 0,8 * (0.5 * M1 + 0,5 * M2) + 0,2 * L;  M1, M2 - points at the mid-term expressed as a percentage, and L - point laboratory (with completed all lab. Exercises) expressed as a percentage. The final evaluation is determined as follows:  percentage Rating  50% to 61% is sufficient (2)  62% to 74% good (3)  75% to 87% of very good (4)						that uirer % p acco	t did not ment for oints on ording to	
Required literature	88% 100% Excellent (5)  Title  Title  Number of copies in the library					in Ava		ility via media	
(available in the	J. Proakis: Digital Communication, IV. Ed.								
library and via other media)  • S. Benedetto: Principlesofdigitaltransmission: with wireless application									
	L. W. Couch II: D     Communication S								

Optional literature (at the time of submission of study programme proposal)	
Quality assurance methods that ensure the acquisition of exit competences	<ul> <li>Evaluation of results in accordance with the above learning outcomes</li> <li>Feedback from students via surveys</li> <li>Self-evaluation of teachers</li> <li>Institutional and non-institutional evaluations</li> </ul>
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					
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	<u> </u>			<u> </u>	
	COURSE	DESCRIPTION						
Course objectives	operation principle, and - calculating and estimat - differentiating between disadvantages	<ul> <li>differentiating between specific radar types and perceiving their advantages and disadvantages</li> <li>visualization of possibilities and characteristics of surveillance and targeting radar operation</li> </ul>						
Course enrolment requirements and entry competences required for the course	Finished the undergraduate					echno	ology	
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to:  - develop competencies in individual and team work in analyzing and designing certain radar subsystems  - estimate and calculate radar target parameters  - recognize the relation between certain tactical and technical radar requirements  - evaluate and perceive advantages and disadvantages of certain radar types  - consider and analyze characteristics of surveillance and targeting radars						nents	
	Course content					Lh	ours	

	_						•	
	Introduction to rada	r systen	ns.				1	
	Basic principles of r	adar sy	stems.				2	
	Parameters of rada	r signal.					2	
	Radio wave propag	Radio wave propagation, radar equation and maximum range.						
	Radar cross section.							
Course content	Estimation of target	Estimation of target position parameters by radar signal.						
broken down in	Basic radar hardwa	re.					2	
detail by weekly class schedule	Moving target indica	ation (M	TI) radar				3	
(syllabus)	Doppler impulse rad	dar.					3	
	Synthetic aperture r	adar (S	AR).				2	
	Meteorological rada	ır.					2	
	Ultra wideband (UW	/B) rada	ar.				2	
	Target tracking.						2	
	Clutter cancelation	in radar	systems				1	
	List of laboratory exe	ercises					LE hours	
	Transmission and ref	ection	measure	ments o	of device	es using vector	2	
	Radar principles- the	measu	rement o	f target	distanc	е.	6	
	Numerical simulation	of targe	et radar c	ross se	ction.		2	
	The measurement of	bistatic	radar cro	oss sec	tion.		2	
	SAR radar concept-	simulatio	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	centre o	f electror	ics (PC	E) Split		5	
	⊠ lectures			   ⊠ inda	anandar	nt assignments		
	☐ seminars and wor	rkshops			ltimedia	it assignments		
Format of instruction	☐ exercises				oratory			
	☐ on line in entirety				k with n	nentor		
	□ partial e-learning				(oth	er)		
2	⊠ field work				· · · · ·			
Student responsibilities	Performed all labora				t least <i>i</i>	70 % of the times sche	eduled.	
Screening student	Class attendance	1.5	Researc	ch		Practical training		
work (name the proportion of ECTS	Experimental work		Report			Individual work		
credits for each activity so that the	Essay		Seminal essay	ſ	2	Laboratory exercises	1	
total number of ECTS credits is equal to the ECTS	Tests	0,5	Oral exa	m Preparation for laboratory exercises				
value of the course)	Written exam		Project			(Other)		
Grading and evaluating student work in class and at the final exam	lecturing and the ser The midterm test co includes individual w	There is one midterm test and seminar essay. The midterm test is after 7 week lecturing and the seminar essays are presented during the next part of the semestre midterm test consists of theoretical questions and numerical. Seminar estances includes individual work and work in groups, and the presentation of the results. In the state of the presentation of the presentation to the presentation of the pre						

	of the seminar essay is obligatory. The midterm tes Grade (in percentage) is formed according to the form Grade(%) = 0,1 NP + 0,1 LV + 0 the activities in percentage:  NP - attendance at lectures, LV - laboratory assessment, M - test results, S- seminar essay	nula:	it as written test.				
	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.						
	Peebles, P. Z: "Radar Principles", John Wiley & Sons, 1998.	1					
Optional literature (at the time of submission of study programme proposal)	<ul> <li>Tait, P: "Introduction to Radar Target Recognition</li> <li>Zentner, E.: Antene i radiosustavi, Graphis Zagre</li> </ul>						
Quality assurance methods that ensure the acquisition of exit competences	<ul> <li>Evaluation of results in accordance with the above learning outcomes</li> <li>Feedback from students via surveys</li> <li>Self-evaluation of teachers</li> <li>Institutional and non-institutional evaluations</li> </ul>						
Other (as the proposer wishes to add)							

NAME OF THE	DIOCI COTDOMACNICTI	00					
COURSE	BIOELECTROMAGNETI	CS .					
Code	FELJ24	Year of study	1.				
Course teacher	Antonio Šarolić, Ph.D., Full Professor	Credits (ECTS)	5				
Associate to achora	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				
	COURS	E DESCRIPTION					
Course objectives	- acquiring knowledge	<ul> <li>understanding the human electrophysiology</li> <li>acquiring knowledge on therapeutic and diagnostic methods</li> </ul>					
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 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						
	potentiai biornedicai a	pplications			ully OI	gans a	and to
	Course content	pplications			L hours	- A	AE ours
	·	pplications			L	- A	λE
	Course content				L hours	- A	AE ours
	Course content Introduction and history.				L hours 2	- A	AE ours 0
	Course content Introduction and history. Structure of neuron and m	nuscle cells.			L hours 2	- A	AE ours 0
Course content	Course content Introduction and history. Structure of neuron and m Membrane potential.	nuscle cells.			L hours 2 2	- A	AE ours 0 0
Course content broken down in	Course content Introduction and history. Structure of neuron and m Membrane potential. Axon as transmission line	nuscle cells. (cable).			L hours 2 2 2 2	- A	AE ours 0 0 0
broken down in detail by weekly	Course content Introduction and history. Structure of neuron and m Membrane potential. Axon as transmission line Membrane activation.	nuscle cells. (cable).			L hours 2 2 2 2 2	- A	AE ours 0 0 0 0
broken down in	Course content  Introduction and history.  Structure of neuron and m Membrane potential.  Axon as transmission line Membrane activation.  Synapses, receptors and	uscle cells. (cable). brain.			L hours 2 2 2 2 2 2	- A	0 0 0 0 0
broken down in detail by weekly class schedule	Course content  Introduction and history.  Structure of neuron and m Membrane potential.  Axon as transmission line Membrane activation.  Synapses, receptors and Heart.	cable). brain. onductor.			L hours 2 2 2 2 2 2 2	- A	0 0 0 0 0 0 0
broken down in detail by weekly class schedule	Course content  Introduction and history. Structure of neuron and m Membrane potential. Axon as transmission line Membrane activation. Synapses, receptors and Heart. Volume source. Volume c	cable).  brain.  onductor.			L hours 2 2 2 2 2 2 2 2 2	- A	0 0 0 0 0 0 0
broken down in detail by weekly class schedule	Course content  Introduction and history. Structure of neuron and m Membrane potential. Axon as transmission line Membrane activation. Synapses, receptors and Heart. Volume source. Volume of Electrocardiography (ECG) Electroencephalography (	cable).  brain.  onductor.			L hours 2 2 2 2 2 2 2 2 2 2	- A	0 0 0 0 0 0 0 0
broken down in detail by weekly class schedule	Course content  Introduction and history. Structure of neuron and m Membrane potential. Axon as transmission line Membrane activation. Synapses, receptors and Heart. Volume source. Volume of Electrocardiography (ECG) Electroencephalography (Electrophysiology of the ecother diagnostic and there	cable).  (cable).  brain.  onductor.  6).  EEG).	applied		L hours 2 2 2 2 2 2 2 2 2 2 2 2	- A	0 0 0 0 0 0 0 0 0
broken down in detail by weekly class schedule	Course content  Introduction and history.  Structure of neuron and m Membrane potential.  Axon as transmission line Membrane activation.  Synapses, receptors and Heart.  Volume source. Volume of Electrocardiography (ECG Electroencephalography)  Electrophysiology of the electromagnetics. Magnet	cable).  (cable).  brain.  onductor.  6).  EEG).  ye. Electrodermal reaction. apeutic methods based on a ic resonance imaging (MRI) the University of Split. Visit	applied		L hours 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	- A	0 0 0 0 0 0 0 0 0 0
broken down in detail by weekly class schedule	Course content  Introduction and history.  Structure of neuron and m Membrane potential.  Axon as transmission line Membrane activation.  Synapses, receptors and heart.  Volume source. Volume of Electrocardiography (ECG Electroencephalography)  Electrophysiology of the electromagnetics and there electromagnetics. Magnet Visit to Medical School of	cable).  (cable).  brain.  onductor.  6).  EEG).  ye. Electrodermal reaction. apeutic methods based on a ic resonance imaging (MRI) the University of Split. Visit course topics.	applied		L hours 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	hc	0 0 0 0 0 0 0 0 0 0 0 0
broken down in detail by weekly class schedule	Introduction and history. Structure of neuron and m Membrane potential. Axon as transmission line Membrane activation. Synapses, receptors and Heart. Volume source. Volume of Electrocardiography (ECG) Electroencephalography (ECG) Electrophysiology of the effection agnetics. Magnet Visit to Medical School of companies related to the of	cable).  (cable).  brain.  onductor.  6).  EEG).  ye. Electrodermal reaction. apeutic methods based on a ic resonance imaging (MRI) the University of Split. Visit course topics.	applied		L hours 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	hc	0 0 0 0 0 0 0 0 0 0 0 0 0

Membrane activation	1.					4	
Synapses, receptors	and bra	in.				2	
Electrocardiography	(ECG).					2	
		G).				2	
						2	
						2	
		Universi	ty of Sp	olit. Visit	to companies	6	
⊠ lectures			□ inde	der	et aggignmente		
⊠ seminars and wo							
⊠ exercises							
☐ <i>on line</i> in entirety		ļ		•	aantar		
☐ partial e-learning	□ partial e-learning						
⊠ field work			<u> </u>	(0016	=i) 		
least 70% of the sch the amount of 100%	Student is required to attend the lectures and auditory exercises in the amount of at east 70% of the schedule. Student is required to attend the laboratory exercises in he amount of 100% of the schedule and to complete all tasks associated with aboratory exercises.						
Class attendance	1	Researc	:h		Practical training		
Experimental work	0,5	Report			Laboratory exercises	0,5	
Essay		Seminar essay		1	Individual work	1	
Mid-exam	0,5	Oral exa	ım		(Other)		
Written exam	0,5	Project			(Other)		
the middles of the sexercises are comple. The first mid-exam is exam is based on the To pass at each midexam containing nu 50% of points must be from the lectures). To earn the right to earned from the part from auditory exercisfirst mid-exam contails a student earns the have passed the whee exams. At the first exam terminals of the material that all other exam terminaterial. Approaching the eresponsibilities. The overall point per	semeste leted, scles based are first se dexam, imerical be earned approach of the ses) and aining the nole exament, stude hat they ms, stude exams is reentage	er, while the chedules to on the firecond hall min. 50% problems ed from the set first midels and min. 30% eory (matter we grade m with the ents may haven't plents muster set defining edefining	the sector be agreed to be agre	ond will greed with of the control of the endinger of the endinger of the endinger of the legal of the endinger of the endinge	be held after the lead th the students. Durse material. The sematerial. It be earned from the manditory exercises) was containing theory manditory exercises and containing theory manditory exercises and containing the earned from the ectures). It is earned from the exercise and as average from the exams, he/she is contained as average from the exams. It is exam, containing all the requirements of the exam containing all the requirements of the exams.	ctures and cond mid- part of the and min. (material se must be se (material part of the both mid- gonly that the course in student e average	
	Synapses, receptors  Electrocardiography Electroencephalogra Electrodermal reactic Other diagnostic and electromagnetics. Ma Visit to Medical Schorelated to the course  I lectures I seminars and wor I exercises I on line in entirety I partial e-learning I field work  Student is required to least 70% of the schothe amount of 100% laboratory exercises  Class attendance  Experimental work  Essay  Mid-exam  Written exam  During the semester the middles of the sexercises are completed to the course of the sexercises are completed to the sexe	Electrocardiography (ECG).  Electroencephalography (EE Electrodermal reaction.  Other diagnostic and therape electromagnetics. Magnetic r Visit to Medical School of the related to the course topics.  I lectures I seminars and workshops I exercises I on line in entirety I partial e-learning I field work  Student is required to attend least 70% of the schedule. Sthe amount of 100% of the slaboratory exercises.  Class attendance  I Experimental work  O,5  Essay  Mid-exam O,5  Written exam O,5  During the semester, two mithe middles of the semeste exercises are completed, so The first mid-exam is based exam is based on the first set To pass at each mid-exam, exam containing numerical 50% of points must be earned from the lectures).  To earn the right to approace arned from the part of the from auditory exercises) and first mid-exam containing the lift a student earns the positing have passed the whole exame exams.  At the first exam term, stude half of the material that they At all other exam terms, studematerial.  Approaching the exams is responsibilities.  The overall point percentages.	Synapses, receptors and brain.  Electrocardiography (ECG).  Electroencephalography (EEG).  Electrodermal reaction.  Other diagnostic and therapeutic methelectromagnetics. Magnetic resonance visit to Medical School of the Universive related to the course topics.  I lectures  I seminars and workshops  I exercises  I on line in entirety  I partial e-learning  I field work  Student is required to attend the lectule ast 70% of the schedule. Student is the amount of 100% of the schedule alaboratory exercises.  Class attendance  Experimental work  O,5  Report  Essay  Mid-exam  O,5  Project  During the semester, two mid-exams the middles of the semester, while the exercises are completed, schedules to the first mid-exam is based on the first second haled to the first mid-exam is based on the first second haled to pass at each mid-exam, min. 50% exam containing numerical problems 50% of points must be earned from the from the lectures).  To earn the right to approach the second from the lectures).  To earn the right to approach the second from the lectures are containing theory (mathematical from auditory exercises) and min. 30% exam containing numerical problems 50% of points must be earned from the from auditory exercises) and min. 30% exam containing numerical problems 50% of points must be earned from the lectures).  To earn the right to approach the second from the part of the first midfrom auditory exercises) and min. 30% exam containing numerical problems 50% of points must be earned from the second from the part of the first midfrom auditory exercises) and min. 30% exam containing the ory (mathematical from the part of the first midfrom auditory exercises) and min. 30% exam containing the ory (mathematical from the part of the first midfrom auditory exercises) and min. 30% exam containing the ory (mathematical from the part of the first midfrom auditory exercises) and min. 30% exam containing the ory (mathematical from auditory exercises) and min. 30% exam containing the ory (mathematical from auditory exercises	Synapses, receptors and brain.  Electrocardiography (ECG).  Electroencephalography (EEG).  Electrodermal reaction.  Other diagnostic and therapeutic methods be electromagnetics. Magnetic resonance imagi Visit to Medical School of the University of Sprelated to the course topics.  I lectures  I led work  Student is required to attend the lectures and least 70% of the schedule. Student is required the amount of 100% of the schedule and to a laboratory exercises.  Class attendance  I Research  Experimental work  I Research  Experimental work  I Research  Experimental work  I Research  I Res	Synapses, receptors and brain.  Electrocardiography (ECG).  Electroencephalography (EEG).  Electrodermal reaction.  Other diagnostic and therapeutic methods based on electromagnetics. Magnetic resonance imaging (MRI Visit to Medical School of the University of Split. Visit related to the course topics.  I lectures  I lectures  I lectures  I lectures  I lectures  I learning I multimedia I laboratory I work with multimedia I laboratory I work with multimedia I laboratory I work with multimedia I least 70% of the schedule. Student is required to atthe amount of 100% of the schedule and to complete laboratory exercises.  Class attendance  I Research  Experimental work  I Research  Experimental work  I Research  I Researc	Synapses, receptors and brain.  Electrocardiography (ECG).  Electroencephalography (EEG).  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.  I lectures  I lectures  I independent assignments  I multimedia  I laboratory  I work with mentor  I work with mentor  I work with mentor  I work of the schedule. Student is required to attend the laboratory exercises.  Class attendance  I Research  Experimental work  Student is required to attend the lectures and auditory exercises in the am least 70% of the schedule. Student is required to attend the laboratory exercises.  Class attendance  I Research  Experimental work  O,5  Report  Laboratory exercises  Seminar essay  I Individual work  Student exam  O,5  Oral exam  O(Other)  During the semester, two mid-exams will be held. The first mid-exam will the middles of the semester, while the second will be held after the lece 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 se exam is based on the first second half of the course material. The se exam is based on the first second half of the course material. The se exam containing numerical problems (material from auditory exercises)  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 first mid-exam containing numerical problems (material from the lectures).  To earn the right to approach the second mid-exam, min. 30% of points must be earned from the grifts mid-exam containing numerical problems (material from the lectures).  To earn the right to approach the second mid-exam, min. 30% of points must be earned from the grifts mid-exam containing numerical problems from th	

	50% - 62,4% -> sufficient (2)						
	62,5% - 74,9% -> good (3)						
	75% - 87,4% -> very good (4)						
	87,5% - 100% -> excellent (5)						
	nal grade can be supplemented by performing practical project work involving dividual and experimental work, in agreement with the teacher. cam terms: according to the academic year calendar						
	Title	Number of copies in the library	Availability via other media				
Required literature	<ul> <li>Jaakko Malmivuo &amp; Robert Plonsey: Bioelectromagnetism - Principles and Applications of Bioelectric and Biomagnetic Fields, Oxford University Press, New York, 1995.</li> </ul>						
(available in the library and via other media)	<ul> <li>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.</li> </ul>						
	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)	<ul> <li>Šantić, A: Biomedicinska elektronika, Školska knj</li> <li>The Biomedical Engineering Handbook (Second Bronzino, CRC Press, 2000.</li> </ul>						
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	Type of instruction	L	S	AE	LE	DE	
713300iate teachers	Assistant	(number of hours)	30		15	15		
Status of the course	Obligatory	Percentage of application of e-learning	0					
	COURSI	E 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.							
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to:  - 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  - analyze simple uniform antenna arrays							
	Course content				or S hours		\E ours	
	Introduction. Antenna parameters. Polarization. Radiation pattern.						1	
	Directivity. Gain. Antenna i	mpedance. Effective area			2		1	
	Effective length. Antenna factor. Relations linking the antenna parameters. Friis equation.				2		1	
	Elementary electrical dipol	e (EED). Field around the	EED.		2		1	
Course content	Radiated power and radiation resistance of EED. Efficiency of EED.				2		1	
broken down in	Zones surrounding the ant	enna – near and far field.			2		1	
detail by weekly class schedule	Resonant dipoles. Halfway	e dipoles. Fullwave dipole	S.		2		1	
(syllabus)	Electrically short dipole and	d unipole.			2		1	
	Mutual impedance of dipol	es.			2		1	
	Antenna array. Uniform line	ear antenna array.			2		1	
	Array with uniform amplitude	de distribution.			2		1	
	Arrays with non-uniform ar				2		1	
	Practical examples of ante	nna installations in use – f	ield trip		2		1	
	List of laboratory or design	exercises				LE	nours	
	Introduction. Antenna parai Directivity. Gain. Antenna ii		ation pa	ttern.			2	

	Effective length. Ante parameters. Friis equaround the EED.						2
	Radiated power and Zones surrounding the					iciency of EED.	2
	Resonant dipoles. Hadipole and unipole.	alfwave	dipoles. I	ullwav	e dipole	es. Electrically short	2
	Mutual impedance of array.	f dipoles	s. Antenna	a array.	Uniforn	n linear antenna	2
	Array with uniform ar amplitude distribution		distributi	on. Arra	ays with	non-uniform	2
	Practical examples of antenna installations						1
Format of instruction	<ul> <li>☑ lectures</li> <li>☐ seminars and workshops</li> <li>☐ exercises</li> <li>☐ on line in entirety</li> <li>☐ partial e-learning</li> <li>☑ field work</li> <li>☑ independent assignments</li> <li>☐ multimedia</li> <li>☑ laboratory</li> <li>☐ work with mentor</li> <li>☐ (other)</li> </ul>						
Studentresponsibiliti es	least 70% of the sch	edule. S of the s	Student is	require	ed to att	ry exercises in the am end the laboratory exe e all tasks associated	ercises in
Screening student work (name the	Class attendance	2	Researc	:h		Practical training	0,5
proportion of ECTS	Experimental work	0,5	Report	Report Laboratory exercise		Laboratory exercises	0,5
credits for eachactivity so that the total number of	Essay		Seminar essay Individual wo		Individual work	1	
ECTS credits is equal to the ECTS	Mid-exam	0,5	Oral exam (Other)		(Other)		
value of the course)	Written exam	0,5	Project		0,5	(Other)	
Grading and evaluating student work in class and at the final exam	the middles of the sexercises are comple. The first mid-exam is exam is based on the To pass at each midexam containing nutsons of points must from the lectures). To earn the right to earned from the part from auditory exercistists mid-exam contains a student earns the have passed the whexams. At the first exam ter half of the material to	semester eted, so so based e first so d-exam, imerical be earned approat of the ses) and ining the ne positionale exam, student they	er, while thedules to on the firecond hamin. 50% problem ed from the second that the second hamin. 30% eory (matter grade m with the ents may thaven't person to the second that the ents may thaven't person the second that the ents may the ents may the ents may the ents may that the ents may the ents	the sector be accepted by the sector be accepted by the sector because	ond will greed with preed with the course of the emid-examination the lemant of the lemant on the lemant of the le	ourse material. The sematerial.  It be earned from the part auditory exercises) exam containing theory  In many min. 30% of points and numerical problems at be earned from the ectures).  I exams, he/she is containing the exam	cond mid- cond mid- part of the and min. (material s must be a (material part of the sidered to both mid-

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 **Number of** Availability via Title copies in other media the library Required literature (available in the • E. Zentner: Antene i radiosustavi, Graphis, library and via other Zagreb 2001. media) Constantine A. Balanis: AntennaTheory: Analysisand Design, Wiley, 1997. Optional literature (at the time of V. Roje: Antene I dio, skripta, Sveučilište u Splitu 1981. submission of study Handbook of antennas in wireless communications, CRC Press, 2002. programme proposal) Quality assurance methods that ensure Surveys providing student feedback the acquisition of exit competences 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 teachers	Niko Ištuk, Teaching Assistant	Type of instruction (number of hours)	L 45	S	AE 15	LE 15	DE		
Status of the course	Obligatory	Percentage of 0							
	COURSE	DESCRIPTION	<u></u>						
Course objectives	systems - application of acquired circuits, devices and sy	knowledge to improve im-	ctromag	netic	interfe	erence			
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 test the electromagnetic standards and regulation analyze electromagnet with concentrated para	grounding of electrical device compatibility by measure	lity of elections and systems and systems are	struct ectrica d circu in acc stems nd trar	ures, al devi uits cordan using nsmiss	as welces ce witemode	l as h ls es		
	Course content				L		λΕ		
	Introduction to electromagn	netic compatibility			hours 3	110	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.				3		1		
class schedule (syllabus)	Shielding.				3		1		
(Syllabus)	Grounding.				3		1		
	Measurements in electrom	agnetic compatibility.			3		1		
	Electromagnetic compatibi regu- lations. Electromagne radiocommunication system	etic compatibility in	ls and		3		1		

	Historical overview of with concentrated pa		-	g. 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 electr	omagne	etic compa	atibility.				1
	Electronic componer	nts and	their equi	valent c	ircuits.			1
	Radiated emissions	and sus	ceptibility	<b>'.</b>				1
	Conducted emission	s and s	usceptibili	ity				1
	Filtering.							1
	Shielding.							1
	Grounding.							1
	Measurements in ele	ectroma	gnetic cor	mpatibil	ity.			1
	Electromagnetic com Electromagnetic com						ations.	1
		orical overview of EMC modelling. Low-frequency models with centrated parameters.					h	1
	High-frequency mod	gh-frequency models with distributed parameters.						1
	Analysis of wire ante	nnas in	EMC app	olication	ns.			1
	Transmission line mo	odels.						1
Format of instruction		□ on line in entirety □ partial e-learning □ (other)						
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 work (name the	Class attendance	2	Researc	ch		Practical tra	ining	0,5
proportion of ECTS	Experimental work	0,5	Report			Laboratory	exercises	0,5
credits for eachactivity so that the total number of	Essay		Seminal essay	r		Individual w	ork	1
ECTS credits is equal to the ECTS	Mid-exam	0,5	Oral exa	am		(Othe	er)	
value of the course)	Written exam	0,5	Project		0,5	(Othe	∋r)	
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 midexam containing nut 50% of points must from the lectures).	semeste leted, so s based le first s d-exam, imerical	er, while the chedules to the firm the firm econd hamin. 50% problem	the secto be acted to be acted	ond will greed work the control course nts muserial from	I be held after the studer ourse material material or 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)	<ul> <li>HandbookofElectromagneticCompatibility, ed. R.</li> <li>Tesche, F.M.: Ianoz, M.V., Karslsson, T.: EMC AnalysisMethodsandComputationalModels, John</li> </ul>		
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				
A a a a i a ta ta a a b a va	Anna Šušnjara,	Type of instruction	L	S	AE	LE	DE
Associate teachers	TeachingAssistant	(number of hours)	30	0	0	15	
Status of the course	Obligatory Percentage of application of e-learning 0						
	COURSI	DESCRIPTION					
Course objectives	simetry, - Assessmentof lowfrequencyandhigh - Permanentadoptingar	blyfundamentalprinciplesof human frequencyelectromagnetic nddeepeningknowledgeintl andinternationalregulations ingradiation	exp fields heareac	oosure	e lectror	nagnet	to tism
Course enrolment requirements and entry competences required for the course	- Electromagnetic fields	s, Electromagnetic waves					
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	<ul> <li>Applymethods for them</li> <li>Applymethods for thec</li> <li>Analyzethelevelofthe ionizingradiationusingr</li> <li>Mathematicallyformula nwirestructures.</li> <li>Analyzesimpletransmis</li> <li>Computefundamentalpels.</li> <li>Use comment</li> </ul>	nationalandinternationalreg tesimplecasesofelectroma ssionlines, groundingsyste parametersofinternaldosim	and HF d HF fie exposu gulation agneticw msanda etrybym	elds re s vavear antenr neans	to ndradi nas ofsimp		
	Course content				L hours		\E ours
	Electrosmog: electro	omagneticpollutionoftheen	vironme		2	110	out 3
Course content broken down in detail by weekly class schedule	Couplingmechanismsofele body. Biol Lowfrequencyandhighfrequeniologicalandstatistic	ogicaleffectsofelectromagruencyeffects.	hum neticfiel		2		
(syllabus)	Fundamentalquantitiesofel currentdensity, inducedel (SAR), specificabsorption(	ectricfield, specificabsorp		ate	2		
	Guidelines for protection and international regulations leves. Protection measures		Natio refer		2		

	Methodsoftheoretica and internal field dosir		erimenta	Ildosimetry.	Incident	2	
	Incident fielddosii Calculationandmeas powerlinesandsubst	uremen	tof LF			2	
	Incident fielddosim electromagneticfield mobilephones, base	. Exp	osure	nandmeasuren to RFID	nentof HF antennas,	2	
	Classificationofmode Simplifiedandanaton		for lymodels		Ildosimetry.	2	
	LF Electromagneticmoolowfrequencies.		agneticmo hebody.		LF posure to	2	
	HF Electromagneti non-ionisingradiation		ng. The	eyeandbrainex	posure to	2	
	The human bodyexp	osure to	o transier	ntradiation.		2	
	Thermalresponseoft electromagneticradia to theeyeandbraindu	ation vis	okih frek		to HF alresponse	2	
	Biomedicalapplication Electricalstimulation Methodsofthe Transcranialmagnetic	ofnerve: h	s. La uman	ser radiatio	onoftheeye. stimulation.	2	
	List oflaboratoryor de	esign ex	cercises				LEhours
	Human exposure to a simulationmodels			radiation (frequ	uenciesup to	10 MHz)	2
	Human exposure to r – simulationmodels	non-ioni	sing EM r	adiation (frequ	enciesabove	: 10 MHz)	2
	Measureequipmenta EM fields	ndmeth	ods for th	neassessmento	of human ex	posure to	3
	Measurementof LF e	lectricfie	elds				2
	Measurementof LF m	nagnetic	fields				2
	Measurement of HF EM fields					2	
	EM fieldcalculationin	ninthevicinityof base stations					2
	⊠lectures □seminars and wor			□independen	t assignmer	ıts	
	⊠exercises			□multimedia			
Format of instruction	□ <i>on line</i> in entirety			⊠laboratory			
	□partial e-learning			□work with m			
	□field work			□ (othe	er)		
Studentresponsibiliti es	The presence on lec Performed all require				70 % of the t	imes sche	duled.
Screening student	Class attendance	1,8	Researc	ch	Practical tra	aining	
work (name the proportion of ECTS credits for	Experimental work		Report		(Oth	er)	1,8
CI EUIIS IUI	Essay		Seminal essay	r	(Oth	er)	0,1
eachactivity so that the total number of							
eachactivity so that	Tests	0,1	Oral exa	am	(Oth	er)	0,1

	There are two midterms and final exams. The first midlecturing and the second one is after the next 6 week in duration) consists of 3 questions (each containinumerical problem) and 2 longer numerical problems grade is the positive assessment of laboratory exerc midterm. Grade (in percentage) is formed according to Grade(%) = 0,5 (M1 + M2) where M1 and M2 are the midterm test results, and is	as. Each midtering theoreticals. The requirerises and 50 % of the formula:	erm test (120 min I part and short ment for passing 6 points on each		
Grading and evaluating student work in class and at the final exam	percentage score:  Percentage score:  Grade:				
the final exam	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 obliged to pass final test (150 min in duration) in winter/fall examination period. Final test consists of 4questions(each containing theoretical part and short numerical problem) and 2 longer numerical problems. The requirement for passing grade is 50 % points. Final grade isformedaccording to the described procedure. The midterm and final exams are carried out as written tests.				
	Title	Number of copies in	Availability via		
Required literature	Title	the library	other media		
(available in the library and via other	D.Poljak, <i>Teorija elektromagnetskih polja s</i> primjenama u inženjerstvu, Šk. knjiga Zagreb, 2014.		other media		
(available in the	D.Poljak, Teorija elektromagnetskih polja s		other media		
(available in the library and via other	D.Poljak, Teorija elektromagnetskih polja s primjenama u inženjerstvu, Šk. knjiga Zagreb, 2014. D. Poljak: Izloženost ljudi elektromagnetskom	the library  alElectromagn  nagnetic Field	eticcompatibility, ds, WIT Press, el Dekker, 2002.		
(available in the library and via other media)  Optional literature (at the time of submission of study programme	D.Poljak, Teorija elektromagnetskih polja s primjenama u inženjerstvu, Šk. knjiga Zagreb, 2014.  D. Poljak: Izloženost ljudi elektromagnetskom zračenju, Kigen, Zagreb, 2007.  1. D. Poljak, AdvancedModelinginComputationa WileyInterscience, New York 2007.  2. D. Poljak: Human Exposure to Electron Southampton- Boston, 2003  3. R.W.Y. Habash, ElectromagneticFieldsandRa 4. D. Poljak: Exposure of Humans to Electron	alElectromagn nagnetic Field adiation, Marc magnetic Rac	neticcompatibility, ds, WIT Press, el Dekker, 2002. liation, SoftCOM		

NAME OF THE	MEASUREMENTS IN WI	RELESS SYSTEMS					
COURSE		ı	l a				
Code	FELJ22	Year of study	2				
Course teacher	Zoran Blažević, Ph.D., Full Professor	Credits (ECTS)	5			ı	
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: 241 Elective: 242	Percentage of application of e-learning	0				
	COURSI	E DESCRIPTION					
Course objectives	various radio systems,	radio propagation in differ					ı.
Course enrolment requirements and entry competences required for the course	Finished the undergraduat						
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	parameters	s and analysis of fixed and e radio propagation of arb			•		е
	Course content				L		\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 parai	meters.			2		1
	Propagation path-loss mod	Mobile radio channel parameters.					
							1
Course content	First midterm exam	dels. Hata-Okumura model	•		3		1
Course content broken down in detail by weekly		of ground networks compa			2		1
broken down in	First midterm exam Statistical channel models	of ground networks compa model. tatistical models based on					
broken down in detail by weekly class schedule	First midterm exam Statistical channel models with Maxwell theory based Satellite radio-channels. Statellite radio-channels.	of ground networks compa model. tatistical models based on l, Suzuki model).	arison		2		1
broken down in detail by weekly class schedule	First midterm exam Statistical channel models with Maxwell theory based Satellite radio-channels. S measurements (Loo mode	of ground networks compa model. tatistical models based on I, Suzuki model). eters. Wide-band measure	arison		2		1
broken down in detail by weekly class schedule	First midterm exam Statistical channel models with Maxwell theory based Satellite radio-channels. Someasurements (Loo mode Wide-band channel param	of ground networks compa model. tatistical models based on I, Suzuki model). eters. Wide-band measure s based on measurements	arison		2 4 4		1 1 3
broken down in detail by weekly class schedule	First midterm exam Statistical channel models with Maxwell theory based Satellite radio-channels. S measurements (Loo mode Wide-band channel param Wide-band channel models	of ground networks compa model. tatistical models based on I, Suzuki model). eters. Wide-band measure s based on measurements	arison		2 4 4 2		1 1 3 1
broken down in detail by weekly class schedule	First midterm exam Statistical channel models with Maxwell theory based Satellite radio-channels. Simeasurements (Loo mode Wide-band channel param Wide-band channel model: Wide-band indoor radio channel models with Maxwell theory based with Maxwell	of ground networks comparmodel. tatistical models based on I, Suzuki model). eters. Wide-band measures based on measurements annel modelling.	arison		2 4 4 2		1 1 3 1
broken down in detail by weekly class schedule	First midterm exam Statistical channel models with Maxwell theory based Satellite radio-channels. Simeasurements (Loo mode Wide-band channel param Wide-band channel models Wide-band indoor radio channel midterm exam	of ground networks compared model. tatistical models based on I, Suzuki model). eters. Wide-band measures based on measurements annel modelling.	ements.		2 4 4 2 3	LET	1 1 3 1

	Wide-band channel r	neasure	ements					3	
	Wide-band indoor ch	annel m	neasurem	ents				3	
	Radio-links planning	Radio-links planning by using measured data and software. 3							
Format of instruction	☐ seminars and workshops ☐ multimedia			mentor					
Studentresponsibiliti es	The presence on led Performed all labora				least 70	% of the time	es schedu	ıled.	
Screening student	Class attendance	2,0	Researc	:h	ı	Practical traini	ng		
work (name the proportion of ECTS	Experimental work		Report		1	Individual work	<	1.5	
credits for eachactivity so that the total number of	Essay		Seminal essay			Laboratory exe	ercises	0,8	
ECTS credits is equal to the ECTS	Tests	0,5	Oral exa	ım		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	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.								
		Title	)			Number of copies in the library	Availab other i		
Required literature (available in the	Z. Blažević; Mjer predavanja	enja u b	ežičnim :	sustavima	а,		e-leai por	_	
library and via other media)	M. Patzold: "Mob 2002.	ile Fadi	ngChann	els", Wile	ey,	1			
<ul> <li>Doble, J.: "Introduction to Radio Propagation for Fixedand Mobile Communications", Artech House Boston - London, GB, 1996.</li> </ul>					1				
Optional literature (at the time of submission of study programme proposal)	<ul><li>G. H. Bryant: "Pr</li><li>Zentner, E.: Ante</li></ul>						blishing,	1993.	
Quality assurance methods that ensure	<ul> <li>Evaluation of results in accordance with the above learning outcomes</li> <li>Feedback from students via surveys</li> <li>Self-evaluation of teachers</li> </ul>								

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

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	L	S	AE	LE	DE
Associate teachers	iviaja Skiijo, FTI.D.	(number of hours)	30	0	0	30	0
Status of the course	Elective						
	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		AE ours
Course content	Introduction. Historical per transmission.	spective of radio and wirel	ess		2		
broken down in detail by weekly class schedule	Principles and techniques Transformers and resonan electrically small antennas	t transformers (Tesla Coil)			4		
(syllabus)	Antenna scattering matrix. Spherical Mode Theory-Ar transmission of energy sys	ss	4				
	Rectennas.				2		

	Near-field energy an transformer.	id powe	r transmi	ssion. F	Resonan	t	4	
	Far-field power trans	sfer.					4	
	Ground energy trans	sfer by fa	ar-field sy	/stems	concept		3	
	Satellite energy tran	sfer sys	tem cond	ept			3	
	Norms and standard standard.	ls for wi	reless en	ergy tra	nsfer. C	<b>Q</b> i	2	
	Electromagnetic Compatibility of wireless energy transfer systems.							
	Interference problem between radio-communications systems and radio systems for wireless energy transfer.						2	
	Midterm exam							
	List of laboratory exe	ercises						LE hours
	Measurements and a antennas	nall	8					
	Measurements of tra Oscilloscope	and by	8					
	Measurements of transfer performances by Vector Network Ana						lyser	6
	Tesla Coil Measurem	Tesla Coil Measurements.						8
Format of instruction	<ul> <li>☑ lectures</li> <li>☐ seminars and workshops</li> <li>☐ exercises</li> <li>☐ on line in entirety</li> <li>☐ partial e-learning</li> <li>☒ field work</li> <li>☒ independent assignme</li> <li>☐ multimedia</li> <li>☒ laboratory</li> <li>☐ work with mentor</li> <li>☐ (other)</li> </ul>				ents			
Studentresponsibiliti es	The presence on lec Performed all labora				t least 7	0 % of the	times sch	eduled.
Screening student	Class attendance	1.5	Researc	h		Practical tr	aining	
work (name the proportion of ECTS	Experimental work		Report			Individual work		2
credits for eachactivity so that	Essay		Seminal essay	ſ		Laboratory	exercises	0,8
the total number of ECTS credits is equal to the ECTS	Tests	0,5	Oral exa	ım		Preparation laboratory		0,2
value of the course)	Written exam		Project			(Oth	ner)	
Grading and evaluating student work in class and at the final exam	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,  LV - laboratory assessment,  M - test results.,  S - seminary work results and presentation							

	Title	Number of copies in the library	Availability via other media				
Required literature (available in the	Ki Young Kim (editor), "Wireless Power Transfer-PrinciplesandEngineeringExplorations", InTech, January 2012.		e-learning portal				
library and via other media)	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)	<ul> <li>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.</li> <li>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.</li> <li>N. Tesla, A. Marinčić: Colorado Springs Notes, Nolit, Beograd, 1978.</li> <li>Carol Gray Montgomery, Robert Henry Dickeand Edward M. Purcell, "Principlesofmicrowavecircuits", McGraw-Hill Book Company, Inc., USA, 1948.</li> </ul>						
Quality assurance methods that ensure the acquisition of exit competences	<ul> <li>Evaluation of results in accordance with the above learning outcomes</li> <li>Feedback from students via surveys</li> <li>Self-evaluation of teachers</li> <li>Institutional and non-institutional evaluations</li> </ul>						
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 S	AE	LE 30	DE				
Status of the course	Elective	Percentage of application of e-learning	0		30					
	COURSI	COURSE DESCRIPTION								
Course objectives	electronic/communicati - knowledge on therapeu - understanding the spec electronic devices	izations and application are on/information technology utic, diagnostic and control cifics of functional and safe lication of success criteria	in medical medical ele ty requiren	ectronic nents for	medic	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)	Students will be able to:  - 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 ours				
	Basics of human electroph	ysiology and electrophysic	logy	2		0				
	Measurement medical elec	etronic devices		2		0				
	Diagnostic medical electro			2		0				
	Therapeutic medical electr			2		0				
Course content	Electronic circuits and com Circuits and devices for ele	•		6		0				
broken down in	frequencies			2		0				
detail by weekly class schedule	Circuits and devices for the			2		0				
(syllabus)	Electrical safety aspects at aspects of medical electron		ubility	2		0				
	Theranostic medical electr	ntrol and auxiliary medical electronic devices. E-Health. eranostic medical electronic devices – unifying the rapeutics and diagnostics in innovative medical devices and								
	Translational resaerch and from lab to clinics (from the Assessment of clinical and technology (Health Technology)	e workbench to the bedside economic efficacy of med	∍).	2		0				

	Clinical studies: principles and implementation of clinical trials of medical devices								0
	List of laboratory or	design e	exercises				<u> </u>	LI	E hours
	Basics of human elec	ctrophys	siology						2
	Amplifier circuits								4
	Electrostimulator circ	cuits							4
	Noise and disturband	ce suppr	ression in	electro	nic dev	ices			2
	Electromagnetic com		y testing						2
	Electrical safety testi	_							2
		asurements of dielectric properties of tissues							
	field trip (visit to med	easurement, diagnostic and therapeutic medical electronic devices – eld trip (visit to medical establishments)							
	⊠ lectures			□ind	epender	nt assignmer	ıts		
	⋈ seminars and wo	rkshops			ltimedia				
Format of instruction					oratory				
1 office of motivotion	□ on line in entirety				k with n	nentor			
	☐ partial e-learning				(othe				
	⊠ field work				(Othe	;1 <i>)</i>			
Studentresponsibiliti es		Student is required to attend the lectures and auditory exercises in the amoleast 70% of the schedule.							unt of at
Screening student work (name the				Practical training					
proportion of ECTS	Experimental work	0,5	Report			Laboratory exercises		es	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 exa	ım		(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	Lectures are given in Marinović (1/3 of lec Exam: presentation	ture hou	ırs).				hours)	and	prof.
		Title	•			Number of copies in the librar	n Ava		ility via media
Required literature (available in the	Ante Šantić: Biomed knjiga, Zagreb, 1995		elektronil	ka, Ško	lska				
library and via other media)	Jaakko Malmivuo &	Robert	Plonsey:						
	Bioelectromagnetism								
	of Bioelectric and Bi University Press, Ne			, Oxfor	d				
	- Handbook of bio			electro	magneti	L c fields (third	edition	ı).	
Optional literature	Bioengineering a	_			_	,		,	k S.
(at the time of	Barnes and Ben (								
submission of study	Handbook of biolo     Medical Aspects								gical and
programme	Greenebaum, CR			) i icias	, Lu. 1 10	ink o. banics	and be	,,,	
proposal)	- The Biomedical Engineering Handbook (Second Edition), Ed. Joseph D. Bronzi							. Bro	nzino,
	ODO B 0000	CRC Press, 2000.							
Quality assurance	CRC Press, 2000	CRC Press, 2000.  Surveys providing student feedback							
Quality assurance methods that ensure the acquisition of exit competences			eedback						

NAME OF THE COURSE	RADIO COMMUNICATIO	RADIO COMMUNICATIONS								
Code	FELJ02									
Course teacher	Zoran Blažević, Ph.D., Full Professor	Credits (ECTS)	5							
	A A A A W	Type of instruction	L	S	AE	LE	DE			
Associate teachers	Maja Škiljo, Ph.D.	(number of hours)	0	15	15	0				
Status of the course	Obligatory	Obligatory Percentage of application of e-learning 0								
	COURS	SE DESCRIPTION								
	Training students for:									
Course objectives	radio-propagation, - radio-channel physica	radio-channel physical phenomena modelling, permanent adoption and deepening of knowledge in the field of radio								
Course enrolment requirements and entry competences required for the course	Finished the undergradua	ate study of Communications	s and In	forma	ation T	echno	logy			
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	propagation, - apply fundamental law - calculate and estimate - apply channel models	al phenomena, the quantitients  ws of radio-propagation and e basic radio-channel parants for radio-signal quality estion of radio-channel measurem	model neters,							
	Course content				L hours	- I	\E ours			
	Introduction to Radio Comradio engineering. SI units	f	1		-					
	Radiowave propagation. S		2		1					
	Radio-antenna parameters	and effective isotropic radiat	ed powe	r.	2		2			
	Free space radiowave pro	pagation. Radio-gain.			2		1			
Course content	Propagation by Troposphe	ere			1		1			
broken down in	Effective Earth Radius Mo	odel and Flat Earth Model. D	Ducting.		3		1			
detail by weekly	Radio-horizon by refraction	on. Influence of Earth curvat	ure		2		1			
class schedule (syllabus)	Tropospheric loss by hydr	rometeors and gasses			1		1			
· / · · · · · · · ·	Propagation by Ionospher				3	1	1			
	First midterm exam									
	Propagation by diffraction Knife-Edge Model.	-	4		1					
	Approximate methods for		2		2					
		ffraction. Keller's law of diffr			1		1			
	Propagation by reflection. Ground roughness influen		4		1					

	Interference by direct	t and g	round refl	ected w	ave. Po	wer law.	2	2	1
	Second midterm exa								
	List of laboratory exe	ercises						L	E hours
	Introduction to labora		truments	, device	s and ot	her equipm	ent		2
	Reflection parameter	s meas	urements	;					4
	Transmission parame	eters me	easureme	ents					4
	Measurements of rac	dio-char	nels by s	pectrun	n analys	er			3
	Software estimations	of diffra	action los	S					2
Format of instruction	<ul> <li>☑ lectures</li> <li>☐ seminars and workshops</li> <li>☑ exercises</li> <li>☐ on line in entirety</li> <li>☐ partial e-learning</li> <li>☑ field work</li> <li>☐ independent</li> <li>☐ multimedia</li> <li>☑ laboratory</li> <li>☐ work with me</li> <li>☐ (other)</li> </ul> The presence on lectures in the amount of at least 70					entor	nts		
Studentresponsibiliti es	The presence on led Performed all labora				t least 70	) % of the t	imes	sched	uled.
Screening student work (name the				Practical tra	ainin	g			
proportion of ECTS	Experimental work		Report	rt !		Individual v	vork		1.5
credits for eachactivity so that the total number of ECTS credits is equal to the ECTS	Essay		Seminal essay	Seminar essay		Laboratory exercises		cises	0,8
	Tests	0,5	Oral exa			Preparation for laboratory exercises		cises	0,2
value of the course)	Written exam		Project	:		(Oth	er)		
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 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.								
		Title	•			Number copies i the libra	n   <i>'</i>		ility via media
Required literature (available in the library and via other	<ul> <li>I. Zanchi, Z. Blaž predavanja, FES</li> </ul>	ević: Ra B	adiokomu	ınikacije	),				rning rtal
media)	Boithias, L.: Radi Oxford Academic	io Wave c 1987.	Propaga	tion, No	rth	1			
	<ul> <li>Zentner, E.: Radiokomunikacije, Školska knjiga - Zagreb, 1980.</li> </ul>					2			
Optional literature (at the time of submission of study programme proposal)	<ul> <li>Zentner, E.: Ante</li> <li>Parsons, J. D.: "\ Publishers - Long</li> </ul>	The Mol	oile Radio		-		entec	th Press	6

	Doble, J.: "Introduction to Radio Propagation for Fixed and Mobile Communications", Artech House Boston - London, GB, 1996.
Quality assurance methods that ensure the acquisition of exit competences	<ul> <li>Evaluation of results in accordance with the above learning outcomes</li> <li>Feedback from students via surveys</li> <li>Self-evaluation of teachers</li> <li>Institutional and non-institutional evaluations</li> </ul>
Other (as the proposer wishes to add)	

NAME OF THE COURSE	ALGORITHMS									
Code	FELJ12	FELJ12 Year of study 1.								
Course teacher	Matko Šarić, Ph.D., Assistant Professor									
Associate teachers	Ante Topić, TeachingAssistant	Type of instruction (number of hours)	L 30	S 0	AE 15	LE 15	DE 0			
Status of the course	Obligatory  Percentage of application of e-learning 0									
	COURSE	DESCRIPTION								
Course objectives	Training students for:  - Design of efficient algorithms and analysis of algorithms properties (speed and memory)  - Adopting the practical knowledge about sorting algorithms and graph-based algorithms									
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)	Students will be able to:  - Analyze the execution time of the algorithm  - explain and apply different sorting algorithms  - explain and apply graph-based algorithms  - apply dynamic programming									
Course content	Course content		or S hours		AE ours					
broken down in detail by weekly	Introduction. What are algorithms. Analyzing algorithms in Example D-2 maximum						0			
class schedule (syllabus)	Analyzing of the loops. Solving of summations. Solving 2-D maximum - method of crossing the plane.						0			
	Asymptotic notation. Limite	d rule.			3		0			

	The technique of div execution time analy		rule. Me	rgesort (ps	eudocode,	3	0
	Recursion (search p Master theorem.	attern, i	teration,	recursion t	ree method).	3	0
	Heap data structure. analysis).	Heaps	ort (pseu	docode, ex	recution time	3	0
	Quicksort (pseudoco	de, exe	cution tin	ne analysi	s)	3	0
	The lower limit of so linear time. (counting				ime. Sorting by	3	0
	The algorithms based on graphs (basic concepts and definitions).					3	0
	Graph representation using the adjacency matrix and adjacency list. BFS algorithm.					3	0
	All pairs shortest paths. Dynamic programming. Floyd- Warshall algorithm.					3	0
	Longest common su	bseque	nce. Matı	ix chain m	ultiplication	3	0
	Decision problems. NP-problems and polynomial time verification. NP completeness. Reduction. Hamiltonian path and Hamiltonian cycle.					3	0
	List of laboratory or		LE hours				
	Analysis of typical running times Solving of summations						2
							2
	Recursions						2
	Merge sort I						2
	Merge sort II						2
	Heap sort						2
	Quicksort						2
	Linear time sorting al	gorithm	s				2
	Graph representation	1					2
	BFS algorithm						2
	Floyd-Warshall algor	ithm					2
	Longest common sub	osequer	nce				2
	Matrix chain multiplic	ation					2
Format of instruction	<ul> <li>☑ lectures</li> <li>☐ seminars and workshops</li> <li>☑ exercises</li> <li>☐ on line in entirety</li> <li>☐ partial e-learning</li> <li>☐ field work</li> </ul>			<ul> <li>independent assignments</li> <li>multimedia</li> <li>laboratory</li> <li>work with mentor</li> <li>(other)</li> </ul>			
Studentresponsibiliti es							
Screening student	Class attendance	2,0	Researc	h	Practical tra	aining	
work (name the proportion of ECTS	Experimental work		Report		Individual v	vork	2,2
credits for eachactivity so that	Essay		Seminal essay	r	Laboratory exercise		0,5

the total number of			T <sub>a</sub> .		Preparation fo	r	
ECTS credits is equal to the ECTS	Tests	0,2	Oral exam		laboratory exe		
value of the course)	Written exam	0,1	Project		(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. Midterm test and final test consist of theoretical questions and numerical problems. In the final exams students that did not pass the midterm exams take part. The midterm and final exams are carried out as written tests. The requirement for passing grade is the positive 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)						al test udents ns are ositive
		Title	<b>e</b>		Number of copies in the library	Availabili other m	
Required literature (available in the	Individual work	Title	)		copies in		edia
(available in the library and via other	Individual work  Laboratory exercises		•		copies in	other m e-learning	edia
(available in the		6			copies in	other m e-learning	edia
(available in the library and via other	Laboratory exercises	6			copies in	other m e-learning	edia
(available in the library and via other	Laboratory exercises	s ratory e	xercises Rivest, C.Stein: "		copies in the library	other m e-learning portal	edia
(available in the library and via other media)  Optional literature (at the time of submission of study programme	T.Cormen, C.Leisers secondedition, thirdp  - Evaluation of re - Feedback from - Self-evaluation	son, R.Forinting,	xercises  Rivest, C.Stein: " McGraw-Hill, 20 accordance with ts via surveys	n the abo	tion to Algorithm	e-learning portal  ms",	edia

NAME OF THE	MODII E COMMUNICATI	ONG						
COURSE	MOBILE COMMUNICATIONS							
Code	FELJ14	Year of study 1.						
Course teacher	Zoran Blažević, Ph.D., Full Professor	Credits (ECTS)	5					
Associate teachers	Maia Škilia, Dh.D.	Type of instruction	L	S	AE	LE	DE	
Associate teachers	Maja Škiljo, Ph.D.	(number of hours)	30	0	15	15	0	
Status of the course	Obligatory: 241 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.						5,		
Course enrolment requirements and entry competences required for the course	Finished the undergraduate	e study of Communication	s and Ir	nforma	ation T	echno	logy	
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				L hours		\E ours	
		1		1				
	Classification of digital radio-channels.  Digital radio system performances.  Systems with bandwidth limitation.  Power limited systems.						1	
							2	
							1	
							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 (syllabus)	Cellular radio systems. Cochannel and adjacent channel interference.						1	
	Path-loss law. Base station ling budget. Multipath reception.				2		2	
	First midterm exam							
	Cell radio-coverage calculation.						1	
	Mobile propagation channel analysis.				2		1	
	Radio channel measurements.				2		1	
	Propagation channel classification. Delay-spread and channel coherence bandwidth.						1	
	Second midterm exam							
	List of laboratory exercises					LE	nours	
	Radio channel characteriza measurements.	tion by Vector Network An	alyser			:	5	

	Communication systems testing and simulating by Matlab and Simulink					ılink	2	
	Analog and digital modulation simulations						2	
	Multipath fading channels simulations						2	
	Adjacent and co-channel interference in cellular systems simulations by Simulink					mulink	2	
	COST 207 and GSM/EDGE channel models by Matlab							2
Format of instruction	<ul> <li>☑ lectures</li> <li>☐ seminars and workshops</li> <li>☑ exercises</li> <li>☐ on line in entirety</li> <li>☐ partial e-learning</li> <li>☑ field work</li> <li>☐ independent assignments</li> <li>☐ multimedia</li> <li>☑ laboratory</li> <li>☐ work with mentor</li> <li>☐ (other)</li> </ul>			·				
Studentresponsibiliti es	The presence on lec Performed all labora				t least 7	'0 % of the time	es schedu	ıled.
Screening student	Class attendance	2,0	Researc	h		Practical traini	training	
work (name the proportion of ECTS	Experimental work		Report			Individual worl	k	1.5
credits for eachactivity so that the total number of	Essay		Seminal essay			Laboratory exc	ercises	0,8
ECTS credits is equal to the ECTS	Tests	0,5	Oral exam		Preparation for laboratory exercises		0,2	
value of the course)	Written exam		Project		(Other)			
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 (ii)  the activities in perconsistence of the activities of the activities in perconsistence of the activities in perconsistence of the activities of the activ	cond on retical of take parent tests atory expended (% entage: ance at learning asserted as sory asserted (% entage: ance at learning asserted (% entage: ance	e is after juestions rt In the s. The receives antage) is the point of	the nearly and nu final exequirement and 40 formed	xt 6 wee imerical ams. The nent for % point according	eks. Each midte . The students ne midterm and passing grade s on each midteng to the formuly,4 (M1 + M2)	erm test a that did r d final exa e is the term exar	and final not pass ams are positive
	Title			Number of copies in the library		ility via media		
Required literature (available in the library and via other media)	Z. Blažević: Mobilne komunikacije, predavanja, FESB					e-lea po	rning rtal	
	I. Zanchi, Z. Blažević: Radiokomunikacije, predavanja, FESB						rning rtal	
	David Parson.: The Mobile Radio Propagation Channel, Pentech Press Pub. London, 1992.  2							
Optional literature (at the time of submission of study programme proposal)	<ul> <li>R. Steele: "Mobile Radio Communications", Pentech Press, London, GB and IEEE Press, Piscataway, USA, 1992.</li> <li>Vijag, K. Garg, Joseph, E. Wilkes: Wireless and Personal Communications Systems, Prentice Hall PTR, NY 1996.</li> </ul>							

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

NAME OF THE COURSE	LOCAL AND ACCESS NETWORKS						
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)					DE
Status of the course	<ul> <li>Obligatory (university graduate programme, 242)</li> </ul>	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	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.						

	Introduction. Standards.  The division of the LAN network accounts.					
	The division of the LAN network acco	Introduction. Standards.				
	The division of the Little twonk about	The division of the LAN network according to different criteria.				
	Local area networks of type Ethernet			2		
	Local area networks of type: Token ri		2			
Course content broken down in	Gigabit Ethernet, switched LAN					
detail by weekly	Networks: ATM, ATM LAN		2			
class schedule	Virtual Private Networks-VPN			2		
(syllabus)	Wireless Communication Systems-gesystems	eneral, cellular (mobile)		2		
	Wireless LAN (WLAN) networks			2		
	Broadband access networks-general			2		
	xDSL technology: HDSL, ADSL, VDS	SL		2		
	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		
	Exercise 2.: Local Area Network - The network	e role of Switch in LAN Ethe	ernet	2		
	Exercise 3.: Local Area Network - a nwith different users, terminals and ser		twork	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 on 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					
Format of instruction	<ul> <li>☑ lectures</li> <li>☐ seminars and workshops</li> <li>☐ exercises</li> <li>☐ on line in entirety</li> </ul>	<ul><li>☐ independent assignment</li><li>☐ multimedia</li><li>☒ laboratory</li></ul>	nts			
	□ partial e-learning	y work with mentor				
	☐ field work	□ (other)				

Studentresponsibiliti es	<ul><li>positive assessr</li><li>minimum preser</li><li>presence on lab time in a semes</li></ul>	ment of nce duri oratory ter, oints at	sitiveassessment are: laboratory exercises ( ng 70% of overall clas exercises during 100% each mid-term or fina	s teaching time in 6 of overall labora	atory exe				
Screening student	Class attendance	lass attendance 1,0 Research Practical training							
work (name the proportion of ECTS	Experimental work	xperimental work Report Independent work 2,2							
credits for eachactivity so that the total number of	Essay		Seminar essay	Laboratory ex	ercises	1,0			
ECTS credits is equal to the ECTS	Tests		Oral exam	Preparation for Laboratory ex		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 suffic 62% to 74% good (375% to 87% of very 88% 100% Excellen  Independently on reand 4th final (correct the case of organization curricula content. Recommission) exam  Examinations:  1st Final exam 2nd Final exam	Written exam  0,3  Project  (Other)  During the semester there will be two mid-term exams (tests). The 1st mid-term exams will be after 8 weeks of classes, and the 2nd after 15 weeks of classes. On the 1st and 2nd of the final exams, students take exam of those parts of the curricula which hey did not pass on some of the mid-term exams. On the 3rd and 4th of the finite forms of the state exam of complete course curricula.  Rating (%) = 0.1PL + 0.2LA + 0.35 (M1 + M2)  PL - presence on the lectures (expressed in percentage),  A- grades from laboratory assessment (expressed in percentage),  M1, M2- the 1st and 2nd mid-term exam grades or final exam grades (expressed in percentage),  The final grade is determined as follows:  Decreentage Rating  50% to 61% is sufficient (2)  12% to 74% good (3)  175% to 87% of very good (4)  18% 100% Excellent (5)  Independently on results obtained during the 1st or 2nd mid-term exams, on the 3nd and 4nd 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  2nd Final exam  2nd Final (correctional) exam							
Required literature (available in the		Title	9	Number of copies in the library	Availab other	ility via media			
(available in the library and via other media)  • Milutin Kapov, Josip Lorincz, "Local and Access Networks", FESB-Split, 2015, (2009), internal script					e-lea poi				

	<ul> <li>Josip Lorincz, "Instructions for performing laboratory exercises in local and access networks", FESB Split, internal script, 2015.</li> </ul>		e-learning portal		
	Alen Bažant and others: "The basic architecture of the network", ELEMENT, Zagreb, 2004.	5			
	M. Vrdoljak and others: "New Communication Technologies", FESB Split, HT TKC Split, softcore library Split in 1999.	5			
Optional literature (at the time of submission of study programme proposal)	<ul> <li>M. Jose ., M. Caballero and others, "SDH / SONE Synchronization Networks", Artech House, Bostor</li> <li>Alex Gillespie: "Broadband Access Technology In Artech House, Boston, London, 2000.</li> <li>Annabel Z. Dodd, "Telecommunications", Algorith</li> </ul>	n, London, 200 sterfaces and N	03. Management,		
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	J24 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	ΑE	LE	DE		
Associate teachers	Assistant	(number of hours)	30			30			
Status of the course	Elective	Percentage of application of e-learning	0	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: - describe the cell struct	ure							

of the course (4 to 10 learning	<ul><li>describe the electron</li><li>apply the electron</li></ul>		٠.				brain an	d heart
outcomes)	function	rd= aath	'er af ha	4 1	المناسبات	e linatio	ممالم مالم	4!
	<ul><li>analyze the electroph</li></ul>		•				_	
	potential biomed			CO to th	io rarioti		odily orgi	and and to
	Course content						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	١.					2	0
broken down in	Synapses, receptors	and bra	ain.				2	0
detail by weekly class schedule	Heart.						2	0
(syllabus)	Volume source. Volu	ıme con	ductor.				2	0
,	Electrocardiography	(ECG).					2	0
	Electroencephalograhpy (EEG).						0	
	Electrophysiology of the eye. Electrodermal reaction. 2						0	
	Other diagnostic and therapeutic methods based on applied electromagnetics. Magnetic resonance imaging (MRI).					2	0	
	Visit to Medical School of the University of Split. Visit to companies related to the course topics.						0	
	List of laboratory or o	design e	xercises					LE hours
	Membrane potential.							4
	Axon as transmissior	n 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		Univers	ity of Sp	olit. Visit	to companie	es	6
	□ lectures			□ indo	nandan	t aaaignman	40	
	⊠ seminars and wor	kshops			penden timedia	t assignmen	เธ	
Format of instruction	⊠ exercises			□ India				
1 omat of mondonom	☐ <i>on line</i> in entirety				k with m	entor		
	☐ partial e-learning				(othe			
⊠ field work								
Student responsibilities	Student is required to least 70% of the sch the amount of 100% laboratory exercises	edule. Sof the s	Student is	require	ed to att	end the labo	ratory ex	ercises in
	Class attendance	1	Researc	:h		Practical tra	ining	

Screening student	For a size a stal const.	0.5	Damant		1 -1	:	0.5
work (name the	Experimental work	0,5	Report		Laboratory exe	ercises	0,5
proportion of ECTS credits for each	Essay		Seminar essay	1	Individual work	K	1
activity so that the total number of	Mid-exam	0,5	Oral exam		(Other)		
ECTS credits is 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	At the first exam term, students may choose to take the exam containing on the last of the material that they haven't passed at mid-exams						res and nd mid- rt of the nd min. material must be material rt of the dered to oth mid- nly that e course student average tion:
	a Jackka Malmiyus	Title			copies in the library	Availab other i	
Required literature (available in the	Jaakko Malmivud Bioelectromagne Applications of B Fields, Oxford U 1995.	etism - F Bioelectr niversity	Principles and ic and Biomagne Press, New York				
library and via other media)	Handbook of bio electromagnetic Bioengineering a Electromagnetic and Ben Greene	fields (tl and Biop Fields, baum, (	hird edition): physical Aspects Ed. Frank S. Bai CRC Press, 2007	nes			
	Handbook of bio electromagnetic			ogical			

	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)	<ul> <li>Šantić, A: Biomedicinska elektronika, Školska knjiga, Zagreb, 1995.</li> <li>The Biomedical Engineering Handbook (Second Edition), Ed. Joseph D. Bronzino, CRC Press, 2000.</li> </ul>
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	5			
Associate teachers	Niko Ištuk, mag. ing. el.	Type of instruction	L	S	ΑE	LE	DE
Associate teachers	Triko istak, mag. mg. er.		30			30	
Status of the course	Elective	Percentage of application of e-learning	0				
	COURSE	EDESCRIPTION					
Course objectives	<ul> <li>learning the types, realizations and application areas of electronic/communication/information technology in medical domain</li> <li>knowledge on therapeutic, diagnostic and control medical electronic devices</li> <li>understanding the specifics of functional and safety requirements for medical electronic devices</li> <li>understanding and application of success criteria for medical device innovation and development</li> </ul>				cal		
Course enrolment requirements and entry competences required for the course	rolment nts and petences None.						
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	e level analysis and development of medical devices						

	<ul> <li>characterize a medical electronic device from the aspect of safety</li> <li>critically assess the success of innovation and development of a medical device</li> </ul>							cal device
	Course content						L hours	AE hours
	Basics of human electrophysiology and electrophysiology						2	0
	Measurement medical electronic devices							0
	Diagnostic medical electronic devices							0
	Therapeutic medical	l electro	nic devic	es			2	0
	Electronic circuits ar	nd comp	onents ir	n medic	al devic	es	6	0
	Circuits and devices frequencies	for elec	tric and ı	magnet	ic stimu	lation at low	2	0
	Circuits and devices	for ther	mal proc	edures	at high	frequencies	2	0
	Electrical safety asp aspects of medical e				c comp	atibility	2	0
Course content broken down in	Control and auxiliary Theranostic medical therapeutics and dia methods	electro	nic devic	es – un	ifying th	е	2	0
detail by weekly class schedule (syllabus)	Translational resaer from lab to clinics (fr Assessment of clinic technology (Health	om the cal and e	workben economic	ch to the efficac	e bedsion	de).	2	0
Clinical studies: principles and implementation of clinical tri of medical devices						nical trials	2	0
	List of laboratory or	design e	exercises					LE hours
	Basics of human elec	ctrophys	siology					2
	Amplifier circuits							4
	Electrostimulator circ	cuits						4
	Noise and disturband	ce suppi	ression ir	electro	nic dev	ices		2
	Electromagnetic com	•	y testing					2
	Electrical safety testi							2
	Measurements of die	•	•					2
	Measurement, diagn field trip (visit to med				edical el	ectronic devi	ces –	8
Format of instruction	lectures				its			
Student responsibilities	Student is required to least 70% of the sch		the lect	ures an	d audito	ry exercises	in the an	nount of at
Screening student work (name the	Class attendance	1	Researc	ch		Practical tra	ining	
proportion of ECTS credits for each	Experimental work				Laboratory 6	exercises	0,5	
activity so that the total number of	so that the Essay Seminar Individual			Individual w	ork	1		
ECTS credits is equal to the ECTS	Mid-exam	0,5	Oral exa	am		(Othe	er)	
value of the course)	Written exam	0,5	Project			(Othe	∋r)	
Grading and evaluating student	Lectures are given in Marinović (1/3 of lec			f prof. Š	arolić (2	2/3 of lecture	hours) a	nd prof.

work in class and at the final exam	Exam: presentation and defense of the seminar essa	у	
	Title	Number of copies in the library	Availability via other media
Required literature (available in the	Ante Šantić: Biomedicinska elektronika, Školska knjiga, Zagreb, 1995.		
library and via other 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)	<ul> <li>Handbook of biological effects of electromagnetic Bioengineering and Biophysical Aspects of Electrom Barnes and Ben Greenebaum, CRC Press, 2007.</li> <li>Handbook of biological effects of electromagnetic fie Medical Aspects of Electromagnetic Fields, Ed. Frar Greenebaum, CRC Press, 2007.</li> <li>The Biomedical Engineering Handbook (Second Edic CRC Press, 2000.</li> </ul>	nagnetic Fields, elds (third editic nk S. Barnes ar	Ed. Frank S. on): Biological and ond Ben
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.							
Course teacher	Mladen Russo, Ph.D., Assistant Professor	Credits (ECTS)	5						
	Jelena Čulić, Teaching	_	S	AE	LE	DE			
Associate teachers	Assistant Martina Bašić, Teaching Assistant	Type of instruction (number of hours)	30	0	0	30	0		
Status of the course	Obligatory: 242 Elective: 241	Percentage of application of e-learning	0						
	COURSI	E DESCRIPTION							
Course objectives	<ul> <li>knowledge of the proper and video signals (included)</li> </ul>	nedia systems and virtual erties and methods for gen uding 3D images and video ost important algorithms for s	erating	•					
Course enrolment requirements and entry competences required for the course	Course enrolment requirements and entry competences required for the								
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				L hours		\E ours		
	Introduction. History of mu Overview of multimedia so applications.			а	2		0		
	Audio signal. How humans modelling.	hear and speak. Speech			2		0		
Course content broken down in	Generic compression technopecific algorithms (mp3).	niques for audio signals. A	udio		2		0		
detail by weekly class schedule (syllabus)	Speech specific algorithms and applications in mobile encoding speech and audi	telephony. Review of stan			2		0		
		eo signal. The perception of color (how magnetic radiation). Theory of mixing 2					0		
	nal (RGB, CMY, CMYK). ( JV, YIQ, YCbCr). Software HSV). Gamma correction. I nemory requirements). Ima p).	e-orient Image	ed	2		0			

	Basics of video and television. Analog television and video. Digital television and video. Video formats and memory requirements.						2	0
	Image compression.	JPEG i	modes.				2	0
	Video compression:	H.261.	H.263.				2	0
	Video compression:	MPEG-	1. MPEG	i -2.			2	0
	Video compression:	MPEG-	4.				2	0
	Video compression:	H.264.					2	0
		Fundamentals of virtual reality. History. Stereoscopic (3D) vision. Software and hardware for virtual reality.					2	0
								LE hours
	Sound recording. Sea	arching	of voiced	and ur	nvoiced s	peech. Pito	ch period.	2
	Speech specific algo	rithms (	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 o	n video	quality			2
	Multimedia systems	on mobi	le device	s (Andr	oid progr	amming)		2
	Multimedia systems	on mobi	le device	s (Andr	oid progr	amming)		2
	Multimedia systems	on mobi	le device	s (Andr	oid progr	amming)		2
	3D images						2	
	CAVE system							2
	<ul><li>☑ lectures</li><li>☐ seminars and wor</li></ul>	rkshops			-	assignme	nts	
	⊠ exercises	•			ltimedia			
Format of instruction	□ on line in entirety				oratory k with me	ntor		
	☐ partial e-learning				(other)			
	☐ field work				(Other)			
Studentresponsibiliti es	The presence on lec Performed all require				t least 70	% of the t	imes sche	eduled.
Screening student	Class attendance	3	Researc	ch	F	Practical tra	aining	
work (name the proportion of ECTS credits for	Experimental work		Report		I	ndividual v	vork	1,7
eachactivity so that the total number of	Essay		Semina essay	r		(Oth	ner)	
ECTS credits is	Tests 0,2 Oral exam (Other			ner)				
equal to the ECTS value of the course)	Written exam 0,1 Project (Other)					ner)		
Grading and evaluating student work in class and at the final exam	During a semester the are held according to from the complete of take the midterm the students take the test The requirement for exam. Grade (in per	the cal course if at they st from t passing	endar of f they do did not he comp g grade is	classes not hav pass. A lete cou	. At the find the find the At the material transfer in the find th	nal exam s tive grade ake-up and each midte	tudents ta on the m d commis orm exam	ike the test lidterms or sion exam

	Grade(%) = 0,5*M1+0,5*M2; M1, M2 – midterm test of the final grade is determined as follows:  Percentage Grade  50% to 61% sufficient (2)  62% to 74% good (3)  75% to 87% very good (4)  88% to 100% excellent (5)	results.				
Required literature (available in the library and via other	Title	Number of copies in the library	Availability via other media			
media)	H. Dujmić: Multimedijskisustavi, internal script	1	e-learning portal			
Optional literature (at the time of submission of study programme proposal)	<ul> <li>Steinmetz, Nahrstedt: "Multimedia Fundamentals: Processing", Prentice Hall, 2002</li> <li>Rao, Bojkovic, Milovanovic: "Multimedia Commun StandardsandNetworks", Prentice Hall, 2002</li> </ul>					
Quality assurance methods that ensure the acquisition of exit competences	<ul> <li>Evaluation of results in accordance with the above learning outcomes</li> <li>Feedback from students via surveys</li> <li>Self-evaluation of teachers</li> <li>Institutional and non-institutional evaluations</li> </ul>					
Other (as the proposer wishes to add)						

NAME OF THE	MEASUREMENTS IN WIRELESS SYSTEMS								
COURSE									
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  Percentage of application of e-learning								
COURSE DESCRIPTION									
Training students for: - radio-channel measurements and analysis, - statistical modelling of radio propagation in different environments and f various radio systems, - applying empirical and statistical models for radio-channel characterizat									
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)	<ul> <li>Students will be able to:</li> <li>calculate radio-channel parameters,</li> <li>perform measurements and analysis of fixed and mobile radio systems parameters</li> <li>statistically characterize radio propagation of arbitrary radio-systems on the base of measurements,</li> <li>Apply various channel models</li> </ul>								
	Course content								
		1		1					
	Introduction to Measurements in Wireless Systems.  Fixed radio-links channel parameters. Fading						1		
	Ground radio links plannin		2		2				
	Fading in mobile radio cha		2		1				
	Mobile radio channel parai		2		1				
	Propagation path-loss mod		3		1				
Course content	First midterm exam								
Course content broken down in detail by weekly class schedule (syllabus)	Statistical channel models with Maxwell theory based		2		1				
	Satellite radio-channels. S measurements (Loo mode		4		1				
	Wide-band channel param		4		3				
	Wide-band channel model		2		1				
	Wide-band indoor radio ch		3		1				
	Second midterm exam								
	List of laboratory exercises						nours		
	Antenna measurements by Vector Network Analyser measurements. Measurements calibration.						3		
	ividadarcinicinto danbiation.								

	Wide-band channel measurements 3						3	
	Wide-band indoor ch	annel m	neasurem	ents				3
	Radio-links planning by using measured data and software. 3					3		
Format of instruction	<ul> <li>☑ lectures</li> <li>☐ seminars and workshops</li> <li>☑ exercises</li> <li>☐ on line in entirety</li> <li>☐ partial e-learning</li> <li>☐ independe</li> <li>☐ multimedia</li> <li>☑ laboratory</li> <li>☐ work with</li> </ul>			imedia ratory	mentor			
Student responsibilities	The presence on lectures in the amount of at least 70 % of the times scheduled. Performed all laboratory exercises required.							
Screening student	Class attendance	2,0	Researc	:h		Practical traini		
work (name the proportion of ECTS	Experimental work		Report			Individual worl	<	1.5
credits for each activity so that the total number of ECTS credits is equal to the ECTS	Essay		Seminar essay			Laboratory exe	ercises	0,8
	Tests	0,5				Preparation for laboratory exercises		0,2
value of the course)	Written exam		Project		(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.							
		Title				Number of copies in the library	Availab other i	
Required literature (available in the	Z. Blažević; Mjerenja u bežičnim sustavima, predavanja					e-leai por	_	
library and via other media)	M. Patzold: "Mobile Fading Channels", Wiley, 2002.				1			
	Doble, J.: "Introduction to Radio Propagation for Fixed and Mobile Communications", Artech House Boston - London, GB, 1996.				1			
Optional literature (at the time of submission of study programme proposal)	<ul> <li>G. H. Bryant: "Principles of Microwave Measurements", IEE Publishing, 1993.</li> <li>Zentner, E.: Antene i radiosustavi, Graphis Zagreb, 2001.</li> </ul>							
Quality assurance methods that ensure	<ul> <li>Evaluation of results in accordance with the above learning outcomes</li> <li>Feedback from students via surveys</li> <li>Self-evaluation of teachers</li> </ul>							

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

NAME OF THE COURSE	SYSTEMS FOR WIRELESS TRANSMISSION OF ENERGY								
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	1E 30	DE 0			
Status of the course	Elective	Percentage of application of e-learning 0							
	COURSI	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)	the level - analyse power and energy transmission techniques,								
	Course content  L AE hours hours								
Course content broken down in	Introduction. Historical perstransmission.	ess		2					
detail by weekly class schedule (syllabus)	Principles and techniques for radio-transmission of energy. Transformers and resonant transformers (Tesla Coil), and electrically small antennas.								
	Antenna scattering matrix. Spherical Mode Theory-Antransmission of energy sys	ss	4						

	Rectennas.						2	
	Near-field energy and power transmission. Resonant transformer.			4				
	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 Com	patibility	of wireles	s energy	transfer	systems.	2	
	Interference problem between radio-communications systems and radio systems for wireless energy transfer.			2				
	Midterm exam							
	List of laboratory exe	ercises						LE hours
	Measurements and a antennas	adjustme	ents of in	ductivel	y fed ele	ectrically sm	all	8
	Measurements of tra Oscilloscope	Measurements of transfer performances by Spectrum Analyser, a Oscilloscope				and by	8	
	Measurements of tra	nsfer pe	erformand	es by \	ector N	etwork Anal	yser	6
	Tesla Coil Measurem	nents.						8
Format of instruction	<ul> <li>☑ lectures</li> <li>☐ seminars and workshops</li> <li>☐ exercises</li> <li>☐ on line in entirety</li> <li>☐ partial e-learning</li> <li>☑ field work</li> <li>☑ independent assignment</li> <li>☐ multimedia</li> <li>☑ laboratory</li> <li>☐ work with mentor</li> <li>☐ (other)</li> </ul>				nts			
Student responsibilities	The presence on lec Performed all labora				t least 7	0 % of the ti	mes sche	duled.
Screening student	Class attendance	1.5	Researc	:h		Practical tra	aining	
work (name the proportion of ECTS	Experimental work		Report			Individual w	ork/	2
credits for each activity so that the	Essay		Seminal essay	-		Laboratory	exercises	0,8
total number of ECTS credits is equal to the ECTS	Tests	0,5	Oral exa	Preparation laboratory e				0,2
value of the course)	Written exam		Project				er)	
Grading and evaluating student work in class and at the final exam								

	S – seminary work results and presentation					
	Title	Number of copies in the library	Availability via other media			
Required literature (available in the library and via other media)	Ki Young Kim (editor), "Wireless Power Transfer-Principles and Engineering Explorations", InTech, January 2012.		e-learning portal			
	<ul> <li>Volakis J., C. C. Chen and K. Fujimoto, "Small antennas: miniaturization techniques and applications", New York, McGraw-Hill, 2010.</li> </ul>		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)	<ul> <li>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.</li> <li>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.</li> <li>N. Tesla, A. Marinčić: Colorado Springs Notes, Nolit, Beograd, 1978.</li> <li>Carol Gray Montgomery, Robert Henry Dicke and Edward M. Purcell, "Principles of microwave circuits", McGraw-Hill Book Company, Inc., USA, 1948.</li> </ul>					
Quality assurance methods that ensure the acquisition of exit competences	<ul> <li>Evaluation of results in accordance with the above learning outcomes</li> <li>Feedback from students via surveys</li> <li>Self-evaluation of teachers</li> <li>Institutional and non-institutional evaluations</li> </ul>					
Other (as the proposer wishes to add)						