

SVEUČILIŠTE U SPLITU

FACULTY OF ELECTRICAL ENGINEERING, MECHANICAL ENGINEERING AND NAVAL ARCHITECTURE

DETAILED PROPOSAL OF THE STUDY PROGRAMME

GRADUATE UNIVERSITY STUDY IN AUTOMATION AND SYSTEMS

SPLIT, May 2025

1.1. List ofmandatory and elective courses

List ofcourses										
Year of study	Year of study:1.									
Semester:I.										
OTATUO	CODE	0011005		HOURS IN SEMESTER*						
51A105	CODL	COURSE	L	S	AE	LE	DE	ECIS		
	FEMG01	Modern physics	30	0	0	30	0	4		
Mandatory	FELK04	Computer graphics	30	0	0	30	0	5		
	* L = lecture	es, S = seminars, AE = auditoryexcercise, LE = labora	ratoryexcercise, DE = design excercise							
	FELG32	Telemedicine and Biocybernetics	30	0	0	30	0	5		
	FELH11	Artificial intelligence	30	0	0	30	0	5		
Elective * L = lectures, S = seminars, AE = auditoryexcercise, LE = laboratoryexcercise, DE = design e							excerci	se		

List ofcourses									
Year of study:1.									
Semester:II.									
	CODE	COURSE	НО	URSI	N SEN	MEST	ER*	ECTS	
		COURSE		S	AE	LE	DE	ECIS	
STATUS	FELG14	Operations research	30	0	0	30	0	5	
	FELG10	Digital control	45	0	30	0	0	6	
	FELG33	Optoelectronic measurement methods	30	0	0	30	0	5	
	* L = lecture	es, S = seminars, AE = auditoryexcercise, LE = labora	atoryex	cercise	, DE =	design	excerci	se	

List of courses									
Year of study:2.									
Semester:III.									
	CODE	COURSE		HOURS IN SEMESTER*					
				S	AE	LE	DE	ECIS	
STATUS	FELG23	Optimization and optimal systems	30	0	30	0	0	5	
	FELG24	Microcontrollers and network embedded systems	30	0	0	30	0	5	
	* L = lecture	es, S = seminars, AE = auditoryexcercise, LE = labor	atoryex	cercise	, DE =	design	excerci	se	

1.2. Course description

NAME OF THE COURSE	MODERN PHYSICS									
Code	FEMG01 Year of study 1.									
Course teacher	Nikola Godinović, Ph.D., Associate Professor	Credits (ECTS)	4							
	DuniaPolić, Darko Zarić	Type of instruction	L	S	AE	LE	DE			
Associate teachers	Toni Vrdoljak	(number of hours)	30	0		30	0			
Status of the course	Obligatory	Dbligatory Percentage of application of e-learning 0								
	COURSE	DESCRIPTION								
Course objectives	Understanding the basic laws and concepts ofquantumphysicsandtheirapplicationinmodernengineeringtechniques, technologyandinformation. Theacquiredknowledgeserves as a basis for theadoptionoffurtherexpertisethroughspecializedcourses, as well as preparing for theadoptionoffurtherexpertisethroughspecializedcourses.									
Course enrolment requirements and entry competences required for the course										
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	 Developing ability of abstract trinking and inderstanding the concepts of quantum physics on which modern technologies are based Understanding of theel ectric and magnetic properties of the materials starting from their atomis structure Understandingthefenomenologyofsuperconductors. Basicunderstandingofnuclearphysicsandtheiraplication for energygeneration as well as basicunderstandingofradioactivityanddosimetry. Becomefamiliarwithmoderndiagnosticmethodsandtreatmentsinmedicne: nuclearmagneticresonance (NMR), positronemissiontomography (PET), 									
	Course content			h	L	h	LE			
	Special theory of relativity				2					
	General theory of relativity				2					
	Particle properties of wave	s			2					
	Wave properties of particle				2					
Course content	Introduction to wave mecha	anics - Schrodinger equat	ion		2					
detail by weekly	Application of Schrodinger	equation			2					
class schedule	Schrodinger equation for h	ydrogen atom			2					
(syllabus)	Electrical properties of mat	erial			2					
	Semiconductors				2					
	Magnetic properties of mat	erial			2					
	Phenomenology of superco	onductor			2					
	Atomic nuclei				2					
	Application of nuclear phys	sics			2					
	List oflaboratoryor design e	exercises				LEł	ours			
	Basics statistics of data an	alysis					4			
	Light interference	f alastron shares and stat					2			
	Photoelectric effect	n electron charge and mas	5			+	<u>∠</u> 2			
	Spectral line of casses						2			
	Solar cell characterisation						2			

	Hall effect						2		
	Semiconductor phot	Semiconductor photo detectors							
	Demonstrations of m	nagnetis	m	-			2		
	Demonstration of the	e pheno	menolog	/ of supercon	ductor		2		
	Dosimetry						2		
	Measurement of the	gamma	a-rays spe	ectrum			4		
	⊠ lectures								
	⊔seminars and wor	kshops			9				
Format of instruction	⊠ <u>exercises</u>				1				
	<i>□ on line</i> in entirety			\square work with r	nentor				
	□partial e-learning			□ (oth	er)				
	☐ field work			_ (011)					
Studentresponsibiliti es	The presence on lec	tures in	the amo	unt of at least	70 % of the times	scheo	duled.		
Screening student work (name the	Class attendance	1,0	Researc	h	Practical training	g			
proportion of ECTS credits for	Experimental work		Report		Individual work		2,6		
eachactivity so that the total number of	Essay		Seminal essay		(Other)				
ECTS credits is	Tests	0,2	Oral exa	ım	(Other)				
value of the course)	Written exam	0,2	Project		(Other)				
Grading and evaluating student work in class and at the final exam	There are two midterm exams, two final exams and one make-up exam. The first midterm exam is after 7 weeks of lectures and the second one is after the next weeks. Each midterm test lasts for 90 minutes and consists of the following questions: The requirement for passing grade at the midterm exams is to have at least 50% from each of 4 questions. Students that do not pass one of the midterm exams caretake it during the final exams. Final exams lasts 135 minutes each and consist ou of the following 6 questions: The requirement for passing grade at the final exam is to have at 50% from each of 6 questions. Final grade is determined using the relative grading system based on the arithmetic mean of the per cents of each of the additional questions. Students that have passed both midterm exams or final exams are grouped in four categories: 15% of the students with the highest arithmetic means are assigned grade A (excellent), 35% of the students with the next best arithmetic means are assigned grade B (very good), 35% of the students with the next to next best arithmetic means are assigned grade C (good), and 15% of the students with the lowest passing								
	make-up exam at the final exam.	e begini	ning of fa	I. This exam f	eatures the same	forma	it as the		
	Exam schedule is pr	eaetern	imea thro	ugn the acad	emic calendar.				
		Title	;		copies in	Availa othe	bility via r media		
		D			the library				
	Knapp, V.; Colić,	P.: Uvc	od u elekt						
Required literature (available in the	magnetskasvojst Zagreb, 1997	vamate	njala, Sko	oiskaknjiga,					
library and via other media)	 I. Supek, M. Furi Zagreb, 1994. 	ć: Počel	afizike, Š	kolskaknjiga,					
	A. Beiser: Conce edition, McGraw-	pts of M Hill 200	lodern Pł 3	nysics, sixth					

Optional literature (at the time of submission of study programme proposal)	 E.V. Wichmann: KvantnaFizika, udžbenikfizikeSveučilišta u Berkeley, svezak 4., Tehničkaknjiga, Zagreb, 1988. D. Halliday, R. Resnick, J. Walker: Fundamentals of Physics 10th edition, John Wiley & Sons, Inc., 2013. Vladimir Šips, Uvod u fizikučvrstogstanja, Školskaknjiga 2000.
Quality assurance methods that ensure the acquisition of exit competences	 Student evaluation surveys Teacher self-evaluation Institutionalandnon-institutionalevaluations
Other (as the proposer wishes to add)	

NAME OF THE COURSE	COMPUTER GRAPHICS									
Code	FELK04 Year of study 1.									
Course teacher	Vladan Papić, Ph.D., FullProfessor	Credits (ECTS)	5							
Associate teachers	Denis Štajduhar, mag. ing.	Type of instruction (number of hours)	L 30	S	AE	LE 30	DE			
Status of the course	Obligatory	Percentage of application of e-learning	0	0	U	50	0			
	COURSE	DESCRIPTION								
Course objectives	 Training students for: understanding of basic principles and algorithms of computer graphics, understanding of computer graphics technologies, design and applications of computer graphics algorithms in C programming language and utilization of graphical libraries in programming. 									
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: explain graphical pipeline, analyse basic algorithms of computer graphics, , connect sequence of graphical transformations in order to achieve needed transformation for view, recommend type of shading and animation in order to achieve desired result, critical argue on possibilities and limitations of various display and hardcopy technologies, model simpler objects with computer modelling software tools, , create simpler animations with software tools, create simpler computer programs for object presentation using graphical 									
Course content broken down in	Course content			ł	L nours	A ho	AE ours			
detail by weekly	Uvod									
class schedule (syllabus)	Imageelements, vectorand interactivegraphicsconcept		2							

	Basicalgorithmsofco	mputerg	graphics				2		
	Primitivesfillingandcl	ipping					2		
	Graphical hardware						4		
	Antialiasing						2		
	Geometrictransforma	ations					2		
	Objectsin 3D space						2		
	Curvesandsurfaces						3		
	Lightningandshading)					3		
	Animation						2		
	List of laboratory exe	ercises						LE hours	
	Introducton to OpenC	ntroducton to OpenGL							
	OpenGLexercise: An	imation						2	
	OpenGLexercise: Te	xtures						2	
	OpenGLexercise: Te	xturefilte	ers diptoract	<u></u>				2	
	OpenGLexercise: Lig								
	OpenGLexercise: 3D	DpenGLexercise: 3D						4	
	Blender: modelling							4	
	Blender: animation	lender: animation						4	
	☑ lectures	⊠ lectures							
	□ seminars and workshops □ multimedia				it assignments				
Format of instruction									
	□ on line in entirety □ work with me				pentor				
	□ partial e-learning				(othe	r)			
	☐ field work	field work							
Studentresponsibiliti es	The presence on lectures in the amount of at least 70 % of the times scheduled. Performed all required laboratory exercises.								
Screening student	Class attendance	1,5	Research		Practical train	ing			
proportion of ECTS	Experimental work		Report			Individual work		1,4	
eachactivity so that	Essay		seminal essay		0,8	Laboratory exercises		0,5	
ECTS credits is	Tests	0,2	Oral exa	ım		Preparation for laboratory exercises		0,5	
value of the course)	Written exam	0,1	Project			(Other)			
Grading and evaluating student work in class and at the final exam	 Indee are two midderns and infal exams. The first midterm exam is after 7 weeks of lecturing and the second one is after the next 6 weeks. In the final exams students are answering parts they did not pass in the midterms. The midterm and final exams are carried out as written testsanditlasts for max. 60 minutes. The requirement for passing grade is 50% points on eachmidtermexamorfinalexam, writtenandaccepted seminar workandpositive assessment of laboratory exercises. In finalgrading (inpercentage), eachmidtermexamcontributeswithmax. 30%, seminar workwithmax. 30%, lab. exerciseswithmax. 10% outof total possiblepoints (30%+30%+30%+10%). Final grade isformedinthefollowingway: Percentage Grade 50% to 61% sufficient (2) 62% to 74% good (3) 75% to 87% verygood (4) 								
Required literature (available in the		Title)			Number of copies in the library	Avail othe	ability via er media	

library and via other media)	 T Papić, V.: Introduction to computergraphics, Facultytextbook, 2013. (in Croatian) 		e-learning portal			
Optional literature (at the time of submission of study programme proposal)	 J.D.Foley, A.Dam, S.K.Feiner, J.F.Hughes, Comp PrinciplesandPractice (secondeditionin C), Addisc Company, 1996. D.Hearn, M.P.Baker, Computer Graphics, C Versi 1996. F.S.Hill, Jr. i S.M. Kelley, Computer GraphicsUsin Pearson education, 2007. Shreiner, D., Woo, M., Neider, J., Davis, T., Open Kompjuter biblioteka, 2007. 	outer Graphics on-WesleyPub ion, Prentice H gOpenGL, 3rc GL vodič za p	ishing Iall; 2nd edition, I edition, rogramere,			
Quality assurance methods that ensure the acquisition of exit competences	 Evaluation of results in accordance with the above learning outcomes Feedback from students via surveys Self-evaluation of teachers Institutional and non-institutional evaluations 					
Other (as the proposer wishes to add)						

NAME OF THE COURSE	TELEMEDICINE AND BIOCYBERNETICS								
Code	FELG32 Mojmil Cecić, Ph.D., Full	Year of study	1.						
Course teacher	Professor Josip Musić, Ph.D., Assistant Professor	Credits (ECTS)	5						
Associate teachers	Tea Marasović, Ph.D.,	Type of instruction	L	S	AE	LE	DE		
Associate teachers	Assistant Professor	(number of hours)	30	0	0	30	0		
Status of the course	Elective	Percentage of application of e-learning	0						
	COURSE	E DESCRIPTION	-						
Course objectives	 Training students for: understanding basic principles and techniques in the area of telemedicine and biocybernetics. 								
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: - explain computer and telecommunication basis for telemedicine. - evaluate properties of algorithms for image processing in telemedicine. - rate clinical application of telemedicine. - rate clinical application of telemedicine. - choose sources of medical information in light of distant learning paradigm. - evaluate systems for biomechanical human analysis. - analyze joint forces and moments in correlation with muscle activity. - experiment with measurement systems in biocybernetics based on EMG sensors, inertial sensors and optoelectronic sensors. - evaluate measurement results in light of possible future application and system limitations.								
	Lourse content L								

							hours	
	Introduction to telem	nedicine	. Historic	al deve	lopment	of telemedicine.	2	
	Computer and telec	ommun	ication ba	asis for t	telemed	icine.	2	
	Equipment and serv	vices in t	telemedic	ine.			2	
	Distant learning, sea	arching	through s	ources	of medi	cal information.	2	
	Image processing in	teleme	dicine.				2	
Course content	Ethics and telemedi	cine.					2	
broken down in	Clinical application.						2	
detail by weekly	Introduction to biocy	berneti	cs; overvi	ew of te	echnical	systems for		
class schedule (svllabus)	measurement of hui methods in biomech	measurement of numan biomechanical parameters; measurement methods in biomechanics.						
	Human anthropome terminology and me	Human anthropometric parameter identification; gait analysis: terminology and measurements.						
	Gait parameter mea	etics; Body position	2					
	Electromyography,	measuri	ng muscl	e activit	ty during	human movement.	2	
	Inverse kinematics f	or muso	cle force i	dentific	ation.		2	
	Machine vision in bi	ocybern	etics.				2	
	List of laboratory or o	ist of laboratory or design exercises						
	Introductory lecture c	ntroductory lecture on laboratory safety procedures. laboratory						
	measurement system	ns, and	measurei	ment pr	ocedure	s.	Z	
	Measuring human an	thropon	netric par	ameter	s using t	finite element	3	
	method. Measuring kinematia	noromo	toro duri		uning fo	at agmarag	1	
	Inveasuring kinematic parameters during gait using fast cameras.							
	Measuring EMG mus	cle sign	als durin	g gait.	uonig it		4	
	Calculation of muscle	forces	and mon	nents du	uring ga	it based on		
	measured kinematica with recorded EMG s	al param ignals.	neters and	d floor r	eaction	forces. Comparison	4	
	Measuring cervical s	Measuring cervical spine range of motion using inertial motion sensors.						
	Application of machir	ne visior	n in classi	fication	and aut	tomatic translation of	4	
	Croatian signed alpha	abet.	sing in tol	omodio	ine		2	
		proces	sing in ter	emedic	ine.		3	
		kehone		🗆 inde	ependen	t assignments		
		kshops		🛛 mul	timedia			
Format of instruction				🛛 labo	oratory			
				□ wor	k with m	entor		
	□ partial e-learning				(othe	er)		
	☐ field work				,	,		
Student responsibilities	The presence on lec Performed all require	tures in ed labor	the amore the amore the amore the amore the second se	unt of a rcises.	t least 7	0 % of the times sche	duled.	
Screening student	Class attendance	1	Researc	h		Practical training		
work (name the proportion of ECTS	Experimental work		Report			Individual work	2	
credits for each activity so that the	Essay		Seminar essay			Laboratory exercises	1,5	
ECTS credits is equal to the ECTS	Tests	0,1	Oral exa	ım		Preparation for laboratory exercises	0,3	
value of the course)	Written exam	0,1	Project			(Other)		
Grading and evaluating student work in class and at the final exam	During the semester weeks of lectures (in of lectures (in the a midterm test (as wel of 90 minutes. It cor the final exams stud	there a the area irea of t l as the nsists of lents tha	re two mi a of biocy telemedic final test both the at did no	dterm e bernetic ine in a) is carr oretical t pass t	exams. T cs) and t a form o ied out l questic he midt	The first midterm exan he second one is after of a project assignme in a written format wit ons and numerical pro erm exams take part	n is after 7 13 weeks ent). Each h duration oblems. In The final	

 So % points on average midterm exam ((M1 + M2)/2) or the final exam. Students are allowed to have at least 45% of total points on each midterm exams, as long as the final midterm average is at least 50% of total points. Grade (in percentage) is formed according to the formula: Grade(%) = 0,25L + 0,25M1 + 0,5M2 where: L – laboratory assessment, M1, M2 – midterm test results. Final grade (based on percantages) is formed as follows: Percentage Grade Grade Grade Grade Grade Solv do 62% sufficient (2) 63% do 74% good (3) 75% do 86% very good (4) 87% do 100% excellent (5) According to Article 65. of Faculty's Bylaw, student is required to participate in all teaching activities attending at least 70% of lectures, and 100% of laboratory exercises. In accordance with that student is required to solve and turn over for grading 100% of all laboratory exercises. If student does not meet these criteria, she or he won't be able to take part in the final exam, and will be required to enroll in the course the next year. 							
Title	Number of copies in the library	Availability via other media					
 I. Klapan, I. Čikeš:; Telemedicina u Hrvatskoj, Medika, Zagreb, 2001. 	3	teacher					
 R. J. Jagacinski, J. M. Flach: Control Theory for Humans: Quantitative Approaches to Modeling Performance, Lawrence Erlbaum Associates Inc., 2003 		teacher					
 T. Marasović, Guidelines for laboratory exercises, FESB 		e-learning portal					
M. Cecić, J. Musić: Authorized lecture notes, FESB		e-learning portal					
 Winter D.A.: The Biomechanics and Motor Control Waterloo Press, Waterloo, 1991. Zanchi V., Cecić M., Grujić T., Kuzmanić A., Papić Identification of Human Movement with LaBACS Soft 	of Human Ga V. : Laborator ware Support,	it, University of y for International					
 Congress on Computational Bioengineering, ICCB'03, 24-26 September 2003., Zaragoza, Spain, p.p. 155-161 3.I. Kaplan, I Čikeš (editors): "Telemedicine", Telemedicine Association, Zagreb, 2005. 4. V. Štambuk: "Kibernetika s informatikom", 1989. 							
 V. R. Milačić : "Tehnička kibernetika", 1981. N. Wiener: "Kibernetika ili upravljanje i komunikacija kod živih bića i mašina", 1972 							
 Keeping records of student attendance Annual analysis of course statistics in terms of n Feedback from students via surveys teacher self evaluation Feedback from graduated students (or senior st relevance) 	nidterm and fir udents) on cou	nals exams urse content					
	exam test consists of 8 theoretical questions a requirement for passing grade is the positive assessm 50 % points on average midterm exam ((M1 + M2)/2) allowed to have at least 45% of total points on each final midterm average is at least 50% of total points. Grade (in percentage) is formed according to the forr Grade(%) = 0,25L + 0,25M1 + 0,5M2 where: • L – laboratory assessment, • M1, M2 – midterm test results. Final grade (based on percantages) is formed as follower as follower and the formed according to Article 65. of Faculty's Bylaw, student teaching activities attending at least 70% of leath exercises. In accordance with that student is required are the next year. Title • I. Klapan, I. Čikeš:; Telemedicina u Hrvatskoj, Medika, Zagreb, 2001. • R. J. Jagacinski, J. M. Flach: Control Theory for Humans: Quantitative Approaches to Modeling Performance, Lawrence Erlbaum Associates Inc., 2003 • T. Marasović, Guidelines for laboratory exercises, FESB • M. Cecić, J. Musić: Authorized lecture notes, FESB • M. Cecić, J. Musić: Authorized lecture notes, FESB • M. Cecić, M. Grujić T., Kuzmanić A., Papić Identification of Human Movement with LaBACS Soft Congress on Computational Bioengineering, ICCB'03 Zaragoza, Spain, p.p. 155-161 3.1. Kaplan, I Čikeš (editors): "Telemedicine", Teleme 2005. 4. V. Štambuk: "Kibernetika sinformatikom", 1989. 5. V. R. Milačić : "Tehnička kibernetika", 1981. 6. N. Wiener: "Kibernetika sinformatikom", 1989. 5. V. R. Milačić : "Tehnička kibernetika", 1981. 6. N. Wiener: "Kibernetika ili upravljanje i komunikaci 1972. • Keeping records of student attendance • Annual analysis of course statistics in terms of relevance on the side of the singer sin	exam test consists of 8 theoretical questions and numerical requirement for passing grade is the positive assessment of laborator 50 % points on average midterm exam ((M1 + M2)/2) or the final exa allowed to have at least 45% of total points on each midterm average is at least 50% of total points. Grade (in percentage) is formed according to the formula: Grade(%) = 0.25L + 0.25M1 + 0.5M2 where:					

	-	Periodic institutional evolution of course teachers
Other (as the	/	
proposer wishes to		
add)		

NAME OF THE COURSE	ARTIFICIAL INTELLIGE	NCE							
Code	FELH11	Year of study	1						
Course teacher	Darko Stipaničev, Ph.D., Full Professor (60%) Ljiljana Šerić, Ph.D., Assistant Professor (40%)	Credits (ECTS)	5						
Associate teachers	Toni Jakovčević, Ph.D., Assistant Professor	Type of instruction (number of hours)	L	S	AE	LE	DE		
Status of the course	Elective	Percentage of	30 80	0	0	30	0		
	COURSE	DESCRIPTION	ļ						
			بر ام ما مر	م ابم بام م	field	of ortif	iaial		
Course objectives	intelligence, ways of collect by which this knowledge is introduction to the theoret many applications in scier	teach students basic kno cting and storing knowledg s used in solving complex ical foundations of artificia ince and economy.	viedge je, to rr tasks. i intelliç	e in the nethod In add gence	tion to and ill	of artif algorit an ustrate	the		
Course enrolment									
requirements and entry competences required for the course	Basic knowledge of computers and programming. To follow the College is necessary knowledge of English.								
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	 Students will be able to su Explain the difference computational intellige Present complex task Understand the difference systems based on known Explain the procedure different types of math standard logic). Apply the structural re- networks, frames, sce Describe and present intelligence, especially and directed search) Apply logical reasoning Apply simple machine Write simple programs intelligence (Prolog, L Describe the applicati systems. 	accessfully mastering the s s between biological intelli- ence and distributed intellig s and prepare them for au- ence between data, inform owledge. Is of knowledge elicitation nematical logic (proposition presentation of knowledge marios, stereotypes, and p standard methods of solvi y methods of searching the g, probabilistic reasoning, elearning tasks (unsupervi s in programming languag ISP, AIXML, Jess). on of artificial intelligence,	subject: gence, gence. tomatic ation a and kn hal logi e, partic roduct ng tasl e know fuzzy r sed an es and in part	artific c solvir nd kno owledg c, prec cularly ion rule (s of a ledge l reason d supe tools o icular t	al intension of the sema es. rtificia of artificia of art	Iligenco n. ge and ring us logic, r ntic undirec l). icial h expe	e, ing non- cted		

	Course content						L or S hours	LE hours
	Introduction to Artifi related disciplines. multiple intelligence intelligence. The tec	Introduction to Artificial Intelligence - the name, history, related disciplines. Biological intelligence, the theory of multiple intelligences. The research area of artificial intelligence. The techniques of artificial intelligence and success criteria						0
	Complex tasks and methods. Problem s (undirected and dire	4	0					
Course content broken down in detail	Knowledge and storage of knowledge – I part introduction, data, information, knowledge. Knowledge-based systems. Knowledge and storage of knowledge - II part mathematical logic (standard and non-standard logic)						4	0
schedule (syllabus)	Logical reasoning. I conditional probabil models). Fuzzy (fuz	Probabi ity, Bay zy) reas	listic reas s network soning.	ioning (j ks, hidd	probabil en Marl	ity, kov	6	0
	Knowledge and sto storage knowledge script, frames, prod	rage of (seman uction s	knowledo tic netwo ystems).	ge - Par rks, ste	rt III stru reotype	icture s, the	2	0
	Machine learning (u	Insuper	vised and	l superv	/ised)		4	0
	Examples of applica systems. Processin vision.	Examples of applications of artificial intelligence. Expert systems. Processing and understanding speech. Computer						8
	The programming la	0	15					
	The programming la	anguage	e Prolog a	and exp	ert syst	em shell	0	15
Format of instruction	 □ ⊠ seminars and ⊠ exercises □ entirety □ partial e-learning □ field work 	 ∠ lectures □ seminars and workshops ∠ seminars and workshops ∠ exercises □ on line in ∠ exercises □ on line in ∠ multimedia ∠ laboratory □ work with mentor □ field work 					nts	
Student responsibilities	The presence on le Performed all require	ctures ii red labo	n the amo ratory ex	ount of a ercises	at least	70 % of the	times sche	duled.
Screening student	Class attendance	1,5	Researc	h		Practical tra	aining	
work (name the proportion of ECTS	Experimental work		Report			Individual v	vork	
credits for each activity so that the	Essay		Seminai essay	•		Laboratory	exercises	1,5
credits is equal to the	Tests		Oral exa	ım		Preparation laboratory	n for exercises	
course)	Written exam	2	Project			(Oth	ner)	
Grading and evaluating student work in class and at the final exam	The exam consists the semester will be at 18 weeks. A stud- in June and July, s through colloquia ta taking the final exar The exam is compu- tasks with auditory student has a total 25% passing the the a student has less the from the theoretical	Written exam2Project(Other)The exam consists of a written part and if necessary additional oral exam. Durit the semester will be two tests. The first colloquium in 8 weeks of classes, the second target and July, students who have not collected inadequate number of point through colloquia take the whole subject covered by the two tests. The condition taking the final exam is successfully finished practical lab exercises.The exam is comprehensive and includes the theoretical part of the material a tasks with auditory exercises. The condition for positive assessment is that the student has a total of at least 50% on the exam or when it must have a minimu 25% passing the theoretical part of the points on the tasks and / or less than 25% point						n. During e second al exams of points idition for erial and that the minimum duties. If % points

	Students who did not pass the exam after two final autumn periods. All test questions students will be k	l exams can p nown before th	ass the exam in ne exam.				
	These rules apply equally to students who are enrol and to those students who enter college for the seco	led this course and time.	for the first time				
	The final grade is determined as follows: percentage Rating 50% to 61% is sufficient (2) 62% to 74% good (3) 75% to 87% of very good (4) 88% 100% Excellent (5)						
	The first colloquium will take the material to the teaching units to the seventh week nclusive, and on the other the rest of the teaching weeks. Examinations are held in terms of the anticipated calendar of classes.						
	Under Article 65 of the Statute of the Faculty, the st in all forms of teaching and attend: lectures at least not meet these requirements, the student will not be a signature.	udent is requii 70% of classes able to take t	red to participate s. If she or he do he exam and get				
		Number					
	Title	of copies in the	Availability via other media				
Required literature (available in the library and via other	Title D.Stipaničev, Lj. Seric, Lectures from artificial intelligence, lecturing notes and internal textbook	of copies in the	Availability via other media e-learning portal				
Required literature (available in the library and via other media)	Title D.Stipaničev, Lj. Seric, Lectures from artificial intelligence, lecturing notes and internal textbook	of copies in the	Availability via other media e-learning portal				
Required literature (available in the library and via other media)	Title D.Stipaničev, Lj. Seric, Lectures from artificial intelligence, lecturing notes and internal textbook	of copies in the	Availability via other media e-learning portal				
Required literature (available in the library and via other media)	Title D.Stipaničev, Lj. Seric, Lectures from artificial intelligence, lecturing notes and internal textbook	of copies in the	Availability via other media e-learning portal				
Required literature (available in the library and via other media) Optional literature (at the time of submission of study programme proposal)	Title D.Stipaničev, Lj. Seric, Lectures from artificial intelligence, lecturing notes and internal textbook - A.Cawsey, Inte Essence of Artificial Intelligence, P - S.Russel, P.Norvig, Artificial Intelligence: A Moderr Ed. 2002. - AI on the Web (http://http.cs.berkeley.edu/%7Eruse - American Association for Artificial Intelligence (<a %7eruss"="" href="http://www.www.www.www.www.www.www.www.www.w</td><td>of copies
in the
rentice Hall, 19
Approach, Pi
sell/ai.html)</td><td>Availability via
other media
e-learning
portal
998.
rentice Hall, 2nd</td></tr><tr><td>Required literature
(available in the
library and via other
media)
Optional literature (at
the time of
submission of study
programme proposal)
Quality assurance</td><td>Title D.Stipaničev, Lj. Seric, Lectures from artificial intelligence, lecturing notes and internal textbook - A.Cawsey, Ine Essence of Artificial Intelligence, P - S.Russel, P.Norvig, Artificial Intelligence: A Moderr Ed. 2002. - AI on the Web (<u>http://http.cs.berkeley.edu/%7Erust</u> - American Association for Artificial Intelligence (www.)</td><td>of copies
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rentice Hall, 19
Approach, Pr
sell/ai.html)
w.aaai.org)
above learning</td><td>Availability via
other media
e-learning
portal
998.
rentice Hall, 2nd</td></tr><tr><td>Required literature
(available in the
library and via other
media)
Optional literature (at
the time of
submission of study
programme proposal)
Quality assurance
methods that ensure
the acquisition of exit</td><td>Title D.Stipaničev, Lj. Seric, Lectures from artificial intelligence, lecturing notes and internal textbook - A.Cawsey, Ine Essence of Artificial Intelligence, P - S.Russel, P.Norvig, Artificial Intelligence: A Modern Ed. 2002. - Al on the Web (http://http.cs.berkeley.edu/%7Eruss - American Association for Artificial Intelligence (www. - Evaluation of results in accordance with the - Feedback from students via surveys	of copies in the rentice Hall, 19 Approach, Pr sell/ai.html) w.aaai.org.) above learning	Availability via other media e-learning portal 998. rentice Hall, 2nd				
Required literature (available in the library and via other media) Optional literature (at the time of submission of study programme proposal) Quality assurance methods that ensure the acquisition of exit competences	Title D.Stipaničev, Lj. Seric, Lectures from artificial intelligence, lecturing notes and internal textbook - A.Cawsey, Ine Essence of Artificial Intelligence, P - S.Russel, P.Norvig, Artificial Intelligence: A Moderr Ed. 2002. - AI on the Web (http://http.cs.berkeley.edu/%7Eruss - American Association for Artificial Intelligence (wwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwww	of copies in the	Availability via other media e-learning portal 998. rentice Hall, 2nd				

NAME OF THE COURSE	OPERATIONS RESEARCH								
Code	FELG14	Year of study	1.						
Course teacher	Jadranka Marasović, Ph.D., Full Professor	Credits (ECTS)	5						
Associate teachers	Martina Bašić, mag.img.	Type of instruction (number of hours)	L 30	S 0	AE 0	LE 30	DE 0		
Status of the course	Elective	Percentage of application of e-learning	0						
	COURSE	DESCRIPTION							
Course objectives	Training students for: To enable students using en- solutions for engineering pro- basic concepts of optimizat approaches can be achieved fastest and organized sear- acquire practical knowledge precision interface in order Examples from everyday life	raining students for: o enable students using examples to understand the importance of optimimal olutions for engineering practice and research. By gaining knowledge through asic concepts of optimization, the necessary theoretical knowledge about different approaches can be achieved, about mathematical and heuristic methods, about the astest and organized search for optimal solutions, too. To enable students to acquire practical knowledge, user-oriented, on the need for software solutions and precision interface in order to work independently to obtain optimal solutions.							
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: 1. iimplement models of different systems, quantitative (math) and qualitative (graphs, tables, text) models, 2. apply mathematical conversion to the original models and to understand the purpose of these conversions in the application of known methods of optimization, if the solutions and methods for the original model do not exist, 3. describe the difference between defined mathematical optimization methods and search methods and describe the impossibility of finding a universal method of solving, 4. pick and sort out the proper method of optimization based on model, 5. apply the results optimum analysis on the appropriate practices, 6. calculate the strategic optimum, 7. solve independently complex tasks of optimizing where it is necessary to 								
	Course content				L	A	λE		
Course content broken down in	Introduction: Systems appr modeling (in the analysis a acting and in the problems systems). The model is an Modeling is an iterative pro compromise between comp approximation.		2		0				
detail by weekly class schedule (syllabus)	Quantitative models and di characteristics: determinist continuous, discrete, linear input and output variables a of the model. Physical, eco building models. Qualitative	ffferences of the systems ic, stochastic, static, dynar and nonlinear. The select and their impact on the con nomic and other laws as a e models.	nic, ion of mplexit a basis	y for	2		0		
	The impact of constraints on the behavior of the system and how to add them to the original model - space of solutions. Objective function as an indicator of optimality. Optimal is not perfect - depends on objective function,on						0		
	constraints and on methods approach as the main featu	s of solving. Multidisciplina re of all tasks optimization	ry I.						

Operations research, history and way of thinking with the tasks of optimization. Mathematical conversions and mathematical operations - basic ideas used through the orientation in space of solutions and seeking optimum.	2	0
Linear static models. The standardization of models. Problems with unbounded spaces solutions (infinite limits).	2	0
Simplex algorithm - one of 10 the best algorithms of the 20th century. Examples of solving. The meaning of optimality criteria and feasibility criteria.	2	0
Qualitative models - poorly structured models. Heuristics. Search. Branching (Branch and Bound method).	2	0
Transport problem. Methods seeking basic possible solutions and methods of seeking improved solution to the optimum - the basics of search.	2	0
Transport problems with ambiguous warehouses (transshipment problem)	2	0
0-1 Programming. Backpack problem (loading / unloading). Travelling salesperson.	2	0
Game theory and optimal strategic decisions-making.	2	0
Nonlinear Programming: mathematical procedures that can	2	0
create problems to resolve and seek optimum. It is essential to create characteristic search, which can become complicated, but can unexpectedly diverge. Basic information are what, why and how to keep it under control.	-	Ū
Graph theory. Modeling events and activities. Optimization tasks modeled using graph theory (CPM method - Critical Path Method). Software solutions such tasks.	2	0
List of laboratory or design exercises		LE hours
Postoptimal analysis, the reasons for its implementation to the o results from the practice.	ptimal	2
Sensitivity analysis of optimal solutions depending on the change coefficients of the objective function. Examples.	e of the	2
Sensitivity analysis of optimal solutions depending on the change coefficient from the right side of constraints. Examples.	e of the	2
Preparing for use of already created software solutions with examined to a solution with examination of the solution of the so	mples of	2
Integer programming: the need and ways to search for such solu linear programming. Examples.	utions in	2
A simple example of solving linear programming tasks - solving already created software on a digital computer and "hand-made mathematical solutions".	using	2
Testing problems of parameters sensitivity, solving tasks using a created software on a digital computer and "hand-made mathem solutions".	already natical	2
Solving simple example of dual Simplex, using digital computer a graphics solutions.	and	2
The application of the dual simplex in practice with the example optimal cutting shape, minimization of material thrown. The use of linear programming tasks in automation systems.	of	2
Solving examples of optimal transport of goods between several Croatia - the basic transport problem.	towns in	2
Solving examples of optimal transport of goods between several Croatia - ambiguous warehouses.	cities in	2
Illustration "the power of models" in the example of problem-solv scheduling (students - classrooms). The problem layout, basical programming can be mathematically translated into a form of tra problems and dealt with using "its" program.	ring ly 0-1 nsport	2
Problem solving traveling salesman, optimal touring several citie	es in	2

Format of instruction	 ☑ lectures □ seminars and work □ exercises □ on line in antiants 	 Iectures Iseminars and workshops I exercises Ion line in entirety 			 independent assignments multimedia iaboratory 			
	□ on line in entirety			□work	with me	entor		
	□field work			🛛 ser	ninar es	say (other)		
Student	Minimum of 70 perce	ent lectu	ire attend	lance. (Complet	ing all the requi	ired labora	atory
responsibilities	exercises.							
work (name the	Class attendance	1.5	Researc	h		Practical traini	ng	
proportion of ECTS credits for each	Experimental work		Report			Individual work	(0.5
activity so that the	Essay		Seminai essay	•	1	Laboratory exe	ercises	1
ECTS credits is	Tests	0.5	Oral exa	ım		(Other)		
value of the course)	Written exam	0.5	Project			(Other)		
Grading and evaluating student work in class and at the final exam	During the semester will be held during cl. the end of classes. In 40% correct answers be at least 50% correct It is necessary during recognized (enrolled The final grade is de calculated as follows Percentage Gra 50% to 61% suffi 62% to 74% goo 75% to 87% very 88% to 100% exce The final exam enc students' did not encompasses the e minimum of 50 perces	there w ass (acc ndividua s, or tota ect. g the se) score termine s (Includ Grade [' de icient (2 d (3) / good (ellent (5 ompass pass a ntire core	<pre>/ill be two cording to al colloqu al points a mester to achieved d based o ing labor %] = 0.45) 4)) ses the e t either purse loa ect answe</pre>	mid-te b the ca ium will achieve b resolv by test on the t atory exists atory exist	rm exan lendar), be cons d that g e home is and e otal nun kercises - 0.45*M ourse lo d-term require e exams	ns (tests). The and the other of sidered passed ive a positive e work and semir xams. nber of points e points, M3) 12 + 0,1*M3 12 + 0,1*M3	first mid-te colloquiun if it achie valuation hars to be earned, wh earned, wh correction ing the e rding to th	erm n after ved must nich is nich is
Required literature		Title	•			copies in	Availabi other n	lity via nedia
library and via other media)	J.Marasović: "Introdu (in Croatian: Uvod u Authorized lectures,	uction in operaci FESB, 2	i Operatio jska istra 2000.	ons Res živanja	search"	the library	e-lean port	ning tal
Optional literature (at the time of submission of study programme proposal)	 T.B. Boffey: "Gra Kong, 1982. R. Bronson, G. N Operations Rese H.A. Taha: "Oper 	ph Theo laadimu arch, M rations F	ory in Ope thu: "Ope cGraw H Research	erations erations ill, 1998 : An Int	s Resea Resear roductio	rch", McMillan I ch", Schaum's n", Prentice Ha	Press, Ho Outline of III, 1997	ng f
Quality assurance methods that ensure the acquisition of exit competences	 Keeping records Annual analysis of Student survey of Teacher self-eval Feedback information 	on class of exam n teach luation ation fro	s attenda results ing perfor	nce mance ates reg	garding	course content	relevancy	,
Other (as the proposer wishes to add)								

NAME OF THE COURSE	DIGITAL CONTROL						
Code	FELG10	Year of study	1				
Course teacher	Darko Stipaničev, Ph.D., Full Professor	Credits (ECTS)	6				
Associate teachers	Josip Musić, Ph.D., Assitant Professor	Type of instruction (number of hours)	L 45	S 0	AE 30	LE 0	DE 0
Status of the course	Obligatory	Percentage of application of e-learning	80				
	COURSE	DESCRIPTION					
Course objectives	The acquisition of advance of digital control.	knowledge about the proc	cesses c	of ana	ilysis a	nd de	sign
Course enrolment requirements and entry competences required for the course	Completed course Linear c	ontrol systems.					
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	 Students will be able to suc Describe the historica Identify the difference Explain quantisation of Apply techniques for r holder, D / A converte To model discrete syste Modified-Z transform. Know how to identify i Describe the discrete Analyse discrete syste Accuracy and error ste Analyse discrete syste Accuracy and error ste Analyse discrete syste Iocus of discrete syste Apply various discrete continuous controller. (setup poles and zero response). The design State feedback design Establish and implement function of a discrete of Recognise potential p quantization noise). Understand hoe digita 	ccessfully mastering the su l development of digital ma between continuous and o of continuous signal by time estoring continuous signal r. tems using equations diffe Impulse transfer functions mpulse transfer function. by system state variables. em as follows: Stability. An eady state. em in the frequency domai em), and analyse discrete se control systems design p Design of discrete control s, the procedure based on n of discrete controllers in the principles. ent digital control through n controller. roblems of implementation al control could be applied.	abject: anageme discrete e, sampl from dis erence. 2 . The ec alysis of n, in cor system b rocedure lers base the defi the pseu realization	ent signa screte Z-tran quival f tran mplex by sta es: Sa ed on initior udo-fr on of al cor	als and A / D co e signa asforma ent sys sient re a areas a areas a areas a areas a contir o of the equen impuls htrol (so	syste onvert ils, 0-c ation. stem. (root ables. g of th uous e desir cy dor e tran caling	ms. er. order se. se. data red main. sfer
	Course content			L	or S nours	A ho	\E ours
	Introduction to digital contro and systems, sampling and	ol, continuous and discrete d recovery, A / D and D / A	e signals	;	6		0
Course content	Modeling of discrete syster transform, modified Z trans	ns - difference equations, form	Z		3		8
broken down in detail by weekly class schedule	Impulse transfer function an function. Parameter identifi transfer function	nd equivalent impulse tran cation of equivalent impuls	ster Se		6		2
(syllabus)	Description of discrete syst	ems by state variables			3		2
	Analysis of discrete control systems in the time domain - transients. Analysis of discrete control systems in complex domain. Analysis of discrete control systems in pseudo- frequency domain. Analysis of discrete control systems in state space domain.					6	
	Design of discrete controlle controllers. Discrete PID co	rs - discretization of contin ntroller	uous		3		2

	Discrete controller d	Discrete controller design by continous data (Dahlin and 6 2					
	Discrete controller d	esign in	state spa	ace domain		3	2
	Realization of impler	nentatio	on of digit	al control syster	ms.	3	2
Format of instruction	 ☑ Iectures ☐ independent as ☑ seminars and workshops ☑ exercises □ on line in entirety □ partial e-learning □ field work □ independent as ☑ multimedia ☑ work with ment □ (other) 				t assignmer entor er)	nts	
Student responsibilities	The presence on lect Performed all require	tures in ed labor	the amore the amore the the the the the the the the the th	unt of at least 70 rcises.	0 % of the ti	mes sch	eduled.
Screening student	Class attendance	2,5	Researc	h	Practical tra	aining	
proportion of ECTS	Experimental work		Report		Individual w	/ork	
credits for each activity so that the	Essay		Seminar essay	,	Laboratory	exercise	S
ECTS credits is	Tests		Oral exa	m	Preparation laboratory e	i for exercises	,
value of the course)	Written exam	3,5	Project		(Oth	er)	
Grading and evaluating student work in class and at the final exam	The exam consists of semester will be two 18 weeks. A studen June and July, stude colloquia take the w the final exam is suc The exam is compri- tasks with auditory student has a total of passing the theoreti student has less tha from the theoretical did not pass the exa All test questions stu These rules apply er and to those student The final grade is de percentage Rating 50% to 61% is suffic 62% to 74% good (3 75% to 87% of very 88% 100% Excellent The first colloquium inclusive, and on the terms of the anticipa Under Article 65 of th all forms of teaching meet these requirent signature.	f a writte tests. T t can pa nts who hole sul cessfull ehensiv exercis f at least cal part n 25% o part of t un after udents w qually to s who e termine ient (2) good (4 t (5) will take e other t ted cale he Statu and atto nents, th	en part ar The first c ass the co bject cove y finished e and ind es. The t 50% on of the noi he mater two final vill be known o students enter colled d as follo) e the mat he rest of he rest of endar of c tte of the end: lectu- he studer	ad if necessary a colloquium in 8 v purse by these collected inade ered by the two I practical lab ex- cludes the theo condition for per the exam or whe naterial and 25° ints on the tasks al again taken f exams can pas own before the e s who are enrol ge for the seco ws: erial to the teach the teaching w lasses. Faculty, the stud- int will not be at	additional or veeks of cla tests. In the equate numb o tests. The xercises. retical part ositive asse en it must ha % of the de s and / or le the entire et as the exam exam. led this cound nd time.	al exam. Isses, the two fina- ber of point condition of the messment ave a mini- posited ess than a xam. Stu- in autur rse for the o the sev- ninations ired to para a. If she con- he exam	During the e second at al exams in nts through n for taking aterial and is that the imum 25% duties. If a 25% points idents who nn periods. he first time venth week are held in articipate in r he do not and get a
		Title	•		Number of copies	s Avai	lability via er media
					in the		

Required literature (available in the library and via other media)	D.Stipaničev, J.Marasović, Digitalno vođenje on- line, on-line (Web) udžbenik, MZT – Informatički projekt, 2004. <u>http://laris.fesb.hr/digitalno_vodjenje</u>		e-learning portal	
Optional literature (at the time of submission of study programme proposal)	 Aström, K.J.; Wittenmark, B.Computer controlled Prentice-Hall Int. series, London, 1996. J.R.Vaccaro, Digital Control – A State Space App J.A.Borrie, Modern Control Systems – A Manual of Hall Int., 2000 D.Ibrahim, Microcontroller Based Applied Digital O 	systems - theo roach, McGra of Design Meth Control, J.Wille	ory and design, wHill, 1995. nods, Prentice ay & S.2006.	
Quality assurance methods that ensure the acquisition of exit competences	 Evaluation of results in accordance with the above learning outcomes Feedback from students via surveys Self-evaluation of teachers Institutional and non-institutional evaluations 			
Other (as the proposer wishes to add)				

NAME OF THE COURSE	OPTOELECTRONIC MEA	OPTOELECTRONIC MEASUREMENT METHODS							
Code	FELG33	Year of study	1	1					
Course teacher	Ivo Stančić, Ph.D., Assistant Professor	Credits (ECTS)	5						
Type of instruction		L	S	AE	LE	DE			
Associate teachers		(number of hours)	30			30			
Status of the course	Elective	Percentage of application of e-learning	0						
	COURSE	E DESCRIPTION							
Course objectives	e objectives Training students for: Understand the basic principles of camera and optical lens elements Operate with linear, IR / night and heat cameras Apply camera to control industrial process or use it as a sensor Operate and apply a data from larger and LIDAP								
Course enrolment requirements and entry competences required for the course									

Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able – Have detail kno – Apply algorithm – Apply algorithm – Analyze data fro	 tudents will be able to: Have detail knowledge of camera and camera optical elements Apply algorithms for 3D reconstruction of motion Apply algorithm for surface reconstruction Analyze data from laser range finders and create map of area 						
	Course content					L	AE	
	Introduction to optoe	lectroni	CS				2	nours
	Machinevisionaandcomputervision							
	Mathematicaldescriptionofcamerasandgeometryof a space							
	Lenseoptical system and distorsions							
	Color system and ph	otosens	itivechips	5			2	
	Inudstrialcameras. li	nearcan	neras. mo	otioncar	oturesvs	stems	2	
	IR camerasandappli	cations					2	
	Stereovisionsvstems	6					2	
	3D scanners	-					2	
Course content	Laser rangefindersa	nd LIDA	R				2	
broken down in	Nightvisioncamerasa	andimac	eintensif	iers			2	
detail by weekly	Future of optoelectro	nics					2	
(syllabus)	Introduction to optoe	electroni	cs				2	
(Synabas)								LE
	List oflaboratoryor de	esign ex	ercises					hours
	Introduction to Matlal	o: image	e loading,	captur	e and e	diting		2
	Introduction to Matlab: video loading, capture and editing							2
	Camera calibration and distortion removal							2
	Movement reconstruction from single camera in single plane						2	
	viovement reconstruction with stereovision system in space						2	
	Laser and in rangemoders							2
	idar and applications in robotics							2
	Cameras in visible and IR spectrum. Presentation of night optics							2
	IR thermal camera and temperature calculation						2	
	□lectures							
	□seminars and wor	kshops		⊠inde	penden	t assignmer	nts	
	□exercises	•		⊠mult	imedia			
Format of instruction	□ <i>on line</i> in entirety				ratory			
	□partial e-learning				(otho			
	□field work				(otne	() ()		
Studentresponsibiliti								
es								
Screening student work (name the	Class attendance	1	Researc	h		Practical tra	aining	
proportion of ECTS	Experimental work		Report			Impended	research	1,7
eachactivity so that	Essay		Seminai essay		1	Laboratory	exercises	1
ECTS credits is	Tests	0,2	Oral exa	am		(Oth	ier)	
equal to the ECIS value of the course)	Written exam	0,1	Project			(Othe	er)	

	During the semester there are two midterm exams ac	cording to tead	ching calendar or				
	The requirement for passing grade is the positive assessment of laboratory exercises and 50 % points on average midterm exam ((M1 + M2)/2) or the final exam. Students are allowed to have at least 45% of total points on each midterm exams, as long as the final midterm average is at least 50% of total points						
	Midterm consists of both theoretical questions and numerical problems. The midterms consist of 4 questions while final exam test consists of 6 questions divided into two groups.						
evaluating student	In determining the final grade (in percentages) each (or project assignment with 60%), while laboratory ex	midterm cont ercises contrib	ributes with 30% pute with 40%.				
the final exam	Final grade (based on percentages) is formed as follo	ows:					
	Percentage Grade 50% do 62% sufficient (2) 63% do 74% good (3) 75% do 86% very good (4) 87% do 100% excellent (5)						
	In case student does not complete midterms or project exams he/she needs the final exam in which case it contributes with 60% toward final grade, and lab exercises again with 40%.						
Required literature	Title	Number of copies in the library	Availability via other media				
Required literature (available in the library and via other media)	 Title Hartley, R., Zisserman, A.: 'Multipleviewgeometryincomputervision' (Cambridge University Press, 2003) 	Number of copies in the library	Availability via other media				
Required literature (available in the library and via other media)	 Title Hartley, R., Zisserman, A.: 'Multipleviewgeometryincomputervision' (Cambridge University Press, 2003) Shapiro, G., Stockman, G.C.: 'Computer vision' (Prentice-Hall, 2001) 	Number of copies in the library	Availability via other media				
Required literature (available in the library and via other media) Optional literature (at the time of submission of study programme proposal)	 Title Hartley, R., Zisserman, A.: 'Multipleviewgeometryincomputervision' (Cambridge University Press, 2003) Shapiro, G., Stockman, G.C.: 'Computer vision' (Prentice-Hall, 2001) 	Number of copies in the library	Availability via other media				
Required literature (available in the library and via other media) Optional literature (at the time of submission of study programme proposal) Quality assurance methods that ensure the acquisition of exit competences	 Title Hartley, R., Zisserman, A.: 'Multipleviewgeometryincomputervision' (Cambridge University Press, 2003) Shapiro, G., Stockman, G.C.: 'Computer vision' (Prentice-Hall, 2001) Keeping records of student attendance. Annual analysis of course statistics in terms of mi - Feedback from students via surveys. Teacher self-evaluation. Feedback from graduated students (or senior students) 	Number of copies in the library dterm and fina	Availability via other media				

NAME OF THE COURSE	OPTIMIZATION AND OPTIMAL SYSTEMS									
Code	FELG23		Year of st	tudy		2.				
Course teacher	Mirjana Bonković, Pl FullProfessor	η.D.,	Credits (E	ECTS)		5				
Associate teachers			Type of ir (number (nstruction of hours	on S)	L S AE I 30 0 0 5			LE 30	DE 0
Status of the course	Obligatory		Percenta applicatio	ge of n of e-l	earning	0				
	COURSE DESCRIPTION									
Course objectives	Training students for adoptionandunderstandingofthebasicknowledgeof:optimizationprocedures for solvingproblemsinthefieldsofengineering, such as robot control, productionplanningand / oranalysis (understanding) theimagecontent.									
Course enrolment requirements and entry competences required for the course										
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	 Students will be able to: Applyoptimizationmethods to engineeringproblems, includingdeveloping a model, defininganoptimization problem, applyingoptimizationmethods, exploringthesolutionandinterpretingresults. Understandandapplyunconstrainedoptimizationtheory for continuousproblems, includingthenecessaryandsufficientconditionsandsteepestdescent, Newton'smethod, conjugategradientandquasi-Newton methods. Understandandapplydiscretealgorithms, includingbranchandbound, exhaustivesearchandsimulatedannealing. Understandandapplythesimplexalgorithm for solvinglinearproblemswithconstraints. 					ems,				
	Course content	ilanty wi							L h AE ł	iours nours
	Introduction. Models	ofengin	eeringopt	imizatio	on.					2
	Mathematicalmodeli	ng. Obje	ectivefund	ction.						2
Course content	Performanceoffeedbackcontrol system.							4		
broken down in	Optimizationwithoutconstraints. Gradientmethod. Newton'smethod.					4				
detail by weekly	Discreteoptimization. Simulatedannealing. Geneticalgorithms.						4			
(syllabus)	Optimizationwithconstraints. Linearprogramming. Simplexalgorithm.						4			
(,)	Non-linearoptimizationwithconstraints.					_	4			
		JIIS.	onlineare	ntimiza	tionmat	hode for	r			۷
	Visualservoing. Analysisand processing ofmedicalimages .							2		
								6		
Format of instruction	⊠lectures ⊠independent assignments ⊡seminars and workshops ⊠independent assignments ⊡exercises ⊡laboratory ⊡on linein entirety ⊠work with mentor □partial e-learning □(other)									
Studentresponsibiliti es										
	Class attendance	2	Research			Practic	al trair	ing		

Screening student	Experimental work		Report		Individual work	<	1
proportion of ECTS	Essay		Seminar essay		Laboratory exe	ercises	0
eachactivity so that the total number of	Tests	0,3	Oral exam		Preparation fo laboratory exe	r rcises	0
ECTS credits is equal to the ECTS value of the course)	Written exam	0,3	Project	1,4	(Other)		
Grading and evaluating student work in class and at the final exam	Written exam0,3Project1,4(Other)During the semester, students receive smaller project tasks that have to be addressed. In addition, there are two midterm exams. The first midterm exam is after 7 weeks of lectures and the second one is after 13 weeks of lectures (in a form of presentation and defense of the project assignment). Each midterm test (as well as the final test) is carried out in a written format with duration of 90 minutes. The requirement for passing grade is the positive assessment of project tasks and 50 % points on average midterm exam ((M1 + M2)/2) or the final exam. Students are allowed to have at least 45% of total points on each midterm exams, as long as the final midterm average is at least 50% of total points. Grade (in percentage) is formed according to the formula:Grade(%) = 0,5M1 + 0,5M2 where: • M1, M2 – midterm test results. It is possible to be relieved of the midterm exams in case of making extensive smaller project tasks. According to Article 65. of Faculty's Bylaw, student is required to participate in all teaching activities attending at least 70% of lectures, and 100% of laboratory exercises. If student does not meet these criteria, she or he won't be able to take part						
	in the final exam, an	d will be	e required to enro	oll in the	course the nex	xt year.	ano pare
	in the final exam, an	<u>d will be</u> Title	e required to enro	oll in the	Course the next Number of copies in the library	xt year. Availabi other r	ility via nedia
Required literature	in the final exam, an D. Pierre, Optimizati John Willey&Sons, N	d will be Title onTheo New Yor	e required to enro ryWithApplicatio k, 1969.	oll in the	 Course the next Number of copies in the library 	xt year. Availabi other r e-learnin	ility via nedia
Required literature (available in the library and via other media)	in the final exam, an D. Pierre, Optimizati John Willey&Sons, N M. Bonković: Autoriz	d will be Title onTheo <u>New Yor</u> zirana pi	required to enro ryWithApplicatio k, 1969. redavanja, FESE	ns,	course the next Number of copies in the library	xt year. Availabi other r e-learnin e-learnin	ility via nedia
Required literature (available in the library and via other media)	in the final exam, an D. Pierre, Optimizati John Willey&Sons, N M. Bonković: Autoriz http://apmonitor.com hapters (10.03.2017	d will be Title onTheo New Yor zirana pi <u>n/me575</u> .)	e required to enro ryWithApplicatio k, 1969. redavanja, FESE /index.php/Main	ns, /BookC	course the next Number of copies in the library	xt year. Availabi other r e-learnin e-learnin	ility via nedia
Required literature (available in the library and via other media)	in the final exam, an D. Pierre, Optimizati John Willey&Sons, N M. Bonković: Autoriz http://apmonitor.com hapters (10.03.2017 V. Zanchi, Optimizad	d will be Title onTheo <u>New Yor</u> zirana pr <u>/me575</u> .) cija, Sve	e required to enro ryWithApplicatio rk, 1969. redavanja, FESE /index.php/Main eučilište u Splitu,	ns, <mark>3</mark> /BookC 1983.	e course the nex Number of copies in the library	xt year. Availabi other r e-learnin e-learnin e-learnin	ility via nedia Ig Ig
Required literature (available in the library and via other media) Optional literature (at the time of submission of study programme proposal)	 in the final exam, an D. Pierre, Optimizati John Willey&Sons, N M. Bonković: Autoriz http://apmonitor.com hapters (10.03.2017 V. Zanchi, Optimizad Kamran Iqubal: F bookboon.com (⁷ Numerical Recip Press, Brian P. F Convex Optimizad Stephen Boyd or 	d will be Title onTheo New Yor zirana pr i/me575 .) cija, Sve Fundame 19.03.20 es in C flannery ation, Ste n Conve	e required to enro ryWithApplicatio redavanja, FESE /index.php/Main eučilište u Splitu, ental Engineerin)17.) (or C++) : The A , Saul A. Teukol ephen Boyd & Li x Optimizations	ns, <mark>BookC</mark> 1983. g Optim rt of Sci sky, Wil ieven Va pdfs	e course the nex Number of copies in the library ization Methods entific Computi liam T. Vetterlin andenberghe, 2 video lecture	xt year. Availabi other r e-learnin e-learnin e-learnin s, s, ng, by Wi ng. 2004 s	ility via nedia Ig Ig Ig Iliam H.
Required literature (available in the library and via other media) Optional literature (at the time of submission of study programme proposal) Quality assurance methods that ensure the acquisition of exit competences	 in the final exam, an D. Pierre, Optimizati John Willey&Sons, N M. Bonković: Autoriz http://apmonitor.com hapters (10.03.2017 V. Zanchi, Optimizad Kamran Iqubal: F bookboon.com (7 Numerical Recipe Press, Brian P. F Convex Optimizati Stephen Boyd or Keeping records Annual analysis of Feedback from s Teacher self-eva Feedback from g relevance. Periodic institution 	d will be Title onTheo New Yor zirana pr zirana pr	e required to enro ryWithApplicatio (k, 1969. redavanja, FESE redavanja, FESE redavanja, FESE redavanja, FESE (index.php/Main eučilište u Splitu, ental Engineerin 017.) (or C++) : The A , Saul A. Teukol ephen Boyd & Li x Optimizations ent attendance. e statistics in ter via surveys. d students (or se lution of course f	oll in the ns, 7BookC 1983. g Optim rt of Sci sky, Wil ieven Va pdfs ms of m enior stu teachers	e course the nex Number of copies in the library ization Methods entific Computi liam T. Vetterlin andenberghe, 2 video lecture hidterm and fina udents) on cour s.	xt year. Availabi other r e-learnin e-learnin e-learnin s, ng, by Wi 2004 s als exams se conten	ility via nedia ig ig ig ig ig ig ig ig ig ig ig ig ig

NAME OF THE COURSE	MICROCONTROLLERS AND NETWORK EMBEDDED SYSTEMS						
Code	FELG24	Year of study	2.				
Course teacher	Mirjana Bonković, Ph.D., FullProfessor	Credits (ECTS)	5				
Associate teachers	Ivo Stančić, Ph.D., AssistantProfessor	Type of instruction (number of hours)	L 30	S 0	AE 0	LE 30	DE 0
Status of the course	Obligatory	Percentage of application of e-learning					
	COURSE	E DESCRIPTION					
Course objectives	 Training students: to develop an understate embedded systems to develop an understate to be familiar with concellate to be able to create eminetwork and the Internet. 	nding for the purpose and nding of basic microcontro ept of microcontroller inter bedded system that comm et	the des Iler arc faces nunicate	sign pr hitectu es via :	inciple ire a loca	es of th Ether	ne met
Course enrolment requirements and entry competences required for the course	Finished programming course						
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	 Students will be able to: define and understand the basic concepts related to the process of designing the embedded system. define and understand the interfacing techniques program the related microcontrollers' peripheral systems to establish the appropriate functionality of the embedded system design the embedded system in the Arduino environment that reflect the functionality based on the information processing acquired from the sensors. apply a procedure that provides network data transmission from sensor to the processing unit apply a procedure which ensures the functionality of the embedded system 						
	Course content					hc	L
	The purpose of a microcon	troller. Embedded system	desian	princi	ples.		2
	Embedded system design	in Arduino environment.		1			2
	Knowledge and understanding of fundamental embedded systems design paradigms, architectures, possibilities and challenges, both with respect to software and hardware.						2
Course content	Microprocessor peripheral devices. General purpose input output.						2
broken down in	Serial communication: SPI, USART, IIC.						4
detail by weekly	Real time clock. Timers.						
A / D and D / A converters. Realization of A / D converters.							2
(Syllabus)	Interrupts. Programming in	interrupts.					2
	Architecture and functional microprocessors' components for network communication.						
	Using IP for local and Internet communications. Exchanging messages using UDP and TCP, e-mail. Alarm system.						
	Osing the web interiace.	ded eveter regarding the	onorau				2
	consumption		energy				2
	Introduction to the Arduino	development environment	: hardw	are			iours
	componentsandprogrammi	ng mode.					2
	Digital input - output. Serial	Monitor.					2
	Analog input. PWM output.						2

	Speedcontrolof DC motors.							2
	Using GPS module.							2
	Using NRF modules.							2
	Sensors: OneWire temperature sensor, analogsensor (gyroscope), IIC sensor.						IC	2
	Ethernet shild. Exchangingmessagesusing UDP and TCP.							2
	Web server (withand	withoutf	eedback	, e-mai	l, alarm s	system.		2
	Optimization of the e	mbedde	ed system	regarc	ling the e	energy consum	ption	2
	Student projects.	Student projects.						6
Format of instruction	 ☑ lectures ☑ seminars and workshops ☑ exercises ☑ on line in entirety ☑ partial e-learning ☑ field work □ independent ☑ multimedia ☑ Multimedia ☑ aboratory ☑ work with multimedia ☑ (other 				t assignments entor)			
Studentresponsibiliti es								
Screening student	Class attendance	2	Researc	h		Practical trainir	ng	
proportion of ECTS	Experimental work		Report			Individual work	2	0,6
eachactivity so that	Essay		essay	-	1	Laboratory exe	ercises	0,8
ECTS credits is	Tests	0,2	Oral exa	al exam		Preparation for laboratory exercises		0,2
value of the course)	Written exam	0,2	Project			(Other)		
Grading and evaluating student work in class and at the final exam	 During the semester there are two midterm exams. The first midterm exam weeks of lectures and the second one is after 13 weeks of lectures (in a presentation and defense of the project assignment). Each midterm test (a the final test) is carried out in a written format with duration of 90 minur equirement for passing grade is the positive assessment of laboratory exercised % points on average midterm exam ((M1 + M2)/2) or the final exam. Studiallowed to have at least 45% of total points on each midterm exams, as lor final midterm average is at least 50% of total points. Grade (in percentage) is formed according to the formula: Grade(%) = 0,1L + 0,4M1 + 0,5M2 where: L – laboratory assessment, M1, M2 – midterm test results. According to Article 65. of Faculty's Bylaw, student is required to particip teaching activities attending at least 70% of lectures, and 100% of laterning activities attending at least 70% of lectures, and 100% of laterning activities attending at least 70% of hereing as the second of t					n exam i res (in a n test (as 20 minut ry exerc am. Stud s, as lon s, as lon s, as lon able to t able to t	s after 7 form of s well as es. The ises and ents are g as the g as the boratory ake part	
	Title				Number of copies in the library	Availab other	ility via media	
Required literature (available in the library and via other media)	Steven F. Barrett, An Processing for Every Digital Circuitsand S &ClaypoolPublishers	rduino M /one!, S lystems, s, 2010.	/licrocont synthesisl , Morgan	oller ₋ecture	s on			
	David Russeell, Intro	oduction	to Embe	dded S	ystems			
	Using ANSI C and the Arduino Development							
	Environment, SynthesisLectures on Digital							

	Circuitsand Systems, Morgan &ClaypoolPublishers,							
	2010.							
	Michael Predko, HandbookofMicrocontrollers,							
	TabBooks, 1998.							
	M. Bonković, J. Musić, I. Stančić, Mikroregulatori i e-learning							
	ugradbeni mrežni sustavi, FESB, 2014.							
	1. Claus Kuhnel, Klaus Zahnert, BASIC Stamp : An Introduction	to						
Optional literature	Microcontrollers, Newnes, 2000.							
(at the time of	2. Han-Way Huang, PIC Microcontroller, Thomson Delmar Learr	ning, 2004.						
submission of study	3. Jan Axelson: Embedded Ethernet and Internet complete, Lake	eview Research						
programme	LLC, 2003., ISBN: 1-931448-00-0							
proposal)	- Microcontroller links							
	http://people.westminstercollege.edu/faculty/rerickson/control/stamplinks.html							
	 Keeping records of student attendance. 							
Quality assurance	- Annual analysis of course statistics in terms of midterm and finals exams.							
methods that ensure	 Feedback from students via surveys. 							
the acquisition of	- Teacher self-evaluation.							
exit competences	- Feedback from graduated students (or senior students) on course content							
	relevance.							
Other (ee the	- Periodic Institutional evolution of course teachers.							
Other (as the								
add)								