

UNIVERSITY OF SPLIT

FACULTY OF ELECTRICAL ENGINEERING, MECHANICAL ENGINEERING AND NAVAL ARCHITECTURE

DETAILED PROPOSAL OF THE STUDY PROGRAMME

GRADUATE UNIVERSITY STUDY IN MECHANICAL ENGINEERING

SPLIT, February 2022

1.1. List of mandatory and elective courses

Module: Structures and Energy Technology - 261

		List of courses						
Year of study	y: 1.							
Semester: I								
OTATUS.	CODE	COLIDSE	НО	URS	IN SE	MEST	ER	ECTS
314103	CODE	COURSE	L	S	AE	LE	DE	ECIS
	FEML01	Mathematics – special topics	30	0	30	0	0	5
	FESL01	Fluid flow	30	0	15	15	0	5
	FESL10	Finite element method	30	0	15	0	15	5
Mandatory	FESL12	Heat and mass transfer	30	0	30	0	0	5
Mandatory	FETL18	Machine tools	45	0	0	15	0	5
	FESL23	Heating and air conditioning	30	0	30	0	0	5
	Total		195	0	120	30	15	30
* L = lectures, S = seminars, AE = auditoryexcercise, LE = laboratoryexcercise, DE = design excercise								

		List of courses						
Year of study	y: 1.							
Semester: I	Ι.							
OT ATU O	CODE	COURSE	НО	URS	N SE	MEST	ER	ECTS
51A105	CODE	COURSE	L	S	AE	LE	DE	ECIS
	FESL04	Fatigue strength of materials	30	0	0	30	0	5
Mandatory	FESL05	Optimization methods	45	0	0	15	0	5
	FETL25	Manufacturing process planning	45	0	0	0	15	5
Flective	FESL40	Innovations in technics	30	0	30	0	0	5
LICOLIVO	* L = lecture	s, S = seminars, AE = auditoryexcercise, LE = laborato	ryexce	rcise, D	DE = de	esign e	xcercis	е

		List of courses						
Year of study	/: 2.							
Semester: I	II.							
STATUS	CODE	COURSE	HO	URS	N SE	MEST	ER	ECTS
31A103	CODE	COURSE	L	S	AE	LE	DE	ECIS
	FESL17	Computer aided design 1	30	0	0	0	30	5
Mandatory	FESL24	Energy efficiency in buildings	30	0	30	0	0	5
Mandatory	FESL38	Aerotechnics and wind turbines	30	0	30	0	0	5
	* L = lecture	s, S = seminars, AE = auditoryexcercise, LE = laborato	ryexce	rcise, D	DE = de	esign e	xcercis	e

Module: Computer-Aided Design and Engineering - 262

		List of courses						
Year of study	y: 1.							
Semester: I	-							
STATUS	CODE	COLIDSE	HO	URS	IN SE	MEST	ER	ECTS
31A103	CODE	COURSE	L	S	AE	LE	DE	ECIS
	FEML01	Mathematics – special topics	30	0	30	0	0	5
	FESL01	Fluid flow	30	0	15	15	0	5
Mandatory	FESL10	Finite element method	30	0	15	0	15	5
	FETL05	Plant layout	30	0	0	15	15	5
	* L = lecture	s, S = seminars, AE = auditoryexcercise, LE = laborato	ryexce	rcise, D	DE = de	esign e	xcercis	е

		List of courses						
Year of study	y: 1.							
Semester: I	I.							
OTATUS.	CODE	COURSE	НО	URS	IN SE	MEST	ER	ECTS
31A103	CODE	COURSE	L	S	AE	LE	DE	ECIS
	FESM15	Computer aided design 2	30	0	0	0	30	5
	FESL05	Optimization methods	45	0	0	15	0	5
	FETL07	Computer aided manufacturing	30	0	0	0	30	5
	FESL04	Fatigue strength of materials	30	0	0	30	0	5
	FESN19	Computational fluid dynamics	30	0	0	30	0	5
	FESL42	Theory of plasticity and viscoelasticity	45	0	15	0	0	5
	* L = lecture	s, S = seminars, AE = auditoryexcercise, LE = laborato	ryexcei	rcise, D	DE = de	esign e	xcercis	e

		List of courses						
Year of study	y: 2.							
Semester: I	II.							
OTATUO	CODE	COURSE	HO	URS	IN SE	MEST	ER	ECTS
31A103	CODE	COURSE	L	S	AE	LE	DE	ECIS
	FETL06	Production planning and control	30	0	15	15	0	5
Mandatory	FESL49	Numerical synthesis in engineering	45	0	0	0	15	5
	FESL36	Introduction to information systemy	30	0	0	15	0	5
	FESL23	Heating and air conditioning	30	0	30	0	0	5
	* L = lecture	s, S = seminars, AE = auditoryexcercise, LE = laborato	ryexce	rcise, D	DE = de	esign e	xcercis	e

Module: Production Mechanical Engineering - 263

		List of courses						
Year of study	y: 1.							
Semester:								
	CODE	COURSE	HO	URS	IN SE	MEST	ER	ECTS
	CODE	COURSE	L	S	AE	LE	DE	ECIS
STATUS	FETL18	Machine tools	45	0	0	15	0	5
01/100	FETL04	Engineering maintenance	45	0	0	15	0	5
	FETL22	Nonconventional machining processes	45	0	0	15	0	5
	* L = lecture	s, S = seminars, AE = auditoryexcercise, LE = laborato	ryexce	rcise, D	DE = de	esign e	xcercis	е

		List of courses						
Year of study	y: 1.							
Semester:	II.							
STATUS	CODE	COLIDSE	НО	URS	IN SE	MEST	ER	ECTS
31A103	CODE	COURSE	L	S	AE	LE	DE	ECIS
	FETL25	Manufacturing process planning	45	0	0	0	15	5
Mandatory	FETL27	Material selection	30	0	30	0	0	5
	FESL05	Optimization methods	45	0	0	15	0	5
	FETL07	Computer aided manufacturing	30	0	0	0	30	5
	* L = lecture	s, S = seminars, AE = auditoryexcercise, LE = laborato	ryexce	rcise, D	DE = de	esign e	xcercis	e

		List of courses						
Year of study	y: 2.							
Semester: I	11.							
STATUS	CODE	COLIDSE	НО	URS	IN SE	MEST	ER	ECTS
31A103	CODE	COURSE	L	S	AE	LE	DE	ECIS
	FETL06	Production Planning And Control	30	0	15	15	0	5
Mandatory	FESL01	Fluid flow	30	0	15	15	0	5
	FESL10	Finite element method	30	0	15	0	15	5
	FETL17	Hydraulic and pneumatic systems	30	0	0	15	15	5
	FETL26	Design for assembly	30	0	0	0	30	5
	* L = lecture	s, S = seminars, AE = auditoryexcercise, LE = laborato	ryexcei	rcise, D	DE = de	esign e	xcercis	e

1.2. Course description

NAME OF THE COURSE	MATHEMATICS - SPECIA	AL TOPICS					
Code	FEML01	Year of study	1				
Course teacher	Ivan Slapničar, Ph.D., Full Professor	Credits (ECTS)	5				
	Lana Periša, Teaching		L	S	AE	LE	DE
Associate teachers	assistant Anita Carević, Teaching assistant	Type of instruction (number of hours)	30	0	30	0	
Status of the course	obligatory	Percentage of application of e-learning	15				
	COURSE	E DESCRIPTION					
Course objectives	Training students for: - understanding co integrals depending differential equation - applications of the technical sciences.	ncepts of selected advanc g on parameters, calculus ns e above concepts to mech	ed matl of varia anical e	hemat itions, engine	ical top and pa ering a	oics: artiial and otl	her
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: derive and apply methods explain the main idea of and state sufficient condition of surface area, define Sturm-Liouville precognize and solve simes derive heat equation, Linitial and boundary conditionation of the uniqueness of methods (using eigenfulties and solve simpler wave equation) solve simpler wave equation of the solve simpler wave equation of t	ods for solving integrals de of calculus of variations, de iditions for extrema, classical problems of the s problem and explain the st mpler problems, aplace equation and wave nditions, of the solution and solve th unctions or Fourier and La uations in the case of linea olterra and Fredholm integ reen function for the Sturm	epending erive the shortest ructure e equation e equation place tr ar and r ral equation -Liouivi	g on p e nece t time : of the ona, a tions v ansfor nonline ations, uille pr	arame ssary and sn solutio nd sta with ap mas), ear wa coblem	ters, condit nallest on, te pos propri ves, s.	ions sible ate
	Course content			L	or S	A	λE
	1. Integrals depending on	parameters.			2		2
	2. Calculus of variations, n for extrema.	ecessary and sufficient co	ndition	s	2		2
Course content broken down in	3. Examples of calculus of Euler's method of finite diff	variations, conditional ext ferences.	rema,		2		2
class schedule	4. Fourier and Laplace tran	nsform.			2		2
(syllabus)	5. Sturm-Liouville problem	•			2		2
	6. Diffusion equation.				2		2
	7. Heat equation.				2		2
	8. Laplace equation.				2		2
	9. Wave equation - linear v	waves.			2		2

	10. Wave equation -	– nonlin	ear waves.			2	2			
	11. Volterra and Fre	dholm ir	ntegral equations	S.		2	2			
	12. Green's function	1.				2	2			
	13. D'Alembert solut	tion of th	ne wave equatio	n.		2	2			
	List of laboratory or o	design e	exercises				LE or DE			
							nouro			
Format of instruction	x lectures seminars and wor x exercises on line in entirety partial e-learning field work	kshops	x indeµ □ mul □ labo □ wor □	bendent timedia bratory k with m (othe	assignment entor r)	S				
Student responsibilities	Regular attendence	to and a	ctive participatio	on in lect	ures and ex	cercises.				
Screening student	Class attendance	2	Research		Practical tra	aining				
proportion of ECTS	Experimental work		Report	Report Self study		у	2			
credits for each activity so that the	Essay		Seminar essay		(Oth	er)				
total number of ECTS credits is	Tests	0.5	Oral exam		(Oth	er)				
equal to the ECTS value of the course)	Written exam	0.5	Project		(Oth	er)				
Grading and evaluating student work in class and at the final exam	During semester two weeks of lectures, a term exam students through assignemen course is minimum 2 After semester, two f Students which did n during final exams. Students which did comprehensive cour is 80. The condition and a total of at leas: 85 and more points - 75-84 points - very g 60-74 points - good (50-59 points - sufficie	o mid-te nd the s can ge ts during 0 points inal exa not pass 1 not p se conte for pas t 50 poin excelle pood (4), (3), and ent (2).	rm exams are h second in the we t 40 points, whil g lectures and ex on each mid-tern ms and two corr one mid-term ex ass any mid-ter ent. In that case sing the course nts. The grade is ent (5),	eld. The eek follo le the re kcercises m exams rection e xam, car erm exa , masimi is minimi formed	first exam wing the lea maining 20 s. The conc s and a total xams are he n take only t um, take th um numbers num 40 poin as follows:	is schedu ctures. At points ar lition for p of at least eld. his part o he final e s of availa ts in the f	led after 7 each mid- e attained assing the 50 points. f the exam exam with able points inal exam			
	Students who did no at leat 10 points, ca number of points is 8 of 40 points in the ex	ot pass t an atten 0, and tl kam and	he course after a d corrections ex he minimum requ l a total of at leas	final exa xam. Or uirement st 50 poi	50-59 points - sufficient (2). Students who did not pass the course after final exams, and have obtained total of at leat 10 points, can attend corrections exam. On the correction exam maxima number of points is 80, and the minimum requirement for a passing grade is minimum of 40 points in the exam and a total of at least 50 points.					

	Mid-term exams, final exams and correction exams a schedule.	are held accor	ding to the exam
	Title	Number of copies in the library	Availability via other media
	I. Slapničar, Matematika 2, FESB, Split, 2002, chapters: Integrals depending on parameters and Calculus of variations.		http://www.fesb. unist.hr/mat2
(available in the	1.		
library and via other media)	J. D. Logan, Applied Mathematics, 3rd Edition, Wiley and Sons, New York, 2006.		
	Lecture materials on FESB e-learning portal.		httpd://elearning .fesb.unist.hr
Optional literature (at the time of submission of study programme proposal)	- P. duChateau, D. W. Zachmann, Partial Differential McGraw Hill, New York, 1986.	Equations, Scl	haum's Outline,
Quality assurance methods that ensure the acquisition of exit competences	 homework short tests quizzes mid-term exams final exam student questionnaires 		
Other (as the proposer wishes to add)			

NAME OF THE COURSE	FLUID FLOW							
Code	FESL01	Year of study			1			
Course teacher	Prof. Zoran Milas, PhD	Credits (ECTS)			5			
Associate teachers		Type of instruction (number of hours)	L	S	AE	LE	DE	
Status of the course	Compulsory	Percentage of	2		1	I		
		application of e-learning						
	Training students for:	DESCRIPTION						
Course objectives	understanding of stress-strain relationship in viscous fluids solving NS equation and apllying the solutions in various engineering problems . deepening knowledge on the boundary layers and on the effect of pressure gradient on boundary layer development. being familiar with the limitations of potential flow theory modelling the effect of tip vortices on lifting surfaces of finite span introduction into turbulence modelling							
Course enrolment requirements and entry competences required for the course	Mathematics 2, Fluid Mechanics 1,							
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	 Students will be able to: critically apply the available analytical solutions of Navier-Stokes equation for solving engineering problems associated with viscous fluid flow evaluate the pressure drop in porous media and the overflow rating of settling tanks. understand the effect of viscosity on load-carrying capacity of bearings analyze the distribution of fluid pressure and shear stress around the body in parallel stream and to understand the effect of flow separation make use of the superposition of elementary potential flows for modelling complex flows use experimental data on lift-drag of slender bodies and apply correction to the force coefficients for various aspect ratios 							
	Course content			L	or S	/ hc	AE ours	
	Stress in fluids, Navier equ in fluids	ation, rotation and deform	ation ra	te	2		1	
	Stokes constitutive relation	s, Navier-Stokes eq.			2		1	
broken down in	Hagen-Poiseuill flow in circ Carman eq. for porous me	ular pipe, concentric annu edia.	li, Koze	ny	2		1	
detail by weekly	Couette flow, hydrodynami	c lubrication.			2		1	
(svllabus)	Stokes (sphere) flow, settling	ng velocity.			2		1	
(-)	Boundary layer theory, frict Skan flow,	tion coefficient for flat plate	e, Falkr	er	2		1	
	Separation of boundary lay	ver, Karman boundar layer	r eq.		2		1	
	Solution techniques for Kar	rman integral boundary lag	yer eq.		2		1	
	Potential flow, stream function	Potential flow, stream function, elementary potential flows. 2 1						

	Kutta-Joukowsky the of profiles. Hydrody	eorem fo namic n	or isolateo nass.	d profile	and for	r cascade	2		1
	Tip vortices, vortex s coefficients.	sheet, et	ffect of fir	nite spar	n on lift-	drag	2		1
	Introduction to turbu	lence m	odelling.				2		1
	Prandtl mixing lengtl	n model	. Comple	x turbul	ence mo	odels.	2		1
	List of laboratory or	design e	exercises						E or DE hours
	Pressure drop in cap	illary tuł	ре						2
	Porous media flow, fl	orous media flow, fluidization							2
	ag house air filter and sand filter (field work)								2
	Viscous damper								2
	Airfoil drag								1.5
	Leading edge pressu	ire distri	bution						1,5
Format of instruction	 ➢ lectures ☐ seminars and workshops ☐ independent ☐ multimedia ☑ aboratory ☐ work with me ☐ independent ☐ wultimedia ☑ laboratory ☐ work with me ☐ (other 				t assignme lentor er)	nts			
Student responsibilities	Class room attendar completed.	Class room attendance min. 70 % . All required laboratory exercises and reports completed.							
Screening student	Class attendance	2,0	Researc	h		Practical training			
proportion of ECTS	Experimental work		Report			Individual work (prep. for test and exam)			2,3
activity so that the total number of	Essay		Semina essay	r		Laboratory exercise reports			0,4
ECTS credits is	Tests	0,2	Oral exa	am		(Other)			
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 midterm tests and final exams. The first midterm test takes place after 7 weeks of lecturing and the second one 6 weeks later. Each midterm test contains 2-3 numerical problems and 12 short questions (incl. multiple choice questions) and 4 essay questions Students who did not pass the midterm tests exams take part in the final exams. The midterm and final exams are carried out as written tests (closed book). The requirement for passing grade is the positive assessment of laboratory exercises/reports and 50 % points on each midterm test/ final exam and successful completion of final oral exam. Grade (in percentage) is formed according to the formula: Grade(%) = 0,1 LE + 0,4(M1 + M2) +0,1 FOE the activities in percentage: \cdot LV – laboratory assessment, \cdot M1, M2 – test results., FOE-final oral exam								
Required literature (available in the		Title)			Number copies i the libra	of Ava n ot ry	ilabi her r	ility via nedia
media)	- Milas Z, Fluid Flov Split, 2015	w -autho	orized lec	tures, F	ESB,	5			

- Virag Z., Mechanics of Fluids 2", FSB, Zagreb	5			
White, F. M.: Viscous Fluid Flow, McGraw Hill, N	ew York, 200	5		
- Evaluation of results in accordance with the above learning outcomes				
- Self-evaluation of teachers				
 Institutional and non-institutional evaluations 				
	 Virag Z., Mechanics of Fluids 2", FSB, Zagreb White, F. M.: Viscous Fluid Flow, McGraw Hill, Ne Evaluation of results in accordance with the above le Feedback from students via surveys Self-evaluation of teachers Institutional and non-institutional evaluations 	Virag Z., Mechanics of Fluids 2", FSB, Zagreb 5 White, F. M.: Viscous Fluid Flow, McGraw Hill, New York, 200 Evaluation of results in accordance with the above learning outcours Feedback from students via surveys Self-evaluation of teachers Institutional and non-institutional evaluations		

NAME OF THE COURSE	FINITE ELEMENT METHOD								
Code	FESL10	Year of study	1.						
Course teacher	Željan Lozina, Ph. D., Full Professor	Credits (ECTS)	5						
Associate teachers	Damir Sedlar, Ph. D., Assistant Professor	ar, Ph. D., rofessor Type of instruction		S	AE	LE	DE		
Associate teachers	Ivan Tomac, Ph. D., Assistant Professor	(number of hours)	30	0	15	0	15		
Status of the course	Obligatory	Dbligatory Percentage of application of e-learning 0							
COURSE DESCRIPTION									
Course objectives	 The aim of the course is to teach the students to be able to use Finite Element programs in a practical way to solve problems in linear elastic stress analysis. A student who has studied the course should be able, in a later industrial setting, to undertake the analysis of real problems with a fair understanding of sensible modelling procedures. The course is also aimed at providing the necessary theoretical and practical background for more advanced studies within the field of finite elements and structural machanics. 								
Course enrolment requirements and entry competences required for the course Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	None 1. Understand the ba a) Strong and we b) Virtual work and c) Basics of the a	sic theory behind the finit ak formulation nd variational formulation pproximate solution of PI	te elem DE	nent m	ethod				

	2. Use the finit	2. Use the finite element method for the solution of practical engineering							
	problems								
	3. Use a comm	ercial F	E-package						
	4. Analyze mo	re advar	nced topics with	nin the fie	eld of finite	elements	and		
	structural m	echanic	S.						
	Course content					L	KV+DE		
	Introduction to basic	nours	nours						
	extension of bar. Wa	ave equa	ation.	ional oqu		3	2		
	Direct approach: Bar	r, beam,	eam, truss,				2		
	Virtual work principle.				3	2			
	Interpolation and ap	proxima	tion of functions	s, shape f	unctions	3	2		
	Strong and weak for	3	2						
	Virtual work approac	3	2						
	Two dimensional pro	blems:	strong and wea	k formula	tion of	3	2		
Course content	content First midterm exam								
broken down in	Shape functions in ty	3	2						
detail by weekly	Virtual work principle	3	2						
(syllabus)	ass schedule CST element for two dimension elasticity.								
(oynabao)	Higher order elemer	3	2						
	Finite elements in dy	3	2						
	Finite elements in el	astic sta	bility.			3	2		
	Second midterm exa	m							
	List of laboratory exe	ercises					LE hours		
Format of instruction	 ☑ lectures □ seminars and work ☑ exercises 	rkshops	□ ind ⊠ mu □ lab	lependen Iltimedia	t assignme	nts			
	□ on line in entirety			rk with m	entor				
	☐ partial e-learning			(othe	r)				
Student		4. 1800 - 1	the empirication of the) 0/ -1 +	imagest	dulad		
responsibilities	Performed all require	ed labor	atory exercises.	at least 70	J % of the t	imes sche	eaulea.		
Screening student	Class attendance	2,0	Research		Practical tra	aining			
proportion of ECTS	Experimental work		Report		Individual v	vork	2,9		
activity so that the	Essay		Seminar essay		Laboratory	exercises	s 0		
ECTS credits is	Tests	0	Oral exam		Preparatior laboratory	n for exercises	0		
value of the course)	Written exam	0,1	Project		(Oth	ier)			
Grading and evaluating student	There are two midte lecturing and the se of 10 theoretical qu	rms and cond on estions	l final exams. Th e is after the ne and numerical	he first m ext 6 wee problem	idterm exar ks. Each m s and final	n is after nidterm te tests cor	7 weeks of st consists nsist of 20		

work in class and at the final exam	 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 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. Grading according Faculty and University rules. 					
	Title	Number of copies in the library	Availability via other media			
Required literature (available in the	Ž. Lozina: Autorizirana predavanja, FESB		e-learning portal			
media)	Ž. Lozina: Metoda konačnih elemenata, FESB, Split.	5				
Optional literature (at the time of submission of study programme proposal)	KJ. Bathe: Finite Element Procedures, Prentice Hall	Inc., 1996.				
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	HEAT AND MASS TRANSFER								
Code	FESL12	Year of study	1						
Course teacher	Frano Barbir, Ph. D., Full Professor	Credits (ECTS)	5						
Associate teachers	Dario Bezmalinović, Ph. D., Teaching assistant	Type of instruction (number of hours)	L 30	S 0	AE 30	LE 0	DE 0		
Status of the course	Obligatory	Percentage of application of e-learning	•		•	•			
	COURSE	E DESCRIPTION	•						
Course objectives	Training students for: - Recognizing mechanis - Analytical and numeric - Modeling and analyzin	ms of heat and mass trans al approaches for solving g heat and mass transfer p	sfer heat tra process	nsfer es	proble	ms			
Course enrolment requirements and entry competences required for the course	Thermodynamics 2								
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	 Students will be able to: Recognize and distinguish the basic mechanisms of heat transfer Apply analytical and numerical methods on different cases of heat and mass transfer Choose appropriate equations for calculating the heat transfer coefficient for different cases of heat transfer Break down and solve different cases of heat and mass transfer Analyze the heat transfer during evaporation processes Calculate basic characteristics of cooling towers 								
	Course content			L	_ or S	/ hc	AE ours		
	The course introduction. Categoria temperature field for solid to (CVM) in one-dimensional	urse introduction. Calculation of heat transfer and ature field for solid bodies. The control volume method in one-dimensional steady state heat conduction.					2		
Course content	Two-dimensional steady state heat conduction, control volumes and methods for solving a system of equations. Relaxation (iterative) method for solving a system of equations.						2		
broken down in detail by weekly class schedule (syllabus)	Examples and overview of the equations. One-dimensional transient conduction – the explicit variation of the CVM.						2		
	Criteria of stability of solution application for solving mult	ons. Examples of the CVN i-dimensional problems	1		2		2		
	Examples and overview of the equations. The implicit variation of the CVM. Examples and comparison with the explicit variation. Accuracy of the CVM.						2		
	Fundamentals of the conve for laminar flow.	ection. Mechanisms of hea	t transfe	er	2		2		

	Thickness of the velo Thickness of the tem	ocity bo peratur	undary la e bounda	yer for ary laye	a flat pla r for a fl	ate. at plate.	2	2
	First midterm exam	emolent					2	2
	Link between the bo laminar flow. Lamina integral and the Nus	undary ar flow ir selt nun	layer and n pipes. E nber for la	the Pra nergy b aminar	andtl nu balance, flow in p	mber for its pipes	2	2
	Mechanism of turbul Thickness of a turbu	ent flow lent bou	. The Re Indary la	ynolds a /er for a	analogy a flat pla	te.	2	2
	Thickness of a turbu transfer coefficient fo through a pipe.	Thickness of a turbulent boundary layer for a flat plate. Heat transfer coefficient for turbulent flow over a flat plate and through a pipe.						
	Heat phenomena during an evaporation process, energy balance, simultaneous heat and mass transfer in cooling towers							2
	Characterization of simultaneous heat and mass transfer in diagram. Link between cross flows and co-flows of heat and mass. The Sherwood diagram.						2	2
	Demanded characteristics and physical characteristics of a cooling tower. Thermodynamic limits in heat transfer						2	2
	Second midterm exam							2
	List of laboratory or design exercises							LE or DE hours
				[
Format of instruction	 ☑ lectures ☑ seminars and workshops ☑ exercises ☑ on line in entirety ☑ partial e-learning ☑ field work ☐ independent assignmen ☐ multimedia ☐ laboratory ☐ work with mentor ☐ (other) 				nts			
Student responsibilities	To attend at least 70)% of all	the lectu	ires and	exercis	ses		
Screening student	Class attendance	2	Researc	h		Practical tra	aining	
proportion of ECTS	Experimental work Report			Individual v	vork	2,5		
activity so that the	Essay		Seminal essay	•		(Oth	ner)	
ECTS credits is	Tests	0,5	Oral exa	am		(Oth	ner)	
equal to the ECTS value of the course)	Written exam		Project			(Oth	ner)	
Grading and evaluating student	During the semester the midterm exams	r there a (or are	are two n e not ha	nidterm ppy wi	exams. th their	The stude grades) ha	nts that do ave two f	o not pas inal exan

work in class and at the final exam	of the academic year on pre-decided dates. The first midterm exam takes place after the first 7 weeks of lecturing, while the second midterm exam takes place in after additional 6 weeks of lecturing. All the exams are carried out as written tests. The requirement for a passing grade is >49% points. On the first two final exams (at the end of the semester), the students are required to pass only the part which they failed to pass on the midterm exams. On the second two final exams (at the end of the academic year), the students are required to pass the whole exam, regardless of their success on the midterm exams. The final average percentage is calculated as follows: Points (%) = (M1+M2)/2; where M1 and M2 are percentage points of the first and second midterm test, respectively.						
	The final grade depends on the final percentage and is calculated as follows: 50% to 61% - fair (2), 62% to 74% - good (3), 75% to 87% - very good (4) and 88% to 100% - excellent (5) According to the Article 71 of the Faculty Statute, students are required to attend all						
	forms of lectures and exercises by at least 70%. Students who fail to comply with this regulation will not be allowed to take the exams.						
	Title	Number of copies in the library	Availability via other media				
Required literature (available in the	Title F. Barbir: Uvod u prijenos topline i tvari, interna skripta, FESB, 2014.	Number of copies in the library	Availability via other media e-learning portal				
Required literature (available in the library and via other media)	Title F. Barbir: Uvod u prijenos topline i tvari, interna skripta, FESB, 2014. N. Ninić, Elementi prijenosa topline, FESB 2002	Number of copies in the library	Availability via other media e-learning portal				
Required literature (available in the library and via other media)	Title F. Barbir: Uvod u prijenos topline i tvari, interna skripta, FESB, 2014. N. Ninić, Elementi prijenosa topline, FESB 2002	Number of copies in the library	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 F. Barbir: Uvod u prijenos topline i tvari, interna skripta, FESB, 2014. N. Ninić, Elementi prijenosa topline, FESB 2002 1. J.P. Holman, Heat Transfer, 8th ed., McGraw Hill, 2. E. Ganić, Prijenos toplote, mase i količine kretanja	Number of copies in the library New York, 19 a, Svijetlost, Sa	Availability via other media e-learning portal 997. arajevo 2005.				
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 F. Barbir: Uvod u prijenos topline i tvari, interna skripta, FESB, 2014. N. Ninić, Elementi prijenosa topline, FESB 2002 1. J.P. Holman, Heat Transfer, 8th ed., McGraw Hill, 2. E. Ganić, Prijenos toplote, mase i količine kretanja - Monitoring of students attendance during lectures and 4. Annual analysis of the average exam success - Feedback from students via surveys - Self-evaluation of teachers	Number of copies in the library	Availability via other media e-learning portal 97. arajevo 2005.				

NAME OF THE COURSE	MACHINE TOOLS								
Code	FETL18	Year of study	1						
Course teacher	Dražen Bajić, Ph. D., Full Professor Sonja Jozić, Ph. D., Assistant Professor								
Associate teachers	Mario Veić, Teaching assistant	Type of instruction (number of hours)	S 0	AE 0	LE 15	DE 0			
Status of the course	Obligatory Percentage of application of e-learning 0								
	COURSE DESCRIPTION								
Course objectives	 Training students for: understanding of basic machine tool parts, types of machine tools and their possible application. acquisition of knowledge about the modular construction of modern numerically controlled machine tools. 								
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)	 present the principles of operation and application of machine tools characterize features of machine tools categorize features of mechanisms and systems management machine tools examine the exploitation characteristics of machine tools identify motives of high speed and multi-operation machine tools development designing of driving systems and mechanism in machine tools according to machine tool construction 								
	Course content					A ho	λE		
	Introduction to machine too	ols. State of the art and ma	chine		10015	nc	Juis		
	tools development. Classifi	ication of machine tools.			3				
	Basics of construction mac accuracy.	ls	3						
	Main parts of machine tools spindle bearings.		3						
	Driving system of machine	tools.			3				
Course content	Machine tools control syste	ention and basis concents			3				
broken down in	Milling machines: Classifier	cation and basic concepts			3				
detail by weekly	First midterm exam				3				
class schedule (syllabus)	Machine tools for drilling, b Machines for gear wheels	roaching, sawing, grinding manufacturing.].		3				
	Technical calculations relations relations relations and its particular parts.	ted to the machine as the	whole ur	nit	3				
	Automatic tool change. Aut	tomatic workpiece change	•		3				
	Machine tools for high perf Machining center. Turning	ormance machining opera center. Grinding center.	tion.		3				
	High Speed machine tools tools	Parallel kinematics for ma	achine		3				
	Basic concept of CNC proc	gramming. CAD/CAM intro	duction		3				
	Second midterm exam								

	List of laboratory or	design e	exercises					LE or DE hours
	Movement, typical pa the laboratory. Deter efficency	arts and minatior	mechani n of degre	sms of ee of ma	machine achine to	e tools installed ool workspace	in	2
	Determination of gea	rbox eff	iciency o	n drilling	g machi	ne.		2
	Testing of geometric on the machining acc	accurac	cy lathes	and dril	ls. Influe	ence of machine	e tool	2
	Rigidity of the system	n machir	ne-tool-w	oorkpie	ce.			2
	Determination of gea	rbox eff	iciency o	n turnin	g machi	ne.		2
	Zero point of the wor machining center.	kpiece a	and zero		the tool	at vertical		2
	Automatic CNC prog 3D printer.	utomatic CNC programming. Preparation and model production using D printer.						2
	⊠ lectures	I lectures						
	□ seminars and workshops					it assignments		
Format of instruction	⊠ exercises			⊠ labo	oratory			
	□ <i>on line</i> in entirety	□ on line in entirety						
	partial e-learning				(othe	er)		
	☐ field work				(0	,		
Student responsibilities	The presence on lect Performed all require	tures in ed labor	the amo atory exe	unt of a ercises.	t least 7	0 % of the time	es scheo	duled.
Screening student	ning student Class attendance 2 Research			Practical training	ng			
proportion of ECTS credits for each	Experimental work	0.5	Report		Reports from the laboratory exercises		0.25	
activity so that the total number of	Essay		Seminar essay		(Other)		2.25	
ECTS credits is	Tests		Oral exam		(Other)			
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 that did not pass the the entire exam. Th tests. The requireme 1. Positive ass 2. 50 % points Grade (in percentag Grade(%) = 0,5 M1, M2 – test results Final grade is determ Percentage G 50% do 61% su 62% do 74% go 75% do 87% ve 88% do 100% ex	There are two midterms and final exams. The first midterm exam is after 7 weeks ecturing and the second one is after the next 6 weeks. In the final exams stude hat did not pass the midterm exams take part. In the makeup exam students ta he entire exam. The midterm, final and makeup exams are carried out as writt tests. The requirements for passing grade is: 1. Positive assessment of laboratory exercises 2. 50 % points on each midterm exam or the final exam. Grade (in percentage) is formed according to the formula: Grade(%) = 0,5 (M1 + M2) W1, M2 – test results of first and second midterm exam. =inal grade is determined according to: Percentage Grade 50% do 61% sufficient (2) 52% do 74% good (3) 75% do 87% very good (4) 88% do 100% excellent (5)						weeks of students ents take as written
Required literature		Title				Number of copies in	Availa	bility via
(available in the						the library	othe	r media
library and via other media)	Ekinović S., "Alatne Zenica, 2004.	mašine'	', Mašins	ki fakult	tet,			

	Lopez de Lacalle, Lamikiz "Machine tools for high					
	performance machining", Springer, 2008.					
	Bajić, D., Jozić, S., Predavanja objavljena na		eLearning			
	eLearning portalu, 2015.		portal			
Optional literature (at the time of submission of study programme proposal)	Cebalo, R., "Alatni strojevi – Odabrana poglavlja", Vla - Pahole, I., Balič, J., "Obdelovalni stroji", Univerza	astito izdanje, . a v Mariboru, N	Zagreb, 2001. Iaribor 2003.			
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	HEATING AND AIR CONDITIONING									
Code	FESL23	Year of study	1							
Course teacher	Nižetić Sandro, Ph. D., Associate Professor	Credits (ECTS)	5							
	Ivan Tolj, Ph. D., Teaching assistant Type of instruction		L	S	AE	LE	DE			
Associate teachers	Dario Bezmalinović, Ph. D., Teaching assistant	(number of hours)	30	0	30	0	0			
Status of the course	Elective. Percentage of application of e-learning									
	COURSE	E DESCRIPTION								
Course objectives	Training students for: - Categorization and - Compute and gene according to stand	l description of the HVAC eral design of the elements ards.	systen s inside	ns, e the H	VAC s	system	S			
Course enrolment requirements and entry competences required for the course	Thermodynamics 1, Mathe	matics 1, Mathematics 2.								
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - Consider base terms a - Analyse and compute I - Compare fuels in the H elaborate their impact	nd issues related to the th heat losses and gains acco IVAC systems, i.e. heating to the environment,	ermal o ording and c	comfor to the s ooling	t, standa applic	ards, ations	and			

	 Consider and compute base com systems, Consider and compute ventilation 	cooling, i.e.	HVAC	
	Course content		L or S hours	AE hours
	Introduction and basic terms (issues) comfort. External and internal design conditions.	related to the thermal temperatures. Climate	2 hours	2 hours
	Calculation of the heat losses.		2 hours	2 hours
	Calculation of the heat losses.		2 hours	2 hours
	Heating elements, characteristics, co thermal load.	ating elements, characteristics, correction of the nominal rmal load.		
	Central heating systems, calculation emissions.	2 hours	2 hours	
	Calculation and design of the pipelines in the heating systems.			2 hours
	Boilers, types, classification, boiler rooms.			2 hours
	Other equipment of the heating systems.			2 hours
Course content broken down in detail by weekly	Preparation of the hot water and calc demands.	2 hours	2 hours	
(syllabus)	Regulation of the heating systems.			2 hours
	Calculation of the heat gain.		2 hours	2 hours
	Fan coil devices, other cooling eleme	ents.	2 hours	2 hours
	Central water based air-conditioning s chambers, coolants (refrigerants)	systems, climate	2 hours	2 hours
	Ventilation systems, components, cal airflow for ventilation purpose.	culation of the required	2 hours	2 hours
	Heat pumps, absorption cooling device	ces.	2 hours	2 hours
	List of laboratory or design exercises			LE or DE hours
Format of instruction	⊠ lectures	⊠ independent assignm	nents	

Student responsibilities	□ seminars and workshops ⊠ multimedia □ exercises □ laboratory □ on line in entirety □ work with m □ partial e-learning □ (othe □ field work □ The presence on lectures in the amount of at least 7 Performed all required auditorium exercises. Class attendance 2					ientor er) 0 % of the times scheduled.			
Screening student work (name the	Class attendance	2	Researc	h	2	Practical traini	Practical training		
proportion of ECTS credits for each	Experimental work		Report		(Other)				
activity so that the total number of	Essay		essay		(Other)				
ECTS credits is equal to the ECTS value of the course)	Tests		Oral exa	ım		(Other)			
	Written exam		Project		1	(Other)			
Grading and evaluating student work in class and at the final exam									
	Title				Number of copies in the library		ility via nedia		
De auties diliterrature	S. Nižetić, Online predavanja Grijanje i Klimatizacija dio I i dio II, 2011, FESB.					1			
(available in the library and via other media)	Recknagel, Sprenge Grijanje i klimatizacij Zagreb, 2005 (Prijev	Recknagel, Sprenger, Schramek, Čeperković: Grijanje i klimatizacija 2005, Energetika marketing, Zagreb, 2005 (Prijevod sa njemačkog)							
	ASHRAE Handbook Systems and Equipr Atlanta, USA, 2001,	ASHRAE Handbooks: Fundamentals, Applications, Systems and Equipment, Refrigeration, ASHRAE, Atlanta, USA, 2001, 2002, 2003, 2004							
	Priručnik za Ventilac	iju l klin	natizaciju	, EGE,	2003.				
Optional literature (at the time of submission of study programme proposal)	Časopis: EGE, Ener Časopis: ASHRAE J	getika n ournal,	narketing ASHRAE	, Zagre , Atlant	b :a, USA		<u> </u>		
Quality assurance methods that ensure the acquisition of exit competences	 Evaluation of Feedback from Self-evaluation Institutional a 	results ir m studer n of teac nd non-ir	n accordar hts via surv hers hstitutional	ice with veys evaluat	the abov ions	ve learning outco	mes		
Other (as the proposer wishes to add)									

NAME OF THE COURSE	FATIGUE STRENGTH OF	MATERIALS							
Code	FESL04	Year of study	1						
Course teacher	Željko Domazet, Ph. D., Full Professor Lovre Krstulović-Opara, Ph. D., Full Professor	Credits (ECTS)	5						
Associate teachers	Petra Bagavac, Teaching assistant	Type of instruction (number of hours)	L 30	S 0	AE 0	LE 30	DE 0		
Status of the course	Obligatory (262) Mandatory (261, 263)	Percentage of application of e-learning	40%						
COURSE DESCRIPTION									
Course objectives	 Training students for: Proper and optimal dimensioning of structural and machinery components subjected to loadings during exploitation. Estimating real exploitation loading by means of strain gauge measurements and infrared thermography. Detection of cracks by means of ultrasound testing, penetrant testing and magnetic particles inspection. 								
Course enrolment requirements and entry competences required for the course	magnetic particles inspection. None								
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	 Students will be able to: Explain fatigue limit and Describe methods of e Describe methods of fr Describe strain gauge Describe ultrasound m Describe penetrant tes Describe magnetic par 	d stress concentration. stimating fatigue strength. acture's repair. method. ethod in detection of cracks. ting in detection of cracks.	κs.						
	Course content				_ or S	h	4E		
	Introduction to experimenta	al mechanics in fatique eva	aluation		2		Juis		
	Methods of fatigue evaluation	ion.			2				
	Materials response under i	n-service loading conditior	าร.		2				
	Types and characteristics of structures).	of structural loads (actions	on		2				
Course content	Influences on life time pred components.	lictions of materials and			2				
broken down in	Concepts and methods of f	tatigue strength.			2				
detail by weekly	Fracture mechanics.				2				
Class schedule	Stress concentration.	at we at we a			2				
(39112003)	Design of components and	structures.			2				
	Coues. Ronair and retrofit of fatigu	o domogos			2	_			
	Fatique strength of weldme	e uamayes.			2	+			
	Experimental mechanics in	fatique evaluation and ca	se		2				
	studies.				2				
	List of laboratory or design	exercises				LE	hours		
	Introduction to experimenta	I testing equipment of Stru	ictural I	aborat	tory.	_	1		
	Strain gauge testing – theor	ry and application of strain	gauge	s.			10		

	Penetrant testing.						2
	Magnetic particles in	spectior).				2
	Basics of infrared the	ermogra	phy				6
	Thermoelasticity, pul	sed the	mography and F	Risitano	method.		4
	Ultrasound testing.						3
	☑ lectures		□ ind	enender	nt assignments		
	\boxtimes seminars and wo	rkshops	⊡ mu	ltimodia	it assignments		
Format of instruction	exercises						
Format of Instruction	□ on line in entirety						
	□ partial e-learning			K WILL II			
	☐ field work			(oth	er)		
Student							
responsibilities							
Screening student	Class attendance 2 Research			Practical traini	ng		
proportion of ECTS credits for each activity so that the total number of	Experimental work	1	Report		Individual work	K	1
	Essay		Seminar essay	1	(Other)		
ECTS credits is	Tests		Oral exam		(Other)		
value of the course)	Written exam		Project		(Other)		
Grading and	Evaluation of gained knowledge in form of two colloquiums. Maximal score is 100 points, while minimum is passing of exam is with 50 points. Exam: individual, theoretical. Mode of exam: written form.						
evaluating student work in class and at the final exam	Maximal score is 10 Exam: individual, the Mode of exam: writte	0 points eoretical en form.	, while minimum	is pass	ing of exam is v	with 50 pc	pints.
evaluating student work in class and at the final exam	Maximal score is 10 Exam: individual, the Mode of exam: writte	0 points eoretical en form.	, while minimum	is pass	ing of exam is v	with 50 pc	pints.
evaluating student work in class and at the final exam	Maximal score is 10 Exam: individual, the Mode of exam: writte	0 points eoretical en form. Title	, while minimum	is pass	Number of	vith 50 pc Availab	oints. ility via
evaluating student work in class and at the final exam	Maximal score is 10 Exam: individual, the Mode of exam: writte	0 points eoretical en form. Title	, while minimum	is pass	Number of copies in the library	with 50 pc Availabi other r	bints. ility via nedia
evaluating student work in class and at the final exam	Maximal score is 10 Exam: individual, the Mode of exam: writte	0 points eoretical en form. Title	, while minimum	is pass	Number of copies in the library	Availabi	bints. ility via nedia
evaluating student work in class and at the final exam Required literature (available in the	Maximal score is 10 Exam: individual, the Mode of exam: writte Grubišić, V., Domaze	0 points eoretical en form. Title et, Ž.: Fa	tigue strength c	is pass	Number of copies in the library	Availabi other r E-lear	bints. ility via media rning
evaluating student work in class and at the final exam Required literature (available in the library and via other	Maximal score is 10 Exam: individual, the Mode of exam: writte Grubišić, V., Domaze materials (in Croatia	0 points eoretical en form. Title et, Ž.: Fa an)	tigue strength c	is pass	Number of copies in the library	vith 50 pc Availabi other r E-lear	bints. ility via nedia rning
evaluating student work in class and at the final exam Required literature (available in the library and via other media)	Maximal score is 10 Exam: individual, the Mode of exam: writte Grubišić, V., Domaze materials (in Croatia Additional course materials	0 points eoretical en form. Title et, Ž.: Fa an) aterials	tigue strength c	of	Number of copies in the library	vith 50 pc Availabi other r E-lear E-lear	bints. ility via nedia rning
evaluating student work in class and at the final exam Required literature (available in the library and via other media)	Maximal score is 10 Exam: individual, the Mode of exam: writte Grubišić, V., Domaze materials (in Croatia Additional course ma	0 points eoretical en form. Title et, Ž.: Fa an) aterials	tigue strength c	of	Number of copies in the library	Availabi other r E-lear E-lear	bints. ility via media rning rning
evaluating student work in class and at the final exam Required literature (available in the library and via other media)	Maximal score is 10 Exam: individual, the Mode of exam: writte Grubišić, V., Domaze materials (in Croatia Additional course ma	0 points eoretical en form. Title et, Ž.: Fa an) aterials	tigue strength c	of	Number of copies in the library	vith 50 pc Availabi other r E-lear E-lear	bints. ility via media rning rning
evaluating student work in class and at the final exam Required literature (available in the library and via other media)	Maximal score is 10 Exam: individual, the Mode of exam: writte Grubišić, V., Domaze materials (in Croatia Additional course ma	0 points eoretical en form. Title et, Ž.: Fa an) aterials	tigue strength c	of	Number of copies in the library	Availabi other r E-lear E-lear	bints. ility via media rning rning
evaluating student work in class and at the final exam Required literature (available in the library and via other media)	Maximal score is 10 Exam: individual, the Mode of exam: writte Grubišić, V., Domaze materials (in Croatia Additional course ma - K. Hoffmanr	0 points eoretical en form. Title et, Ž.: Fa an) aterials	tigue strength c	of	Number of copies in the library	Availabi other r E-lear E-lear	bints.
evaluating student work in class and at the final exam Required literature (available in the library and via other media) Optional literature (at the time of	Maximal score is 10 Exam: individual, the Mode of exam: writte Grubišić, V., Domaze materials (in Croatia Additional course ma - K. Hoffmanr Hottinger Ba	0 points eoretical en form. Title et, Ž.: Fa an) aterials	tigue strength c	of asureme	Number of copies in the library ents Using Strainstadt	Availabi other r E-lear E-lear	bints. ility via media rning rning S,
evaluating student work in class and at the final exam Required literature (available in the library and via other media) Optional literature (at the time of submission of study	Maximal score is 10 Exam: individual, the Mode of exam: writte Grubišić, V., Domaze materials (in Croatia Additional course ma - K. Hoffmann Hottinger Ba - M. Andrassy	0 points eoretical en form. Title et, Ž.: Fa an) aterials n: An Int aldwin M y, I. Bork	tigue strength c	of asureme oH, Darr	Number of copies in the library ents Using Strai nstadt ermografije s pri	Availabi other r E-lear E-lear n Gauges mjenom,	bints. ility via media rning rning S, Kigen,
evaluating student work in class and at the final exam Required literature (available in the library and via other media) Optional literature (at the time of submission of study programme	Maximal score is 10 Exam: individual, the Mode of exam: writte Grubišić, V., Domaze materials (in Croatia Additional course ma - K. Hoffmanr Hottinger Ba - M. Andrassy Zagreb, 200	Title er, Ž.: Fa an) aterials n: An Int aldwin M y, I. Bork 8.	tigue strength c	of asureme oH, Darr	Number of copies in the library ents Using Strai nstadt ermografije s pri	Availabi other r E-lear E-lear n Gauges mjenom,	ility via media rning rning S, Kigen,
evaluating student work in class and at the final exam Required literature (available in the library and via other media) Optional literature (at the time of submission of study programme proposal)	Maximal score is 10 Exam: individual, the Mode of exam: writte Grubišić, V., Domaze materials (in Croatia Additional course ma - K. Hoffmanr Hottinger Ba - M. Andrassy Zagreb, 200	n: An Int aldwin M y, I. Bork 8.	tigue strength c	of asureme oH, Darr	Number of copies in the library	Availabi other r E-lear n Gauges mjenom,	bints. ility via nedia rning rning S, Kigen,
evaluating student work in class and at the final exam Required literature (available in the library and via other media) Optional literature (at the time of submission of study programme proposal) Quality assurance	Maximal score is 10 Exam: individual, the Mode of exam: writte Grubišić, V., Domaze materials (in Croatia Additional course materials - K. Hoffmann Hottinger Ba - M. Andrassy Zagreb, 200	Title et, Ž.: Fa an) aterials n: An Int aldwin M y, I. Bork 18.	tigue strength c	of asureme oH, Darr snove te	Number of copies in the library ents Using Strai nstadt ermografije s pri	Availabi other r E-lear E-lear n Gauges mjenom,	bints. ility via media rning rning S, Kigen,
evaluating student work in class and at the final exam 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	Maximal score is 10 Exam: individual, the Mode of exam: writte Grubišić, V., Domaze materials (in Croatia Additional course ma - K. Hoffmann Hottinger Ba - M. Andrassy Zagreb, 200 - Student evaluation - Registering stude	n: An Int aldwin N y, I. Bork ns nt's atter	while minimum while minimum tigue strength c roduction to Mea lesstechnik Gmb bas, S. Švaić: Os	of asureme oH, Darr	Number of copies in the library ents Using Strai nstadt ermografije s pri	Availabi other r E-lear n Gauges mjenom,	bints. ility via media rning rning S, Kigen,
evaluating student work in class and at the final exam 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	Maximal score is 10 Exam: individual, the Mode of exam: writte Grubišić, V., Domaze materials (in Croatia Additional course ma - K. Hoffmanr Hottinger Ba - M. Andrassy Zagreb, 200 - Student evaluation - Registering stude	Title en form. Title et, Ž.: Fa an) aterials n: An Int aldwin M y, I. Bork 8. ns nt's atter	tigue strength c	of asureme oH, Darr	Number of copies in the library ents Using Strai nstadt ermografije s pri	vith 50 pc Availabi other r E-lear n Gauges mjenom,	bints. ility via media rning rning S, Kigen,
evaluating student work in class and at the final exam 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 Other (as the	Maximal score is 10 Exam: individual, the Mode of exam: writte Grubišić, V., Domaze materials (in Croatia Additional course ma - K. Hoffmanr Hottinger Ba - M. Andrassy Zagreb, 200 - Student evaluation - Registering stude	n: An Int aldwin N y, I. Bork 8. nt's atter	while minimum while minimum tigue strength c roduction to Mea lesstechnik Gmb bas, S. Švaić: Os	of asureme oH, Darr	Number of copies in the library	vith 50 pc Availabi other r E-lear n Gauges mjenom,	bints. ility via media rning rning S, Kigen,
evaluating student work in class and at the final exam 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 Other (as the proposer wishes to	Maximal score is 10 Exam: individual, the Mode of exam: writte Grubišić, V., Domaze materials (in Croatia Additional course ma - K. Hoffmann Hottinger Ba - M. Andrassy Zagreb, 200 - Student evaluation - Registering stude	Title an form. Title et, Ž.: Fa an) aterials n: An Int aldwin M y, I. Bork 18. ns nt's atter	v while minimum while minimum tigue strength c roduction to Mea lesstechnik Gmb bas, S. Švaić: Os	of asureme oH, Darr snove te	Number of copies in the library	Availabi other r E-lear n Gauges mjenom,	bints. ility via media rning rning S, Kigen,
evaluating student work in class and at the final exam 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 Other (as the	Maximal score is 10 Exam: individual, the Mode of exam: writte Grubišić, V., Domaze materials (in Croatia Additional course ma - K. Hoffmanr Hottinger Ba - M. Andrassy Zagreb, 200 - Student evaluation - Registering stude	n: An Int aldwin W y, I. Bork N: atter	tigue strength c	of asureme oH, Darr snove te	Number of copies in the library ents Using Strai nstadt ermografije s pri	vith 50 pc Availabi other r E-lear n Gauges mjenom,	bints. ility via media rning rning S, Kigen,
evaluating student work in class and at the final exam 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 Other (as the proposer wishes to	Maximal score is 10 Exam: individual, the Mode of exam: writte Grubišić, V., Domaze materials (in Croatia Additional course ma - K. Hoffmanr Hottinger Ba - M. Andrassy Zagreb, 200 - Student evaluation - Registering stude	n: An Int aldwin W y, I. Bork 8. nt's atter	tigue strength c	of asureme oH, Darr snove te	Number of copies in the library	vith 50 pc Availabi other r E-lear n Gauges mjenom,	bints. ility via media rning rning S, Kigen,

NAME OF THE COURSE	OPTIMIZATION METHODS								
Code	FESL05	Year of study	1						
Course teacher	Damir Vučina, Ph. D., Full Professor	Credits (ECTS)	5						
Associate teachers	Igor Pehnec, Ph. D., Teaching assistant, Ivo Marinić- Kragić, Teaching assistant	Type of instruction (number of hours)	L 45	S 0	AE 0	LE 15	DE 0		
Status of the course	Obligatory	Percentage of application of e-learning	0						
Course objectives	Acquiring theoretical know-now in basic numerical methods and algorithms in engineering optimization. Developing competences in applying computers in engineering numerical optimization. Acquire competences in applying numerical tools in engineering problems.								
Course enrolment requirements and entry competences required for the course	Completed pre-graduate studies which include courses equivalent to computer- aided analysis. Competences in basic engineering analysis methods and program development in C and MATLAB								
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	 After completing the course formulate the engir making model the set of de for engineering pro- make flowcharts fo apply gradient opti apply non-gradient engineering proble solve nonlinear opti apply evolutionary SA, NN) to engineering ree, max. flow, develop and test option 	e the students will be able neering problem as an eng ecision variables, constrair oblems or different optimization me mization methods (HJ, NM coptimization methods (SE ms timization problems with co optimization methods and ering problems methods to network proble wn optimization models ar	to: Jineerin Its and Ithods I) to en D, CG, I D, CG, I Donstrair metah ems: m	g prob excell gineer N, BFC nts euristic in. pat	lem of ence f ing pro SS) to cs (GA h, min <u>MATI</u>	decis unctio blems ; ACC span <u>AB</u>	ion ns S), ning		
	Course content			L	L	A	λE		
	Introduction, basic theore examples of application.	etical concepts. Basic ter	rms and	r k	3	nu	iurs		
Course content	Basic concepts, theoretical	aspects, optimization mo	dels		3				
broken down in detail by weekly	Linear programming, sta	ndard model			3				
ciass schedule (syllabus)	Linear programming, sin	nplex method			3				
	Nonlinear programming, simplex method Nonlinear programming, 1D methods: Interval halving, Fibonacci, Golden section, Interpolation methods, reduction of nD problems to 1D								

Nonlinear programming, n-dimensional methods for unconstrained problems: direct methods (Random search, Hookee-Jeeves, Powell, Nelder-Mead, other)	3	
Nonlinear programming, n-dimensional methods for unconstrained problems: gradient methods (Steepest descent, Conjugate directions method, Newton and Quasi- Newton methods)	3	
First midterm exam		
 Nonlinear programming, constrained n-dimensional method: transformation methods (external and intternal penalty methods, other) 	3	
- Nonlinear programming, constrained n-dimensional method: basic concepts in direct methods: (feasible directions, generalized reduced gradients, SLP, SQP,)	3	
Basic concepts in evolutionary methods and special chapters: simulated annealing, genetic algorithms, etc.	3	
Basic concepts in evolutionary methods and special chapters: neural networks as approximators	3	
Basic concepts and procedures: optimization with discrete variables, branch and bound, GAs. Network problems shortest path, min. spanning tree, max. flow	3	
Examples of setting-up physical and mathematical models for optimization for different engineering problems. Development of algorithms. Development of progams in C and MATLAB.	3	
Second midterm exam		
List of laboratory exercises		LE hours
Basic terms and examples of application.		1
Upumization models		1
Linear programming, Standard model, examples		1
Nonlinear programming, Simplex methods, examples		1
Nonlinear programming, unconstrained n-dimensional met	hods,	1
Nonlinear programming, unconstrained n-dimensional met	hods,	1
Nonlinear programming, (NLP) constrained n-dimensional methods, examples		1
methods, examples Examples of application of neural networks		1
Examples in evolutionary methods, genetic algorithms		1
Examples in evolutionary methods, genetic algorithms		1
Examples of application in engineering and modeling		1

Format of instruction	 ☑ lectures □ seminars and workshops □ exercises □ on line in entirety □ partial e-learning □ field work □ independen □ multimedia ☑ laboratory □ work with m □ (other 				nt assignments nentor er)				
Student responsibilities	The presence on lec Performed all require	he presence on lectures in the amount of at least 70 % of the times scheduled. Performed all required laboratory exercises.							
Screening student	Class attendance	3	Researc	h		Practical traini			
proportion of ECTS	Experimental work		Report			Individual work	K	2	
credits for each activity so that the	Essay		Seminai essay	-		Laboratory exe	ercises		
ECTS credits is equal to the ECTS	Tests		Oral exa	am		Preparation fo laboratory exe	r rcises		
value of the course)	Written exam		Project			(Other)			
Grading and evaluating student work in class and at the final exam	Inere are two midte lecturing and the set of respective theoret overall theoretical quithat did not pass the carried out as writt assessment of labor final exam. Grade (in the activities in perce • M1, M2 – ter	here are two midterms and final exams. The first midterm exam is after 7 weeks of ecturing and the second one is after the next 6 weeks. Each midterm test consists f respective theoretical questions and numerical problems. The final tests consist of verall theoretical questions and numerical problems. In the final exams, students nat did not pass the midterm exams take part. The midterm and final exams are arried out as written tests. The requirement for passing grade is the positive issessment of laboratory exercises and 50 % points on each midterm exam or the nal exam. Grade (in percentage) is formed according to the formula: Grade(%) = 0,5 (M1 + M2) ne activities in percentage: • M1, M2 – test results.							
	Title								
		Title	•			Number of copies in the library	Availabi other r	ility via nedia	
Required literature (available in the	- D. Vučina, 'Metode	Title inženje lište u S	rske num	neričke SB 200:	5	Number of copies in the library	Availabi other r	ility via nedia	
Required literature (available in the library and via other media)	- D. Vučina, 'Metode optimizacije', Sveuči - J. S. Arora, "Introdu	Title inženje lište u S uction to	rske num plitu, FE	neričke SB 2009 n Desig	5 jn",	Number of copies in the library	Availabi other r	ility via nedia	
Required literature (available in the library and via other media)	- D. Vučina, 'Metode optimizacije', Sveuči - J. S. Arora, "Introdu McGraw Hill, 1989 I.Pehnec, Materijali z	Title inženje lište u S uction to za labor	rske num plitu, FE Optimur atorijske	neričke SB 2009 n Desig vježbe	5 In",	Number of copies in the library	Availabi other r	ility via nedia	
Required literature (available in the library and via other media) Optional literature (at the time of submission of study programme proposal)	 D. Vučina, 'Metode optimizacije', Sveuči J. S. Arora, "Introdu McGraw Hill, 1989 I.Pehnec, Materijali z G. Vanderplaats, Resea A. D. Belegundu, T Engineering", Prentic S.S. Rao, "Engineer D.E. Goldberg, "Ge Addison Wesley, 199 S. Haykin, "Neural 	Title inženje lište u S uction to za labor Numeric arch and C. R. Cha ce Hall, ering Op enetic al 89 Network	rske num plitu, FE: Optimur atorijske al Optimi Develop andrupatl 1999 timizatior gorithms cs", Prent	neričke SB 2009 n Desig vježbe zation ⁻ ment, 1 a, "Opti n", Wile in searc	5 jn", Techniq 999 mization y Interso ch, optir	Number of copies in the library ues for Enginee n Concepts and cience, 1996 nization and ma tional, 1999	Availabi other r ering Desi d Applicati achine lea	ility via nedia ign", - ions in arning",	
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	 D. Vučina, 'Metode optimizacije', Sveuči J. S. Arora, "Introdu McGraw Hill, 1989 I.Pehnec, Materijali z G. Vanderplaats, "I Vanderplaats Resea A. D. Belegundu, T Engineering", Prentie S.S. Rao, "Enginee D.E. Goldberg, "Ge Addison Wesley, 198 S. Haykin, "Neural Evaluation of res Feedback from s Self-evaluation and 	Title inženje lište u S uction to za labor za labor Numeric irch and . R. Cha ce Hall, ering Op enetic al 89 <u>Network</u> sults in a students of teache non-ins	rske num plitu, FES Optimur atorijske al Optimi Develop andrupatl 1999 timizatior gorithms <u>ks", Prent</u> accordance via surve ers titutional	neričke SB 2009 n Desig vježbe zation ⁻ ment, 1 a, "Opti n", Wile in sear in sear tice Hal ce with eys evaluat	5 jn", Techniq 999 mizatior y Interso ch, optir <u>I Interna</u> the abo ions	Number of copies in the library ues for Enginee n Concepts and cience, 1996 mization and ma ational, 1999 ve learning out	Availabi other r ering Desi achine lea	ility via nedia ign", - ions in arning",	

NAME OF THE COURSE	MANUFACTURING PROCESS PLANNING										
Code	FETL25	Year of study	1.								
Course teacher	Nikola Gjeldum, Ph. D., Assistant Professor	Credits (ECTS)	5								
	Marina Crnjac, Teaching	Type of instruction	L	S	AE	LE	DE				
Associate teachers	assistant	(number of hours)	45	0	0	0	15				
Status of the course	Obligatory	Percentage of application of e-learning	0	-							
	COURSE	E DESCRIPTION									
	Training students to:										
Course objectives	 select raw material and design optimal manufac know how to measure, process identify losses at work 	select raw material and machine tools for specific production batch design optimal manufacturing process know how to measure, sort and analyze process times in manufacturing process identify losses at work									
Course enrolment requirements and entry competences required for the course	None	_identify losses at work one									
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	 analyze product design select optimal size and determine type of product determine elements of product suggest contemporary rest objectivity and accurate the set objectivity and accurate the set objectivity and accurate the set object of the set of the set object of the set of the set	 Students will be able to: analyze product design for manufacturing process design purposes select optimal size and shape of raw material determine type of production in relation to batch size determine elements of process times for batch production suggest contemporary manufacturing process and its ability test objectivity and accuracy of time measurement personnel detect cyclical, periodical and random production steps 									
	Course content					Lh	ours				
	Definition of production sys	stem, production and man	ufactur	ing pro	cess.		2				
	The basic elements of material f	low design in the production of the production of the processes. Dro	on proc cess o	cess.	sed						
	and group process steps, p	process step.		ompor			1				
	Definition of technology an	d technique. Cutting techn	ologie	S.			3				
	Characteristics and levels	of technologies and manul	acturir	ıg			2				
	The basic principles of mai	nufacturing process design	۱.				3				
Course content	The selection of raw mater	ial.					2				
broken down in	Optimal sequence of manu	facturing processes and p	rocess	steps			3				
detail by weekly	Factors influencing on erro	rs in manufacturing proces	sses.	•			2				
class schedule	Selection of manufacturing	baselines.					2				
(syllabus)	First midterm exam						2				
	Group technology.						2				
	Basics of Work and Time S	Study in production enterpr	ise.				2				
	The scale of business succ	cess in the enterprise.					1				
	Time standard. Componen	ts of working time.					2				
	Methods for determining th	e production (working) tim	e.				6				
	Performance rating.						1				
	The work of a worker on m	ultiple machines.					2				
	Types and analysis of loss	es during the work.					1				
	Implementation of better w	ork method.					2				

	Second midterm exa	m						2
	List of design exercis	ses						DE hours
	Design example of m	anulaci	uring pro	cess.	o row r	natorial coloctic	5	3
	tools selection and c	alculatio	n of proc	proces	5, iaw i o	naterial selectic	л,	3
	Autonomous student	s work o	on manuf	acturing	docum	entation for		7
	individual project tasl	٢S		Ğ	,			1
	⊠ lectures			🛛 inde	pender	t assignments		
	□ seminars and wor	rkshops		⊠ mul	timedia	t ussignments		
Format of instruction	⊠ exercises ⊠ laboratory							
I office of instruction	\Box on line in entirety				k with n	entor		
	\Box partial e-learning	□ partial e-learning						
	☐ field work				(0111			
Student	The presence on lec	tures in	the amo	unt of a	t least 7	0 % of the time	s sche	eduled.
responsibilities	The presence exerci	ses in t	he amoui	nt of at l	east 80	% of the times	sched	luled.
Corponing student	Individual project tas	sks com	pleted.					
work (name the	Class attendance	1	Researc	h		Practical traini	ng	
proportion of ECTS	Experimental work		Report			Individual work	(2,7
activity so that the total number of	Essay		Seminal essay			(Other)		
ECTS credits is	Tests	0,2	Oral exa	am		(Other)		
value of the course)	Written exam	0,1	Project		1	(Other)		
Orading and	Positive assessmen minimal 50% points pass at least one of students take the wh conducted in writter questions and nume	t repres on final the mid- ole exa form. rical pro	sents mil exam. Ir term exar m regard Midterm oblems.	nimal 5 n the firs ns take less res exams	0% poi st two fi part. In ults of r and fin	nts on each m nal exams stuc the third and fo nidterm exams. al exams cons	hidterm lents ti burth fi Final list of	n exam or hat did not nal exams exams are theoretical
evaluating student			Grade (%) = 0,4	4D + 0,0	DE		
work in class and at the final exam	 D – Individual project grade (%) E – average points achieved on midterm exams expressed as a percentage or number of points achieved on the final exam expressed as a percentage. 							entage or
	E = (M1 + M2)/2 M1, M2 – average points achieved on midterm exams expressed as a percentage.							
	Grade (%): Fina 50% - 60% suffi 61% - 75% good 76% - 90% very 91% - 100% exce	l mark: cient (2) d (3) good (4 ellent (5)) 4)					
Required literature		Title)			Number of copies in the library	Avail othe	ability via er media
(available in the	Gjeldum, N.: "Tehno	loška pi	riprema p	roizvod	nje",		lr	nternet
media)	lectures on e-learnin	g, FESI	3 Split				(e-l	earning)
	Gačnik, V., Vodenik, procesa", Tehnička I	F.: "Pro knjiga, Z	ojektiranje Zagreb, 1	e tehnol 990.	oških	10		

	Taboršak, D., "Studij rada", Orgadata, Zagreb,	2	
	1994.		
	Car, M., Krznar, M., Šimon, K., "Studij rada – zbirka	1	
	zadataka i rješenja", Liber, Zagreb, 1983.		
Optional literature (at the time of submission of study programme proposal)	 Toboršak, D., Gornik, B., Čala, I., "Priprema pro Zagreb, 1974. Buchmeister, B., Polajnar, A.: "Priprava proizvoo Fakulteta za strojništvo, Maribor, 2000. Polajnar, A., "Študij dela", Univerza v Mariboru, Maribor, 1999 WEB catalogues 	izvodnje", Inže Inje za delo v Fakulteta za s	enjerski biro, praksi", trojništvo,
Quality assurance methods that ensure the acquisition of exit competences	 keeping records of the attendance of students annual evaluation of teachers periodical evaluation of individual project advance feedback from students via surveys self-evaluation of teachers institutional and non-institutional evaluations 	ment	
Other (as the proposer wishes to add)			

NAME OF THE COURSE	TECHNICAL INNOVATIONS									
Code	FESL40	Year of study	1.	1.						
Course teacher	Branko Klarin, Ph. D., Full Professor	Credits (ECTS)	5							
Associate teachers	Goran Gašparović,	Type of instruction	L	S	AE	LE	DE			
	Teaching assistant	(number of hours)	30	0	30	0	0			
Status of the course	Elective	Percentage of application of e-learning	0	_						
	COURSE	DESCRIPTION	-							
Course objectives	Training students for: - acquire knowledge and u - application and analysis of technical applications, - evaluation procedures an - implement and lead the ir	nderstanding of the innova of procedures for the creat d intellectual property prot nnovation process from ide	ation pr ive wor ection, ea to pa	ocesse k of in atent.	es, terest	for				
Course enrolment requirements and entry competences required for the course	English language		·							
Learning outcomes expected at the level of the course (4 to	Students will be able to: - recognize the importance human society, - evaluate and self-evaluat	of innovation mainly tech	nical, ir	n the d	evelop	oment	of			

10 learning outcomes)	 recognize the importance of innovation in different technical fields, appoint institutions and intellectual property organisations, link and select the parameters important for innovation, identify steps to innovate and design of project tasks, connect various sources of ideas and design ideas, to design their own innovation. 								
	- recognize steps and design patent applications, create own patent applications create own p								
	Introduction. Etymology and basic definitions. The history and							hours	
	role of invention and	2	2						
	Great explorers and most significant inve	invento ntions a	rs. Exam Ind innov	ples of ations.	the inve	ntion. The	2	2	
	Innovative potential assessment.	innovato	ors. Basic	s for e	aluatio	n and self-	2	2	
	The implications of in and policy. Indexation	nnovatio	on in the i ne Globa	researc I Innova	h, mana ation Inc	agement lex.	2	2	
	Institutions and intel	lectual p	property c	organiza	ation.		2	2	
	Basics for personal i associations of innov	innovativ vators.	ve work a	and mer	nbershi	p in	2	2	
	Innovation processe	s and o	utcomes.				2	2	
Course content	Systematic innovatio	on and d	lesign. Th	ne desig	gn spira	. 	2	2	
broken down in	Association, diffusion features.	n of inno	ovation, ti	ne S-cu	irve and	other	2	2	
class schedule	Eco-innovation and sustainability.							2	
(syllabus)	innovation.							2	
	Legal aspects of intellectual property protection and realization.							2	
	Protected and protect patent license.	2	2						
	List of laboratory or design exercises								
	⊠ lectures	rkebone		🗆 inde	epender	nt assignme	nts		
	⊠ exercises	капора		⊠ mul	timedia				
Format of instruction	\Box on line in entirety			⊠ labo	oratory				
	□ partial e-learning □ work with mentor □ (other)								
Student	The presence on lec	tures in	the amo	unt of a	t least 7	'0 % of the t	imes sche	duled.	
Screening student	Class attendance	3,5	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		Seminal essav	•	1,5	Laboratory	exercises		
total number of ECTS credits is	Tests		Oral exa	am		Preparation laboratory	n for exercises		

equal to the ECTS 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 ecturing and the second one is after the next 6 weeks. Each midterm test consists of seminar essay progress. In the final exams students that did not pass the midterm exams take part. The final exams are carried out as finished seminar essay acceptance. The requirement for passing grade is the positive grade of semina essay. Grade (in percentage) is formed according to the formula: Grade(%) = 0,5 (M1 + M2) where in percentage: M1, M2 – seminar essay status. 								
		Number of copies in the library	Availabi other r	lity via nedia					
Required literature	- Klarin B.: Inovacije	u tehnio		e-lear	ning tal				
(available in the library and via other	- Von Hippel, Eric: T Oxford University Pr		boo	<u>ж</u>					
media)	- Tuomi, Ilkka: Netwo and Meaning in the University Press, 20		boo	эk					
Optional literature (at the time of submission of study programme proposal)	- Bray, D.A.; Konsyn Defense University - - Europe 2020. Flag:	- Bray, D.A.; Konsynski, B.; Streator, J.: Being a Systems Innovator, National Defense University - Information Resources Management College, 2007. - Europe 2020. Flagship Initiative Innovation Union, 2010.							
Quality assurance methods that ensure	 Evaluation of res Feedback from s 	sults in a students	accordance with via surveys	the abo	ve learning out	comes			
exit competences	 Self-evaluation of teachers Institutional and non-institutional evaluations 								
Other (as the proposer wishes to add)	- Feedback from gra	duate si	tudents about the	e course	e relevance				

NAME OF THE COURSE	COMPUTER AIDED DESI	IGN 1								
Code	FESL17	Year of study	1							
Course teacher	Gojko Magazinović, Ph. D., Full Professor	Credits (ECTS)	5							
Associate teachers	Ivan Pivac, Teaching assistant	Type of instruction (number of hours)	S 0	AE 0	LE 0	DE 30				
Status of the course	Obligatory	Percentage of application of e-learning	50							
	COURSE	DESCRIPTION								
Course objectives	 Iraining students for: understanding and application of basic terms and principles of feature-based modeling, parametric modeling, and geometric modeling, ability to build simple models, assemblies, and technical drawings by using a geometric modeling tool. 									
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: explain fundamental principles of geometric modeling, parametric modeling, and feature based modeling, describe an importance and available approaches to the exchange of design data between the different CAD systems, explain the fundamental principles of the parametric curve and parametric surface definitions, use a computer aided design tool, construct simple geometric models and assemblies, determine the model cross-section properties. 									
	Course content			L	or S	/ hc	\E burs			
	Introduction to a course. De		2							
	Introduction to CAD/CAM/C		2							
	Introduction to CAD/CAM/C the expansion of 3D CAD t	CAE systems, part II: appli echnology.	cations	,	2					
	Elements of CAD/CAM/CA		2							
	Geometric modeling; featur modeling.	re based modeling; param	etric		2					
Course content broken down in detail by weekly	Introduction to graphics pro coordinate systems; homog transformations.	ogramming, part I: OpenGI geneous coordinates; coor	_; dinate		2					
class schedule (syllabus)	Introduction to graphics pro removal; rendering; shadin	ogramming, part II: hidden g; ray-tracing.	line		2					
	First midterm exam									
	CAD data structures; excha different CAD systems.	ange of design data betwe	en the		2					
	Parametric curves, part I: H	lermite curve.			2					
	Parametric curves, part II:	Bezier curve; B-Spline cur	ve.		2	_				
	Parametric curves, part III: continuity; NURBS curves.	interpolation curve; geome	etric		2					
	Parametric surfaces: bilinear surface; Bezier surface; B-Spline surface; NURBS surface.									

	Modeling and analys	sis (A br	ief on str	uctural a	analysis).	2		
	Second midterm exam								
	List of laboratory or	design e	exercises					LI	E or DE
	The environment of (CAD des	sian tool;	extrusio	on of a d	closed curve	Э.		2
	Sketch tool; extrude;	round;	chamfer;	hole; pa	aramete	rs.	S.		
	Simple model editing	Simple model editing.							2
	Revolving of a closed	d curve.							2
	Design planes.	Design planes.							2
	Sections; shells, con	straints;	sketchin	g utilitie	S.				2
	Translation patterns;	one- an	nd two-dir	nensior	al.				2
	Radial patterns of se	t feature	es.						2
	Radial patterns of bu	ilt featur	res; featu	re copy	ing.				2
	Helical sweep.								2
	Making assemblies.	oparatic	n nart l						2
	Technical drawing pr	eparatic	n part II						2
		opulatio	n, part n						
	\square seminars and wo	rkshons		🗆 inde	epender	it assignme	nts		
		nonopo		⊠ mul	timedia				
Format of instruction	\square on line in entirety			⊠ labo	oratory				
	⊠ partial e-learning			□ wor	k with m	nentor			
	\square field work	\square field work				ork (other)			
Student									
responsibilities	Attendance of at lea	st 70% I	lectures a	and all d	lesign e	xercises.			
Screening student work (name the	Class attendance	2	Researc	search Prac		Practical training			
proportion of ECTS credits for each	Experimental work		Report		Individual v	vork		0,8	
activity so that the total number of	Essay		Seminar essay		Computer work			2	
ECTS credits is	Tests	0,2	Oral exa	am		(Other)			
value of the course)	Written exam		Project			(Other)			
Grading and evaluating student work in class and at the final exam	and e-learning porta two design problems exams. The requir responsibilities and Grade (in percentag where M1 and M2 a grades from 50% to from 75% to 87%; an	here are two midterm exams during the semester (carried out by using compute nd e-learning portal; 90 minutes duration; each exam: 25 theoretical questions and vo design problems). The final exams attend students that didn't pass the midtern xams. The requirements for passing grade are the fulfillment of studen esponsibilities and at least 50% points on each midterm exam or the final exam irade (in percentage) is determined as follows: Grade(%) = (M1 + M2)/2 there M1 and M2 are the midterm grades. The final grades are: satisfactory (2) rades from 50% to 61%; good (3), grades from 62% to 74%; very good (4), grades om 75% to 87%; and excellent (5), grades from 88% to 100%.							tory (2), grades
						Number	of	lat	
Required literature		Title)			copies i the libra	n Ava ry ot	her i	media
(available in the library and via other	G. Magazinović, Bilje	eške uz	predava	nja, FES	SB	-	6	e-lea	rning rtal
media)	R Toogood Cree P	arametr		orial an	d		httr	د الاح	ooks ao
	Multimedia DVD SC	C Puhli	cations I	Mission	2013	1	map	00	- hr
Optional literature	K Loo: Drinoinler				2010.	dicon Mar		Jine	1000
(at the time of				TE Syst	.ems, A			aunię	ງ, ເອອອ.

submission of study programme proposal)	 C. McMahon, J. Browne: CADCAM: Principles, Practice and Manufacturing Management, Prentice-Hall, Harlow, 1998.
Quality assurance methods that ensure the acquisition of exit competences	 Evaluation of results by the above learning outcomes Feedback from students via surveys Institutional and non-institutional evaluations
Other (as the proposer wishes to add)	

NAME OF THE COURSE	ENERGY EFFICIENCY IN	BUILDINGS								
Code	FESL24	Year of study	2.							
			30	0	30	0	0			
Status of the course	Elective.	Percentage of application of e-learning								
COURSE DESCRIPTION										
Course objectives	 Training students for: Consider and analyse energy consumption in the buildings, Obtain techno-economic aspect of proposed energy efficiency measures in building facilities. 									
Course enrolment requirements and entry competences required for the course	Thermodynamics 1, Mathematics 1, Mathematics 2.									
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	 Students will be able to: Consider base terms and concepts from the field of energy efficiency in buildings as well as sustainable development in general, Analyse energy consumption in buildings, Elaborate existing legislative related to the energy efficiency in buildings, Analyse and propose energy efficiency measures in buildings, 									
	Course content			L	or S ours	A ho	λE urs			
	Introduction to the energy e	efficiency in buildings.		2 h	ours	2 ho	ours			
Course content broken down in	Analysis of the energy cons	sumption for different build	lings.	2 h	ours	2 ho	ours			
detail by weekly class schedule	Legislative related to the er	nergy efficiency in building	S.	2 h	ours	2 ho	ours			
(Syliadus)	Introduction to the energy e (passive and nearly zero be performance buildings).	dings	2 h	ours	2 ho	ours				

	Energy efficiency measures related civil engineering aspect (building thermal envelope, openings, passive architecture elements, etc.)						2 hours	2 ho	ours
	Energy efficiency me water preparation.	easures	in heatin	g syste	ms and	hot	2 hours	2 ho	ours
	Energy efficiency me water preparation.	easures	in heatin	g syste	ms and	hot	2 hours	2 ho	ours
	Energy efficiency measures in cooling (air-conditioning) systems.					2 hours	2 ho	ours	
	Energy efficiency measures in cooling (air-conditioning) systems.					2 hours	2 ho	ours	
	Renewable energy s	sources	in buildin	gs (imp	lementa	ation).	2 hours	2 ho	ours
	Calculation techniqu	es for c	arbon-dic	oxide er	nissions	.	2 hours	2 ho	ours
	Energy audit.						2 hours	2 ho	ours
	Building energy cert	ification					2 hours	2 ho	ours
	Introduction to the economic indicators related to the evaluation of the energy efficiency measures. Economic evaluation of the proposed energy efficiency measures. List of laboratory or design exercises					2 hours	2 ho	ours	
						2 hours	2 ho	ours	
							LE c hc	or DE ours	
Format of instruction	 seminars and wo seminars and wo exercises on line in entirety partial e-learning field work 	rkshops		 ☑ inde ☑ mul □ labo □ wor □ 	epender timedia oratory k with n (othe	nt assignn nentor er)	nents		
Student responsibilities	The presence on lec Performed all require	tures in ed audit	the amo orium exe	unt of a	t least 7	'0 % of th	e times sch	edule	d.
Screening student	Class attendance	2	Researc	:h	2	Practical	training		
proportion of ECTS	Experimental work		Report			(0	Other)		
activity so that the	Essay		Semina essay	ſ		(0	Other)		
ECTS credits is	Tests		Oral exa	am		(Other)			

equal to the ECTS value of the course)	Written exam		Project	1	(Other)		
Grading and evaluating student work in class and at the final exam							
		Title	•		Number of copies in the library	Availabi other r	lity via nedia
Required literature	S. Nižetić, Onli učinkovitost u zgrad	ne pr arstvu (edavanja; Ene 2011 FESB	ergetska			
(available in the library and via other media)	Energy Efficiency in 2004.	Building					
	Energy Efficiency G Buildings'', Guide, A	uide for SHRAE					
	-Skupina autora "Pr	iručnik	za energetske s	aviotniko	" LINDR Zaar	eb 2008	
Optional literature (at the time of submission of study programme proposal)	-Skupina autora, "Ti -Skupina autora, "Pr -Skupina autora, "Pr	pske mj iručnik : iručnik :	ere", UNDP, Zaç za ventilaciju i kl za grijanje", EGE	greb 200 imatizac E, 2005.	iju", EGE, 2003	3,	
Quality assurance methods that ensure the acquisition of exit competences	 Evaluation of Feedback from Self-evaluation Institutional a 	results in m studer in of teac nd non-in	n accordance with hts via surveys chers hstitutional evaluat	the abov	e learning outco	mes	
Other (as the proposer wishes to add)							

NAME OF THE COURSE	AEROTECHNICS AND WIND TURBINES									
Code	FESL38	Year of study	1.							
Course teacher	Branko Klarin, Ph. D., Full Professor	Credits (ECTS)	5							
	Goran Gašparović.	Type of instruction	L	S	AE	LE	DE			
Associate teachers	Teaching assistant	(number of hours)	30	0	30	0	0			
Status of the course	Elective	Percentage of application of e-learning 0								
COURSE DESCRIPTION										
Course objectives Training students for: - explain and apply the basic properties of atmospheric currents, - recognize the effects of air currents in the facilities, especially wind turbines and choose the correct relations to solve them, - analyze and calculate air energy conversion and simple problems										
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: explain the genesis of the wind in the atmosphere and describe the main impacts on the atmospheric flow, enumerate and describe the basic devices for monitoring the state of the atmosphere, analyze the state of wind and specify its main features, list the parts smaller and larger wind turbines and calculate the basic operating parameters, to comment on the status and trends of offshore wind farms, identify and describe the basic features of a rigid sail, 									
	Course content				L or S	ŀ	٩E			
				hours	hc	ours				
	Introduction to aerotechnic flow.	Relative		2		2				
	The atmospheric flows and the impact of the global flow	nange a	nd	2		2				
	Atmospheric boundary laye impacts on the air flow. En- topography.		2		2					
Course content	Condition monitoring, meteorological devices and measurements. Wind potential.						2			
broken down in detail by weekly	Opposing facilities. Bounda surface. Lifting surface an	ary layer around nastrujava Id controls.	anih		2		2			
class schedule (syllabus)	The effect of air flow and g facilities and Turbomachine	as at various facilities, trar ery (wind turbines).	nsport		2		2			
(syllabus)	Atmospheric singularities. and humans. Ways to prote	The extreme effects to the ect people and the environ	objects ment.		2		2			
	Wind turbines and small wi	nd turbines. Urban wind p	owering		2		2			
	Off-shore wind farms.				2		2			
	The rigid sails and semi-rig	id sails. Wind assisted shi	ps.		2		2			
	Flow around cylinder and the	he turbulent wake.			2	<u> </u>	2			
	Introduction to fly. Ground vehicles.	ettect. Drones and unman	ned aer	al	2		2			
	Selected topics of aerospa	ce and wind tunnels.			2		2			
	List of laboratory or design exercises					L	E or DE			
-----------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------	-----------------------------------------	--------------------------------------------------------	-----------------------	----------	--------------		
				Π						
Format of instruction	 ☑ lectures ☑ seminars and wor ☑ exercises □ on line in entirety □ partial e-learning ☑ field work 	lectures □ independent assignments seminars and workshops □ independent assignments exercises □ independent assignments on line in entirety □ laboratory partial e-learning □ work with mentor field work □ (other)								
Student responsibilities	The presence on lect Performed all require	tures in ed labor	the amo atory exe	unt of a ercises.	t least 7	0 % of the time	es sched	uled.		
Screening student	Class attendance	3,5	Researc	h		Practical traini	ng			
proportion of ECTS	Experimental work		Report			Individual work	ĸ			
credits for each activity so that the	Essay		Seminal essay	-	1,5	Laboratory exe	ercises			
total number of ECTS credits is	Tests	ests Oral exam		Preparation for laboratory exercises						
value of the course)	Written exam		Project			(Other)				
Grading and evaluating student work in class and at the final exam	There 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 consists of seminar essay progress. In the final exams students that did not pass the midterm exams take part. The final exams are carried out as finished seminar essay acceptance. The requirement for passing grade is the positive grade of seminar essay. Grade (in percentage) is formed according to the formula: Grade(%) = 0,5 (M1 + M2) where in percentage:				weeks of consists midterm ar essay seminar					
			oouy olu			Number of	Availa			
		Title	9			copies in the library	other	media		
	B. Klarin: Aerotehnik	ka i vjetr	oturbine,	autoriz	irana		e-lea	arning		
Required literature	predavanja, FESB	bou C -		ations	of		pc br	ortai ook		
library and via other	Aerodynamics: base	es of Aei	rodvnami	c Desio	in.		D	JUK		
media)	Wiley, 1997.		,							
- Dyrbye, C.; Hansen, S.O.: Wind Loads on				book						
	Structures, Wiley, 19	996.								
Optional literature	- McCormick BW ·	Aerodyr	namics A	eronau	tics and	l Slight Mechar	nics Wil	ev		
(at the time of submission of study programme proposal)	1995.	leiouyi	iumios, 7	er on du			100, VVI	су,		

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)	- Feedback from graduate students about the course relevance

NAME OF THE COURSE	PLANT LAYOUT						
Code	FETL05 Year of study 2.						
Course teacher	Ivica Veža, Ph. D., Full Professor	Credits (ECTS)	5				
Associate teachers	Marko Mladineo, Ph. D.,	Type of instruction	P	S	AV	LV	KV
Status of the course	Obligatory	Percentage of	30 0	0	0	15	15
	COURSE	application of e-learning					
Course objectives	 Educate students to be able realize feasibility stu project of phases or surfaces, basic eler conditions), understand basics of and energy. 	 ducate students to be able to: realize feasibility study in projecting a new production system, project of phases of production system (define macro and micro locations, surfaces, basic elements of building, basic production structures, work conditions), understand basics of material flow calculation, human factor, information and energy. 					
Course enrolment requirements and entry competences required for the course	Course enrolment requirem Required competences: Co studies of industrial enginee	Course enrolment requirements: None Required competences: Competences and skills achieved after finishing bachelor studies of industrial engineering, mechanical engineering and naval architecture					
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	 Students will be able to: Analyse content of Compare criteria in Define number of w Create transport int Compare layout acc purpose groups, Define production s Analyse functional s field and height of f Apply achieved knows 	 Analyse content of previous study realized, Compare criteria in micro and macro location selection phase, Define number of workplaces, Create transport intensity chart, Compare layout according to processing type (Workshop principle) and purpose groups, Define production surface with discontinuity coefficients method, Analyse functional surfaces (sketch machine with functional surface, unit field and height of factory hale), Apply achieved knowledge and skills on real example. 					
Course content broken down in	Course content			ł	P nours	A ho	۷ ours

detail by weekly	Introduction. Term "s	ntroduction. Term "system", system types. Production system. 2							
class schedule	Scope, nature and objectives of design of production process. 2								
(syllabus)	Basic principles in production process modelling. 2								
	Interrelations of basic	2							
	Previous study.		1				2		
	Location problems M	lain fact	ors for m	icro an	d macro	location	2		
	selection.			noro an	amaore	location	2		
	Production system se	egmenta	ation.				2		
	Production surface ca	alculatio	n, definir	ng of fui	nctional	surfaces	2		
	on workplace. Distan	ces bet	veen ma	chines	and elei	ments.			
	building parameters	cheme	or surfac	e layou			2		
	Material flow types. S	Spatial s	tructure of	designir	ng.		2		
	Layout methods for c	ases wi	th group	by type	s.		2		
	Production and asser	mbly line	es balanc	ina			2		
	Workplace and work	conditio	ns desia	nina. Ti	ne appe	arance of	2		
	fatigue. Work condition	ons.	3	3					
	List of laboratory exe	rcises						LV ho	urs
	Introduction to spatia	l structu	ires					2	
	Layout according to p	ourpose	. Product	ion line	balanc	ing		2	
	Layout according to p	ition U	. Modified	d triang	le meth	DC		2	
	Layout with fixed pos	nredefin	ungary m ped locati					2	
	Transportation proble	ems		0113				2	
	Program task setting							1	
	List of construction exercises							KV ho	urs
	Capacity load calcula	ation						2	
	Transport units defini	ng						2	
	Defining of optimal sp	patial lay	yout					2	
	Storage calculation							2	
	Required surface cal	culation	ving of pr	aiaatad	produc	tion avatam		2	
	Handover of program	task	ving of pr	ojected	produc	lion system		<u> </u>	
		i task						1	
	Seminary work an	d works	hons	⊠ Sol	o tasks				
Format of	\boxtimes Exercise		nopo	□ Mu	timedia				
instruction	\Box on line in full			⊠ Lab	oratory	work			
	□ mixed e-learning				ntorship				
	☐ fieldwork lectures				(oth	er)			
Student	Presence on lectures	and au	ditory ex	ercise r	ninimall	y 70% in tota	al. All labo	oratory	
responsibilities	exercise and project	task rea	lized.						
Screening student	Class attendance	1,0	Researc	h		Practical tra	aining		
proportion of ECTS	Experimental work		Report			Individual w	vork	1	,5
credits for each activity so that the	Essay		Seminai essav	ſ		Laboratory	exercises	0	,5
total number of	Tests	0	Oral			Preparatior	n for		
ECTS credits is equal to the ECTS	Tests	0	Ural exa	am		laboratory e	exercises		
value of the course)	Written exam		Project		2,0	(Oth	ier)		
Grading and evaluating student work in class and at the final exam	During the semester lectures, and second the curriculum on fina has to be written as a	it will I after 6 al exam, written	be realize weeks. S if they di exam in	ed two students dn't pas duratio	colloqu s have p ss in reg n of 45	iums. First ossibility to gular dates. I minutes. Ea	is after 7 retake ag Each of co ch colloqu	weeks ain par blloquiu iium ha	s of rt of ums as 5

	 theoretical questions. Passing condition is 40% of total and project task done. To students are introduced phases of production besides lectures, they are attending to laboratory exet they realizing production system modelling. Students on colloquium and those tasks are also included in gra KV – grade from lectures, LV – grade from laboratory work, M1, M2 – colloquium points. Final grade (in percent) formed according to formula: Grade (%) = 0,20 KV + 0,20 LV + 0, 	I points on ead system mode preises and ac presenting th ade forming (g ,3 (M1 + M2)	ch of colloquiums elling. Therefore, cording to them, neir project tasks grade KV).			
	Title	Number of copies in the library	Availability via other media			
Required literature (available in the library and via other media)	Veža, I., Bilić, B., Bajić, D., "Projektiranje proizvodnih sustava", Fakultet elektrotehnike, strojarstva i brodogradnje, Split, 2001.		e-learning portal			
Optional literature	Aggteleky, B., "Fabrikplanung: Werksentwicklung und Band 1,2,3"., Carl Hanser Verlag, München, 1990. Schenk, M., Wurth, S., "Fabrikplanung und Fabrikbetr wandlungsfähige und vernetzte Fabrik", Springer Verl York, 2004.	Betriebsratior ieb Methoden ag, Berlin, Hei	nalisierung für die delberg New			
Quality assurance methods that ensure the acquisition of exit competences Other (as the	Evaluation of results in accordance with the above learning outcomes Annual analysis of the performance of the examinations Feedback from students via surveys Self-evaluation of teachers Institutional and non-institutional evaluations					
proposer wishes to add)						

NAME OF THE COURSE	COMPUTER AIDED DESIGN 2							
Code	FESM15 Year of study 1							
Course teacher	Gojko Magazinović, Ph. D., Full Professor 5							
Associate teachers	Ivan Pivac, Teaching assistant	Type of instruction (number of hours)	Type of instructionL(number of hours)30					
Status of the course	Dbligatory Percentage of application of e-learning 50							
	COURSE	E DESCRIPTION						
Course objectives Training students for: - understanding the role and significance of CAD/CAE software in contendesign and manufacturing systems, - performing engineering calculations using a spreadsheet software, - building geometric models, generating its technical drawings, and performing engineering calculations using a spreadsheet software, - building geometric models, generating its technical drawings, and performing engineering calculations using a spreadsheet software, - building geometric models, generating its technical drawings, and performing engineering calculations using a spreadsheet software, - building geometric models, generating its technical drawings, and performing engineering calculations using a spreadsheet software, - building geometric models, generating its technical drawings, and performing engineering calculations using a spreadsheet software, - building geometric models, generating its technical drawings, and performing engineering calculations using a spreadsheet software, - building geometric models, generating its technical drawings, and performing engineering calculations using a spreadsheet software, - building geometric models, generating its technical drawings, and performing engineering calculations using a spreadsheet software, - building geometric models, generating its technical drawings, and performing engineering calculations using a spreadsheet software, - building geometric models, generating its technical drawings, and performing engineering calculations using a spreadsheet software, - building geometric models, generating its technical drawings, and performing engineering calculations using a spreadsheet software, - building geometric models, generating its technical drawings, and performing engineering calculations using a spreadsheet software, - building geometric models, generating its technical drawings, and performing engineering calculations using a spreadsheet software, - building geometric models, generating its technical drawings, and performing engineering						ntempo erform	orary	
Course enrolment requirements and entry competences required for the course	Completion of Computer A	npletion of Computer Aided Design 1 course						
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	 Students will be able to: solve simple engineering calculation problems by using a spreadsheet tool, draw a graph by using a spreadsheet tool, use a computer aided design and analysis tool, generate geometric models and assemblies of moderate complexity, link geometric models with spreadsheet analyses, 							
	Course content							
	Introduction to a course. De	escription of an e-learning	portal.		2			
	History of computing and c of numbers; engineering ca	on	2					
	Graphical representation of	f engineering results.			2			
	Spreadsheet numerical inte	egration.			2			
	Spreadsheet equation solv	er; systems of equations.			2			
	The environment of CAD's	oftware; references; desig	n inten	i.	2			
Course content	Curve and surface modelin	ig.			2			
broken down in	First muterin exam	nchin: model editing			2			
detail by weekly class schedule	Model and section properti	es; measurements; materi	al		2			
(syllabus)	Degrees of freedom and as surface finishes.	ssemblies; geometric toler	ances;		2			
	Analysis as a feature; linkir	ng models and analysis.			2			
	Examples of models, analy	sis, and optimization.			2			
	Structural analysis: h-meth conditions; result analysis.	ods; p-methods; boundary	/	2				
	Second midterm exam							
	List of laboratory or design	exercises				LE o ho	or DE ours	
	Spreadsheet tool elements; functions.	; making a simple workshe	et; buil	t-in			2	

	Absolute and relative	psolute and relative cell addressing; complex expressions. 2						
	Vorking with data series; conditional formatting; graphing.						2	
	Jumerical integration: trapezoidal and Simpson's rule.							2
	Equations; linear sys	quations; linear systems; nonlinear systems.						2
	Basic modeling; para	imeters;	relations	; Project	t, part I	: simple parts.		2
	Curves and surfaces	Dood no	rto					2
	Project, part II. advar	iceu pa	ns.					2
	Project, part IV: tech	nical dra	wina					2
	Analysis feature.	vsis feature						2
	Modeling, analysis, a	nd optir	nization.					2
	Static structural analy	ysis of s	imple pa	rts.				2
	⊠ lectures							
	□ seminars and wor	rkshops			penden imadia	it assignments		
	⊠ exercises				integia			
Format of Instruction	□ on line in entirety				ratory	to -		
	⊠ partial e-learning					ientor		
	□ field work				puter w	OIK		
Student	Attendance of at leas	st 70%	lectures a	and all de	esian e	xercises		
responsibilities								1
work (name the	Class attendance	2	2 Research P		Practical traini	ng		
proportion of ECTS credits for each	Experimental work		Report Ir		Individual work	K	0,8	
activity so that the total number of	Essay	issay Seminar C		Computer wor	Computer work			
ECTS credits is	Tests	0,2 Oral exam		(Other)				
value of the course)	Written exam		Project			(Other)		
Grading and evaluating student work in class and at the final exam	There are two midte and e-learning porta numerical and one of three design problem exams. The requir responsibilities and Grade (in percentage where M1 and M2 a grades from 50% to from 75% to 87%; an	here are two midterm exams during the semester (carried out by using computer nd e-learning portal; 90 minutes duration; first exam: five theoretical questions, two umerical and one design problems; second exam: five theoretical questions and tree design problems). The final exams attend students that didn't pass the midterm kams. The requirements for passing grade are the fulfillment of student esponsibilities and at least 50% points on each midterm exam or the final exam. rade (in percentage) is determined as follows: Grade(%) = (M1 + M2)/2 here M1 and M2 are the midterm grades. The final grades are: satisfactory (2), rades from 50% to 61%; good (3), grades from 62% to 74%; very good (4), grades om 75% to 87%; and excellent (5), grades from 88% to 100%.						
	-	Title	9			Number of copies in the library	Availab other	ility via media
Required literature (available in the	G. Magazinović, Bilje	eške uz	predava	nja, FES	В	-	e-lea poi	rning rtal
library and via other	R. Toogood: Creo Pa	arametr	ic 2.0 Tu	torial and	b	1	https://b	ooks.go
media)	Multimedia DVD, SD	C Publi	cations, I	Mission,	2013.		ogle	ə.hr
	B. Plazibat, i drugi: li	nformat	ika 1, Sve	eučilišni			Lin	k at
	studijski centar za st	ručne s	tudije, Sp	olit, 2010	-	-	e-lea	rning
							ро	rtal
Optional literature (at the time of submission of study	 K. Lee: Principles C. McMahon, J. E Management, Pre 	K. Lee: Principles of CAD/CAM/CAE Systems, Addison-Wesley, Reading, 1999. C. McMahon, J. Browne: CADCAM: Principles, Practice and Manufacturing Management, Prentice-Hall, Harlow, 1998.						

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

NAME OF THE COURSE	COMPUTER AIDED MAN	COMPUTER AIDED MANUFACTURING						
Code	FETL07	Year of study	1.					
Course teacher	Dražen Bajić, Ph. D, Full Professor Sonja Jozić, PhD, Assistant Professor	Credits (ECTS) 5						
Associate teachers	Mario Veić, Teaching assistant	Type of instruction (number of hours)	L 30	S 0	AE 0	LE 0	DE 30	
Status of the course	Obligatory/Elective	Percentage of application of e-learning		<u>0</u>				
COURSE DESCRIPTION								
Course objectives	 Training students for: exploring the possibilities of computer application in production with an emphasis on programming CNC machine tools and additive technology. mastering of manual programming and programming in CAD / CAM systems in machining of simple and complex workpiece. 							
Course enrolment requirements and entry competences required for the course	None	Jone						
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	surse Students will be able to: - analyze interactions and need for a comprehensive approach to part design and their manufacturing - apply acquired knowledge and skills to solve a specific task. - apply acquired knowledge and skills in teamwork. - consider role of CAD / CAM systems in modern design and manufacture - generate program for the automatic parts production on CNC machine tools - compare and highlight differences between manual programming and programming by CAD / CAM systems - identify motives of applying computer controlled machine tools and systems for rapid prototyping - comment advantages and disadvantages in development and manufacture of					in Is ns for e of		

	Course content		L or S	AE
			hours	hours
	Introduction. Basic terms. Historical d	levelopment of CAM.	2	/
	Geometric modeling. Engineering mo	odeling. Types of	2	/
	geometric models. 2D and 3D geome	2	,	
	Geometric modeling. Modeling by me	2	/	
	Parametric modeling. Disadvantages	of geometric models.		
	Analysis of technical drawings. Technical	ological documentation.		1
	Programming methods. Manual progr	2	/	
	programming.			
	CNC machine tools programming. Co	oordinate system.	_	,
	Measurement system. Reference poi	2	/	
	tools. The structure of the program bi	OCK.		
	CNC turning. The procedure and mac	chine tools. Tools for	2	1
	programming CNC turning parameter	ers. Manually	2	/
	Automatic programming of CNC lathe	es Possibilities of		
	software package CATIA. Associative	e database. Defining of	2	/
	machining. Machining simulation and	CNC code generating.		
	First midterm exam			
	CNC milling. Different machining ope	rations and machine		
	tools. Tools clamping. Tools storage.	Manipulation with tool	2	/
Course content	and workpiece.			
broken down in	CNC milling. End milling. Face milling	2	/	
detail by weekly	2	/		
(svllabus)	Mill turning. Coaxial and orthogonal n	2	1	
(-)	Rapid prototyping. Stereolithography	2	/	
	Selective sintering.			
	Rapid prototyping. Sintering by precip	2	/	
	Hybrid procedure 3DP / SLA.			
	Second midterm exam			
	List of laboratory or design exercises		LE or DE hours	
	Construction of simple geometric share		2	
	Construction of complex geometric sh	apes and their extrusion.		4
	Technical documentation - Drafting m	odule.		2
	CNC manual programming for lathes.			4
	Module for machining - turning. Rougl	hing and finishing, holes ar	ıd	2
	threads			-
	Module for machining - milling. Rough	ning.		2
	Generating INC code for machining ce	enter.Communication betwe	en	C
	Machining on CNC vertical machining	center Spinner VC560		2
	Module for machining - milling, Rough	hing and finishing, holes.		2
	Module for machining - milling. Surfac	e machining, profile milling	I.	2
	Generating NC code for machining ce	enter.Communication betwe	en	
	computers and machining center.			2
	Machining on CNC vertical machining	center Spinner VC560.		
	Rapid prototyping. STL files. 3D printi	ng		2
	⊠ lectures	☑ independent assignment	nts	
	\square seminars and workshops	🛛 multimedia		
Format of instruction	⊠ exercises	☑ laboratory		
	□ on line in entirety	\Box work with mentor		
	□ partial e-learning	□ (other)		

	☐ field work							
Student responsibilities	The presence on lec Performed all require	The presence on lectures in the amount of at least 70 % of the times scheduled. Performed all required laboratory exercises.						led.
Screening student	Class attendance	2	Researc	h		Practical training	ng	
work (name the proportion of ECTS	Experimental work		Report			Manual progra	mming ation	0,5
activity so that the total number of	Essay		Seminar essay			Individual work	<	2,25
ECTS credits is	Tests	0,25	Oral exa	m		(Other)		
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 that did not pass the the entire exam. Th tests. The requirements fo 3. Positively ev 4. 50 % points Grade (in percentag Grade(%) = 0,2 L – grade of program M1, M2 – test results Final grade is determ Percentage G 50% do 61% su 62% do 74% go 75% do 87% ve 88% do 100% ex 	the midterm exams take part. In the matern exam is duter r weeks of the midterm exams take part. In the makeup exam students take "he midterm, final and makeup exams are carried out as written for passing grade is: evaluated program task "Manually programming CNC turning" ts on each midterm exam or the final exam. age) is formed according to the formula:),2 L + 0,4 (M 1 + M 2) am task "Manually programming CNC turning" ilts of first and second midterm exam. ermined according to: Grade sufficient (2) good (3) very good (4) excellent (5) s: according to the timetable.				eeks of tudents nts take written ing"		
		Title	•			Number of copies in the library	Availabi other n	lity via nedia
Required literature (available in the library and via other media)	Xun Xu: "Integrating Design, Manufacturi Principles and Imple Auckland, New Zeal Hoffmann M : CAD/	Advanc ng, and mentatio and, 200	ed Comp Numerica ons", Univ 09. it CATIA V	uter-Aid al Contr versity o	ded ol: of			
,	Verlag, Muenchen, 2	2005.		, 114				
	manufacturing", lecti	uring, el	er alded _earning,	2015.			eLear port	ning tal
Optional literature (at the time of submission of study programme proposal)	Balič, J.: CAD/CAM McMahon, C., Brown management, Pears	postopk n, J.: CA on Pren	i, Univerz D CAM p tice Hall,	a v Ma principle 1999.	riboru, I es, pract	Maribor, 2002. tice and manufa	acturing	
Quality assurance methods that ensure	 Keeping records c Evaluation of resu Feedback from stu 	Keeping records of class attendance Evaluation of results in accordance with the above learning outcomes Feedback from students via surveys						

the acquisition of exit competences	-	Self-evaluation of teachers Feedback information from graduated students
Other (as the proposer wishes to add)		

NAME OF THE COURSE	FATIGUE STRENGTH OF MATERIALS								
Code	FESL04	Year of study	1						
Course teacher	Željko Domazet, Ph. D., Full Professor Lovre Krstulović-Opara, Ph. D., Full Professor	Credits (ECTS)	5						
Associate teachers	Petra Bagavac, Teaching assistant	Type of instruction (number of hours)	L 30	S 0	AE 0	LE 30	DE 0		
Status of the course	Obligatory (262) Mandatory (261, 263)	Percentage of application of e-learning	40%						
	COURSE	DESCRIPTION	-						
Course objectives	 Training students for: Proper and optimal din subjected to loadings of Estimating real exploits and infrared thermogra Detection of cracks by magnetic particles insp 	nensioning of structural an during exploitation. ation loading by means of aphy. means of ultrasound testir pection.	d mach strain g ng, pen	inery auge etrant	compo measu testing	nents reme J and	nts		
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 fatigue limit an Describe methods of e Describe methods of fr Describe strain gauge Describe ultrasound m Describe penetrant tes Describe magnetic par 	 Students will be able to: Explain fatigue limit and stress concentration. Describe methods of estimating fatigue strength. Describe methods of fracture's repair. Describe strain gauge method. Describe ultrasound method in detection of cracks. Describe penetrant testing in detection of cracks. 							
Course content	Course content			L	_ or S nours	/ ho	λE burs		
broken down in	Introduction to experimenta	al mechanics in fatigue eva	aluation		2	<u> </u>			
detail by weekly	Methods of fatigue evaluat	ion.			2				
Class schedule	Materials response under i	n-service loading conditior	IS.		2				
	Types and characteristics of structures).	of structural loads (actions	on		2				

	Influences on life tim	Influences on life time predictions of materials and							
	components.	do of fo	tique etre	nath			0		
	Eracture mechanics		lingue sire	engun.			2		
	Stress concentration						2		
	Design of component	its and e	structures	•			2		
	Codes		Silucialet				2		
	Repair and retrofit of	fatique	damage	s			2		
	Fatique strength of v	veldmer	nts-	5.			2		
	Experimental mecha	nics in f	atique ev	valuatio	n and ca	ase	2		
	studies.								
	List of laboratory or o	design e	exercises					LE	hours
	Introduction to experi	mental	testing ed	uipme	nt of Stru	uctural labo	ratory.		1
	Strain gauge testing	- theory	and app	lication	of strain	n gauges.			10
	Magnetic particles in:	spection).						2
	Basics of infrared the	rmogra	phy						6
	Thermoelasticity, puls	sed the	mograph	y and F	Risitano	method.			4
	Ultrasound testing.								3
				🗆 inde	ependen	t assignme	nts		
	Seminars and workshops □ overeises ∞ multimedia					0			
Format of instruction	□ exercises □ on line in optiraty □ laboratory								
	□ on line in entirety □ work with me			entor					
	\Box field work				(othe	er)			
Student									
responsibilities									
Screening student work <i>(name the</i>	Class attendance	2	Researc	h		Practical tra	tical training		
proportion of ECTS	Experimental work	1	Report			Individual work			1
activity so that the	Essay		Seminai essay		1	(Oth	ier)		
ECTS credits is	Tests		Oral exa	ım		(Oth	ner)		
value of the course)	Written exam		Project			(Oth	ner)		
Grading and evaluating student work in class and at the final exam	Evaluation of gained Maximal score is 100 Exam: individual, the Mode of exam: writte	knowle points oretical on form.	dge in fo , while m	rm of tw inimum	<i>i</i> o colloc is passi	luiums. ng of exam	is with 5	0 po	ints.
						Number	of Avai	labi	litv via
		Title	•			copies i	n oth	er n	nedia
De su ins diliterations		. <u>×</u> _			~	the libra	ry –		
Required literature	Grubišić, V., Domaze	et, Z.: Fa	tigue stro	ength o	t			lear	ning
library and via other	materials (in Croatia	n)							
media)	Additional course ma	aterials					E	lear	ning
	17 11 77	A 1			-				
Optional literature	- K. Hoffmann	1: An Int	roduction	to Mea	Sureme	nts Using S	strain Gau	iges	,
			1000100111		ni, Daili	เอเลนเ			

submission of study programme proposal)	 M. Andrassy, I. Borbas, S. Švaić: Osnove termografije s primjenom, Kigen, Zagreb, 2008.
Quality assurance methods that ensure the acquisition of exit competences	 Student evaluations Registering student's attendance to course
Other (as the proposer wishes to add)	

NAME OF THE COURSE	COMPUTATIONAL FLU	ID DYNAMICS							
Code	FESN19	Year of study	1						
Course teacher	Assistant professor Igor Pehnec	Credits (ECTS)	5						
Associate teachers	Željko Penga, PhD	Type of instruction	L	S	AE	LE	CE		
	Nikola Mijalić, MEng	(number of hours)	30	0	0	30	0		
Status of the course	Elective	Percentage of application of e- learning	0						
	(
Course objectives	Introduction to full Navier-Stokes equations, continuity and energy equation; physical meaning of the equation terms. Knowledge of discretization methods and numerical solving of discretized equations. Introduction to grid's properties. Main and common pre-processing, processing and post-processing procedures for CFD software. Selection of the appropriate level of modeling and identification of the diminished physical representativness of CFD results.								
Course enrolment requirements and entry competences required for the course	Fluid mechanics								

	Students will b	e able to:								
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	 Describe the Explain the of Identify the Apply CFD of energy in th Model the p 	 Describe the full Navier Stokes equations and energy eq. Explain the discretization procedures and numerical solution of discretized equations. Identify the main causes of reduced physicality CFD simulations. Apply CFD computer programs for calculating 2D flow (stress and changes of internal energy in the fluid). Model the problem of flow of viscous flows with heat exchange for use of commercial codes. 								
	codes. – Critically eva	aluate the r	results.							
	Content					L	LE			
						hours	hours			
	The main flow	equation.				2	2			
	Classification c		2	2						
	Boundary conc	litions of t	the equation			2	2			
	Discretization	of diff. eq	. with Finite I	Difference Met	hod.	2	2			
	The method of	the final	volume. Erro	r discretizatior	۱.	2	2			
Course content broken down in	The generatior	The generation networks and network types.					2			
detail by weekly	Stability.	2	2							
(syllabus)	Numerical diffusion.						2			
	Algorithms solv	ving of dis	scretized equ	ations.		2	2			
	Installation of	boundary	conditions.			2	2			
	Application of fluid and visco	the poten us flow.	itial flow inco	mpressible flu	id, flow of ideal	2	2			
	Application of fluid and visco	the poten us flow.	itial flow inco	mpressible flu	id, flow of ideal	2	2			
	Application of fluid and visco	the poten us flow.	tial flow inco	mpressible flu	id, flow of ideal	2	2			
Format of	⊠ lectures			⊠ individual as	signments		<u> </u>			
instruction	Image: Seminars and a seminars a	workshops	;	 multimedia laboratory 						
Student	Class attendan	ce.								
responsibilities										
	Class attendance	2,0	Research		Practical training					

Screening student	Experimental work		Report		Individual work	<	2,0			
proportion of ECTS	Essay		Seminar essay	0,5	Lab exercises		0,2			
credits for each	Tests		Oral exam	0,3	(Other)					
total number of ECTS credits is equal to the ECTS value of the course)	Written exam		Project		(Other)					
Grading and evaluating student work in class and at the final exam	During the cou and exercises. exams the stud The seminar es semester. Total points (% HV, SV -% poi M1, M2 -% po Corrective Exa the associated	 During the course, students make their homeworks that are given within the lectures and exercises. The students submit their homeworks on the next lecture. At midexams the students present their homeworks. The seminar essay is given to the student that is orally presented at the end of semester. Total points (%) = 0.05 (HV + SV) + 0.45 (M1 + M2) HV, SV -% points from homework and seminar work, M1, M2 -% points at mid-exams. Corrective Exam: A student who does not pass the exam at the time of teaching and the associated exam period, but has collected at least 25% of the total points, orally presented. 								
	explains the se	the associated exam period, but has collected at least 25% of the total points, orally explains the seminar work.								
Required literature (available in the library and via		Titl	e		Number of copies in the library	Availabil other m	ity via nedia			
other media)	- Virag Z. Džijar fluida", FSB, Za	I. , "Raču greb	unalna dinamik	а						
Optional literature (at the time of submission of study programme proposal)	 Anderson, D Mechanics and - John Anderso McGraw-Hill So - H. Versteeg, N The Finite Volu - Hirsch, C. 	 Anderson, Dale; Pletcher, Richard H.; Tannehill, John C, "Computational Fluid Mechanics and Heat Transfer", Hemisphere Pub. Corp. McGraw-Hill (1984) - John Anderson, "Computational FLuid Dynamics the basic and applications", McGraw-Hill Science Engineering Math (1995) - H. Versteeg, W. Malalasekra, "An Introduction to Computational Fluid Dynamics - The Finite Volume Method", Prentice Hall (2007) 								
Quality assurance methods that ensure the	Keeping record examination. S	ls of his a tudent su	ttendance. The arvey in order t	e annual a o evaluate	nalysis of the perfore teachers. Self-ev	ormance of aluation of	the			

acquisition of exit	teachers. Feedback from students who have already graduated from the relevance of
competences	the course content.
Other ()	

NAME OF THE COURSE	THEORY OF PLASTICITY AND VISCOELASTICITY							
Code	FESL42	Year of study	1.					
Course teacher	Vedrana Cvitanić, Ph. D., Associate Professor	Credits (ECTS)	5					
Associate teachers		Type of instruction (number of hours)	L	S	AE	LE	DE	
Status of the course	Elective	Percentage of application of e-learning	45 0	0	15	0	0	
	COURSE	DESCRIPTION						
Course objectives	 Training students for: solving and analyzing provide the solution of stress elements under condition of stress and their algorithmic for nonlinear structural analyzing provide the solution of stress elements under structural analyzing provide the structural analyzing provide the	problems of structural anal c and viscoelastic) materia and strain distributions fo ions of nonlinear material t ts of elastoplastic and visc prmulations that are used in alysis.	ysis ur I behav r simpl behavio oelastio n finite	nder co viour, e loadi our, c const eleme	ndition ng of l titutive nt cod	ns of beam e mode es for	ls	
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 characteristic of compute stress and dis load and residual stress loading or bending load compute limit load for p explain concepts and p three dimensional stress explain algorithm for ca constitutive formulation hardening concept, explain characteristic of 	of mechanical behaviour of splacement distributions for uses and displacements for ding, blane beams and frames ir principles of elastoplastic c ss states under conditions alculating state variables o hs based on isotropic yield of mechanical behaviour of	elasto r elasto beam n elasto onstitu of sma f elasto f unctic viscoe	plastic oplastic s unde oplastic tive for all strai oplastic on and	mater c state c state c state rmulat ns, c proce isotro materi	rials, es, limi l, torsid s, ions fo ess for pic als,	t on or	

	 explain Maxwell's viscoelastic model and Voigt-Kelvin's viscoelastic model and based on these models derive creep response and stress relaxation response, explain solving equations of viscoelastic models by Laplace's transform, explain solving problems of variable loading for beams by Bolzman's principle of superposition, explain principles of viscoelastic constitutive formulations for three dimensional stress states 									
	Course content						L	AE		
	Introduction to theory plastic behaviour. Effe plastic behaviour. Idea Rheological models of	of plastic ect of ter lizations plasticity	city. Exper nperature of one dim	imental and str ensiona	data ab ain rate Il plasticit	out material on material ty diagrams.	3 3	hours		
	Plastic analysis of beams. Axial loading of beams in plastic region. Limit state. Elastic-perfectly plastic model and elastic-linear hardening model.						3	1		
	Torsion loading of beams with circular cross section in plastic region. Limit state. Elastic-perfectly plastic model and elastic-linear hardening model.							1		
	Pure and transverse perfectly plastic model	ate. Elastic-	3	2						
	Plastic analysis of beams and frames.							2		
Course content broken down in detail by weekly	Yielding criteria for isotropic materials: Tresca yielding criterion, von Mises yielding criterion, Drucker-Prager yielding criterion, Mohr- Coulomb yielding criterion. Yielding criteria for anisotropic materials: Hill and Karafillis-Boyce yielding criterion.						5	1		
class schedule (syllabus)	Concepts and principles of elastoplastic constitutive formulations for three dimensional stress states under conditions of small strains. Flow rule. Isotropic and kinematic hardening models for three dimensional stress states.						3			
	Algorithms for calculating state variables of elastoplastic process.							1		
	Examples of complex I	ody load	ding in plas	stic state	э.		1	3		
	Introduction to theory of viscoelasticity. Experimental data for viscoelastic materials. Creep and stress relaxation. Effect of temperature and time on viscoelastic material behaviour.						3			
	Rheological models of model. Generalized model	viscoela odels.	sticity. Ma	xwell's r	nodel. V	oigt-Kelvin's	3	1		
	Solving viscoelastic mo principle of superpositi	odel equa	ations. Lap	olace's tr	ansform	. Boltzman's	3	1		
	Principles of visoelastic	c constitu	ıtive formu	lations f	or three	dimensional	3			
	List of Jahoratory exe	arciene						l E hours		
		5101303								
Format of instruction	 ☑ lectures □ seminars and work ☑ exercises 	rkshops		□ inde ⊠ mul	epender timedia pratory	it assignmei	nts			
	 □ on line in entirety □ partial e-learning □ field work 				k with m (othe	nentor er)				
Student responsibilities	The presence on lec	tures ar	nd exercis	ses in th	ne amou	int of at leas	st 70 % of	the times		
Screening student	Class attendance	1,7	Researc	h		Practical tra	aining			
work (name the proportion of ECTS	Experimental work		Report			Individual w	vork	3,0		

credits for each activity so that the	Essay		Seminar essay		Laboratory exe	ercises		
total number of ECTS credits is	Tests	0,2	Oral exam		Preparation for laboratory exe	r rcises		
equal to the ECTS value of the course)	Written exam	0,1	Project		(Other)			
Grading and evaluating student work in class and at the final exam	There are two midterm exams during the semester. After semester there are two finates exam terms, one corrective exam term and one exam term held by commission according to schedule. The first midterm exam is after 7 weeks of lecturing and the second one is after the next 6 weeks of lecturing. Each midterm exam is written an test consists of theoretical questions and numerical problems. The requirement for passing grade is 50% points on each midterm exam. In the final exams students that did not pass the midterm exams take part. In the additional exam terms students take whole exam. Final number of points is formed according to the formula: Points(%)= (M1 + M2)/2 M1, M2 – points on midexams. Final grade is determined by absolute system of grading. Final grade is determed be the achived final number of points in the following manner: from 50% to 61% - grade sufficient (2), from 62% to 74% - grade good (3), from 75% to 87% - grade very goo (4) and from 88% to 100% - grade excellent (5). According to Article 71 of Faculty Statue, students are obligate to contribute in a education activities and to attend at least 70% of lecture and exercise lessons. Above conditions are necessary to access midterm and final exams.							
			access muterm		al exams.			
		Title			Number of copies in the library	Availabi other n	lity via nedia	
Required literature	Alfirević, I.: "Uvod u tel Golden marketing, Zac	Title	ehaniku kontinuur	na",	Number of copies in the library	Availabi other n	lity via nedia	
Required literature (available in the library and via other media)	Alfirević, I.: "Uvod u ter Golden marketing, Zag Alfirević, I., Pustaić, D. poglavlje: Teorija plast 1996.	Title nzore i m greb, 200 : "Inženju ičnosti, s	ehaniku kontinuur 3. erski priručnik IP1" Školska knjiga, Za	na", ', greb,	Number of copies in the library	Availabi other n	lity via nedia	
Required literature (available in the library and via other media)	Alfirević, I.: "Uvod u tel Golden marketing, Zag Alfirević, I., Pustaić, D. poglavlje: Teorija plast 1996. Alfirević, I., Brnić, J.: "I poglavlje: Teorija visko Zagreb, 1996.	Title nzore i m greb, 200 : "Inženju ičnosti, s nženjers pelastično	ehaniku kontinuur 3. erski priručnik IP1" Školska knjiga, Za ki priručnik IP1", osti, Školska knjiga	na", ', greb, a,	Number of copies in the library	Availabi other n	lity via nedia	
Required literature (available in the library and via other media) Optional literature (at the time of submission of study programme proposal)	Alfirević, I.: "Uvod u tel Golden marketing, Zag Alfirević, I., Pustaić, D. poglavlje: Teorija plast 1996. Alfirević, I., Brnić, J.: "I poglavlje: Teorija visko Zagreb, 1996. Khan, A. S., Huang, S. Simo, J.C., Hughes, T. Springer-Verlag, 1988. Bathe, K.J.: "Finite ele 1996. Brnić, J.:"Elastomehar	Title nzore i m greb, 200 : "Inženje ičnosti, s nženjers pelastično ., "Contin J.R., "Ela ment pro nika i plas	ehaniku kontinuur 3. erski priručnik IP1" Školska knjiga, Za ki priručnik IP1", osti, Školska knjiga nuum theory of plas astoplasticity and v cedures in engine- stomehanika", Ško	na", greb, a, viscoplas ering ana Iska knjig	Viley & Sons Inc. sticity - Computa	Availabi other n	lity via nedia k, 1995. ects", York,	
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	Alfirević, I.: "Uvod u ter Golden marketing, Zag Alfirević, I., Pustaić, D. poglavlje: Teorija plast 1996. Alfirević, I., Brnić, J.: "I poglavlje: Teorija visko Zagreb, 1996. Khan, A. S., Huang, S. Simo, J.C., Hughes, T. Springer-Verlag, 1988. Bathe, K.J.: "Finite ele 1996. Brnić, J.:"Elastomehar - recording studer - evaluation of res - feedback from s - self-evaluation c	Title nzore i m greb, 200 : "Inženji ičnosti, s nženjers pelastično J.R., "Eli ment pro nika i plas nt's pres sults in a tudents of teache non-ins	ehaniku kontinuur 3. erski priručnik IP1" Školska knjiga, Za ki priručnik IP1", osti, Školska knjiga nuum theory of plas astoplasticity and v cedures in enginer stomehanika", Ško eence on lessons accordance with t via surveys ers titutional evaluati	na", greb, a, sticity", V viscoplas ering ana Iska knjig the abov	Viley & Sons Inc. sticity - Computa alysis", Prentice-l ga, Zagreb, 1995	Availabi other n	lity via nedia k, 1995. ects", York,	

NAME OF THE COURSE	PRODUCTION PLANNING AND CONTROL									
Code	FETL06	Year of study	2.							
Course teacher	Boženko Bilić, Ph.D. Full Professor	Credits (ECTS)	5							
	Marko Mladineo Ph. D	Type of instruction	L	S	AE	LE	DE			
Associate teachers	Teaching assistant	(number of hours)	30	0	15	15	0			
Status of the course	Obligatory	Percentage of application of e-learning	0							
	COURSI	E DESCRIPTION								
Course objectives	 Introduce students with Teach students the bas 	the basic tasks of product ic methods and tools for p	ion ma roducti	nagen on ma	nent nagen	nent				
Course enrolment requirements and entry competences required for the course	Completed undergraduate mechanical engineering.	ompleted undergraduate study industrial engineering, naval architecture or echanical engineering.								
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: Explain the strategies of introducing new products to the market Recommend organizational structure of the company Plan the required production capacity Develop basic layout of production equipment Design a project network diagram and Gantt chart Optimize the total cost of the project Plan material inventory for the independent and dependent demand Evaluate the quality management system.									
	Course content		L hours	/ hc	∖E burs					
	Introduction. Types of indu structures		2		0					
	Production function and pro	oduction strategy			2		0			
	Strategies for new product product development.	introduction. Process of n	ew		3		3			
	Product lifecycle managem	nent			2		1			
	Basis of production and ma	anufacturing processes de	sign.		3		3			
	Types of production plans.	The cycles of production.			2		0			
		F			4		0			
Course content		ND CONTROL : Inventori	as in ar	_	4		3			
broken down in	independent demand	AND CONTROL. Inventorio	5 III ai	1	3		0			
detail by weekly class schedule	INVENTORY PLANNING A	AND CONTROL: Inventorie	es in ar	1	2		3			
(syllabus)	QUALITY MANAGEMENT				3		0			
	Second midterm exam				•		•			
	List of laboratory exercises					LE	hours			
	QFD metoda.						2			
	Project management: Proje techniques) and gantt char and activities. Project time diagrams	ect network diagrams (net) t. Project structure analysi management using projec	work pla s - proj st netwo	anning ect ph ork	l ases	s 4				
	Project management: Proje diagrams.	ect cost management usin	g proje	ct netv	vork		2			
	Project management: Reso	ource planning.					2			
	5S method						1			

Format of instruction	 ☑ lectures ☑ seminars and workshops ☑ exercises ☑ on line in entirety ☑ partial e-learning ☑ field work ☑ The presence on lectures and exercises in the am scheduled. Perform all laboratory exercises. Indivi 				epender timedia pratory k with m (othe	nt assignments nentor er)			
Student responsibilities	The presence on lec scheduled. Perform	tures ar all labor	nd exercis atory exe	ses in th rcises.	ne amou Individu	unt of at least 70 ual project tasks	0 % of the s complete	e times ed.	
Screening student	Class attendance	1,5	Researc	h		Practical traini	ng		
proportion of ECTS	Experimental work		Report			Individual work	(2,5	
credits for each activity so that the	Essay		Seminar essay	Seminar essay 0,5		Laboratory exe	ercises	0,5	
total number of ECTS credits is equal to the ECTS value of the course)	Tests	0	Oral exam		Preparation for laboratory exe	r rcises	0		
	Written exam	0	Project			(Other)			
Grading and evaluating student work in class and at the final exam	During semester the weeks of lecturing a take the first midterr access to the second points achieved at th Midterm exams are of and numerical proble oral form. The require midterm exam: M1 – first midterm gr M2 – second midter midterm Requirements for ac positively evaluated pass at least one of students take the wh conducted in writter problems. The teach requirement for pass represents minimal 5 Grade (%): Fina 50% - 60% suffi- 61% - 75% good 76% - 90% very 91% - 100% exce	Written exam0ProjectDuring semester there are two midterm exams. The weeks of lecturing and the second one is after the take the first midterm exam if he/she regularly attent access to the second midterm exam are: regularly at points achieved at the first midterm and positively ex Midterm exams are conducted in written form. They and numerical problems. The teacher reserves the oral form. The requirement for passing grade represend midterm exam:M1 – first midterm grade (%), i.e. percentage points M2 – second midterm grade (%), i.e. percentage points M2 – second midterm grade (%), i.e. percentage points midtermRequirements for access to the final exams are: positively evaluated individual seminar. In the two fip pass at least one of the midterm exams take part. In students take the whole exam regardless results of r conducted in written form. They consist of theor problems. The teacher reserves the right to hold a requirement for passing grade is positive assessment represents minimal 50% points on final exam.Grade (%):Final mark: 50% - 60% sufficient (2) 61% - 75% good (3) 76% - 90% very good (4) 91% - 100% excellent (5)					exam is The stude Requirements and seminoretical qui midterm e % points of e first mic d on the ded class lents that burth final exa s and nu n oral for itive asse	after 7 ent can ents for 25% of ar estions exam in on each lterm second es and did not exams ams are merical m. The ssment	
Required literature		Title	•			Number of copies in the library	Availabi other n	lity via nedia	
(available in the library and via other media)	J. B. Dilworth: Opera value in goods and s College Pub, 1999.	ations M services	anageme , South-V	ent: Prov /estern	viding	0			
	J. W. Stevenson: Pro Management, Irwin F	oductior Professi	/Operation	ons lishing,	1998.	1			

	R. G. Schroeder: Upravljanje proizvodnjom: Odlučivanje u funkciji proizvodnje, MATE d.o.o., Zagreb, 1999.	0	
Optional literature (at the time of submission of study programme proposal)	 B. Bilić: Predavanja postavljena na e-learning por ***"Inženjerski priručnik IP4 – sv. 3", str. 195-236, A. Vila, A., Z. Leicher: Planiranje proizvodnje i kor Zagreb, 1983. 	talu Školska knjiga htrola rokova",	a, Zagreb, 2002. Informator,
Quality assurance methods that ensure the acquisition of exit competences	 Keeping records of the attendance of students Annual evaluation of results in accordance with th Feedback from students via surveys Self-evaluation of teachers Feedback from students who have already graduation the course content 	e above learni ated related to	ing outcomes the relevance of
Other (as the proposer wishes to add)			

NAME OF THE COURSE	NUMERICAL SYNTHESIS	NUMERICAL SYNTHESIS IN ENGINEERING							
Code	FESL49	Year of study	5						
Course teacher	Prof.dr.sc.Damir Vučina	Credits (ECTS)	5						
Associate teachers	laor Pehnec	Type of instruction	L	S	AE	LE	DE		
		(number of hours)	45			15			
Status of the course	elective	Percentage of application of e-learning		_	-				
	COURSE	DESCRIPTION	-						
Course objectives	 Acquire theoretical foundations, methods and algorithms related to shape synthesis for given functionality by applying geometric modelling and multi-objective optimization Develop competences in applying computers in numerical synthesis in engineering Acquire capacity to competently apply numerical tools to engineering 						ape nulti-		
Course enrolment requirements and entry competences required for the course	Succesfully completed cou Optimization methods. Cor analysis and program deve	Succesfully completed courses equivalent to Computer-aided analysis and Optimization methods. Competences related to basic methods of engineering analysis and program development in C and MATLAB							
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - Formulate the en optimization - Model the problem functions	gineering problem as a a as a set of decision variab	paran oles, co	netric Instrair	mode nts and	l for s d excel	shape lence		

	 Model the ex Develop flov modelling, s Solve mul programmin Apply evolut Apply surrog Develop and using advan 	 Model the excellence using valuation methods Develop flowcharts for numerical workflows involving modula for geometric modelling, simulation (e.g.FEA) and optimization Solve multiobjective problems related to constrained non-linear programming Apply evolutionary optimization methods and metaheuristics Apply surrogate models replacing simulators, Develop and test complex models and numerical computational processes using advanced integral tools 							
	Course content					L or S	AE		
	Inroductory concepts	2				nours	nours		
	Modelling 2D shape	and cor	figuratio	n		<u>२</u>			
	Modelling 3D shape		ingulatio	•		3			
	Modelling functionali	ty and e	excellence	Э		3			
	Modelling project val	lue of pr	oject ele	ments		3			
	Shape optimization		,			3			
	Multi-objective optim	ization				3			
	Evolutionary algorith	ms and	operator	S		3			
Course content	Metaheuristics		•			3			
broken down in detail by weekly class schedule (syllabus)	Model reduction and surrogate models								
	Parameterization an	3							
	Numerical workflows	3							
	Engineering applicat	3							
	List of laboratory or design exercises						LE or DE hours		
	Introductory application examples								
	Modelling 2D and 3D shape and configuration								
	Modelling project value of project elements								
	Multi-objective optimization								
	Evolucijski algoritmi i operatori Metabeuristics								
	Surrogate models								
	Numerical workflows in shape optimization						3		
	Engineering applicati	ons					1		
		kahana		v indep	oendent assignmer	nts			
		renobe		🗆 mul	timedia				
Format of instruction	\Box on line in entirety			v labor	atory				
	□ partial e-learning			□ wor	k with mentor				
	□ field work				(other)				
Student responsibilities									
Screening student	Class attendance	3	Researc	h	Practical tr	aining			
proportion of ECTS	Experimental work		Report		Project wo	rk	2		
activity so that the	Essay		Seminai essay	•	(Oth	ner)			
ECTS credits is	Tests		Oral exa	ım	(Oth	ner)			
equal to the ECTS value of the course)	Written exam		Project		(Oth	ner)			

	Exam: theoretical and practical or project							
Grading and evaluating student	Grade(%) = 0,5*M1 + 0,5*M2 M1, M2 – percentage at mid-term exam and final exa	m respectively	ý					
work in class and at the final exam	50% do 61% (2) 62% do 74% (3) 75% do 87% (4) 88% do 100% (5)							
	Title	Number of copies in the library						
Required literature (available in the library and via other media)	-D. Vučina, 'Metode inženjerske numeričke optimizacije', Sveučilište u Splitu, FESB 2005							
	K. Deb, Multi-objective optimization using							
	Evolutionary Algorithms, Wiley, 2001							
	S. Haykin, "Neural Networks", Prentice Hall							
	International, 1999							
	D. Rogers, An Introduction to NURBS, Morgan							
	Kaufmann Publishers, 2000							
	-D. Vučina, 'Metode inženjerske numeričke optimizacije', Sveučilište u Splitu, FESB 2005							
Optional literature (at the time of submission of study programme proposal)	J. S. Arora, "Introduction to Optimum Design", McGra S.S. Rao, "Engineering Optimization", Wiley Interscie G. Farin, Curves and Surfaces for Computer Aided G Guide, Morgan Kaufmann Publishers/ Academic Pres A. Saxena, B. Sahay, Computer-aided engineering d	 Build Strength Streng						
Quality assurance	The annual analysis of examination efficacy. Student surve	ey in order to e	valuate teachers.					
methods that ensure	Self-evaluation of teachers. Feedback from students who	have already gr	aduated from the					
the acquisition of exit competences	relevance of the course content.							
Other (as the proposer wishes to add)	In English or Croatian language.							

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	Develop sets of HTM	IL files f	or the IS					2
	Scripting and Vbscrir	t oxam	nlos					2
	Databases modelling	n norm	alization					2
	SQL	g, nonn	anzation					2
	Active pages, ASP, a	pplicati	ons					2
	Integration of IS							2
Format of instruction	 ☑ lectures ☑ seminars and workshops ☑ exercises ☑ on line in entirety ☑ partial e-learning ☑ field work ☐ independent ☐ multimedia ☑ laboratory ☐ work with me ☐ (other 			nt assignments nentor er)				
Student responsibilities	The presence on lect Performed all require	tures in ed labor	the amou atory exe	unt of at rcises.	least 7	'0 % of the time	es sche	duled.
Screening student	Class attendance	3	Researc	h		Practical traini	ng	
proportion of ECTS	Experimental work		Report			Individual work	(2
credits for each activity so that the	Essay		Seminar essay			Laboratory exe	ercises	
ECTS credits is	Tests		Oral exa	m		Preparation for laboratory exe	r rcises	
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 we lecturing and the second one is after the next 6 weeks. Each midterm test correspective theoretical questions and numerical problems. The final tests correverall theoretical questions and numerical problems. In the final exams, stithat did not pass the midterm exams take part. The midterm and final exam carried out as written tests. The requirement for passing grade is the prevented out as written tests. The requirement for passing grade is the prevented out as written tests. The requirement for passing grade is the prevented out as carried (in percentage) is formed according to the formula: Grade(%) = 0.5 (M1 + M2) the activities in percentage: • M1, M2 – test results.					e positive am or the		
						Number of	Avail	ability via
		Title	•			copies in	Avail	ability via
						the library	ound	i meula
	D. Vučina, M. Šušnja	ar, M. U	vodić 'Uv	vod u				
Required literature	informacijske sustav	e', inter	nal mater	ial				
library and via other	Steven Alter, Inform	ation Sy	stems: F	oundation	on of			
media)	E-DUSINESS							
	Ch J. A. O'Brien, 'Ma Systems', Irwin Inc.	anagem	ent Inforn	nation				
	Online skripts: w3sc 'ASP', 'SQL'	hools - '	HTML', '∖	/BScript	,ı • ,			
Optional literature	 NCSA, 'A Beginn 	er's Gui	ide to HTI	ML', ili '				
(at the time of	HTML - An Intera	ictive Tu	utorial for	Beginne	ers'			
submission of study	 MS VBScript Tution 	urial						
proposal)	 MS ASP pages R. Leinecker, 'Using 	ASP.ne	et', Que, 2	2002				
Quality assurance	 Evaluation of res 	sults in a	accordanc	ce with t	he abo	ve learning out	comes	
methods that ensure	 Evaluation of results in accordance with the above learning outcomes Feedback from students via surveys 							

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

NAME OF THE COURSE	HEATING AND AIR CON	DITIONING						
Code	FESL23	Year of study	1					
Course teacher	Nižetić Sandro, Ph. D., Associate Professor	Credits (ECTS)	5					
	Ivan Tolj, Ph. D.,	Turne of in struction	L	S	AE	LE	DE	
Associate teachers	Dario Bezmalinović, Ph. D., Teaching assistant	(number of hours)	30	0	30	0	0	
Status of the course	Elective.	Percentage of application of e-learning						
	COURSE	E DESCRIPTION						
Course objectives	Training students for: - Categorization and - Compute and gene according to stand	l description of the HVAC eral design of the elements ards.	system inside	ns, the H	VAC s	ystem	IS	
Course enrolment requirements and entry competences required for the course	Thermodynamics 1, Mathematics 1, Mathematics 2.							
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	 Students will be able to: Consider base terms and issues related to the thermal comfort, Analyse and compute heat losses and gains according to the standards, Compare fuels in the HVAC systems, i.e. heating and cooling applications and elaborate their impact to the environment, Consider and compute base components of the heating/cooling, i.e. HVAC systems, 							
	Course content			L	or S	/ hc	AE ours	
Course content broken down in detail by weekly	Introduction and basic term comfort. External and intern conditions.	ns (issues) related to the th nal design temperatures. C	nermal Climate	2 h	ours	2 ho	ours	
(syllabus)	Calculation of the heat loss	ses.		2 h	ours	2 ho	ours	
	Calculation of the heat loss	Ses.		2 h	ours	2 ho	ours	

	Heating elements, c thermal load.	haracter	istics, co	rrectior	of the r	nominal	2 hours	21	nours
	Central heating systemetric emissions.	ems, ca	lculation	of the c	arbon d	ioxide	2 hours	21	nours
	Calculation and design of the pipelines in the heating systems.						2 hours	21	nours
	Boilers, types, classi	fication,	, boiler ro	oms.			2 hours	21	nours
	Other equipment of	the heat	ing syste	ms.			2 hours	21	nours
	Preparation of the hot water and calculation of the heating demands.						2 hours	21	nours
	Regulation of the he	ating sy	stems.				2 hours	21	nours
	Calculation of the he	eat gain.					2 hours	21	nours
	Fan coil devices, oth	er cooli	ng eleme	ents.			2 hours	21	nours
	Central water based chambers, coolants	air-con (refriger	ditioning ants)	system	s, clima	te	2 hours	21	nours
	Ventilation systems, components, calculation of the required airflow for ventilation purpose.					2 hours	21	nours	
	Heat pumps, absorp	tion coo	ling devi	ces.			2 hours	21	nours
	List of laboratory or	design e	exercises					LE ł	or DE
Format of instruction	 lectures seminars and work exercises on line in entirety partial e-learning field work 	rkshops		 ☑ inde ☑ mul □ labo □ wor □ 	epender timedia oratory k with m (othe	nt assignn nentor er)	nents		
Student	The presence on lea	tures in	the amo	unt of a	t least 7	'0 % of th	e times sch	edul	ed.
Screening student	Class attendance	eu audit ว	Researc	ercises.	2	Practical	training		
work (name the proportion of ECTS	Experimental work	۷	Report	11	2		Other)		
credits for each activity so that the	Essay		Seminal	r		(C	ý Dther)		
total number of ECTS credits is	Tests		Oral exa	am		(0	Other)		

equal to the ECTS value of the course)	Written exam	Project	1	(Other)			
Grading and evaluating student work in class and at the final exam							
		Title	Number of copies in the library	Availabi other r	lity via nedia		
	S. Nižetić, Online pr dio I i dio II, 2011, F	edavanja Grijanje i I ESB.	Klimatizacija	1			
Required literature (available in the library and via other media)	Recknagel, Sprenge Grijanje i klimatizacij Zagreb, 2005 (Prijev ASHRAE Handbook Systems and Equipr Atlanta, USA, 2001, Priručnik za Ventilac Priručnik za grijanje,	Recknagel, Sprenger, Schramek, Čeperković: Grijanje i klimatizacija 2005, Energetika marketing, Zagreb, 2005 (Prijevod sa njemačkog) ASHRAE Handbooks: Fundamentals, Applications, Systems and Equipment, Refrigeration, ASHRAE, Atlanta, USA, 2001, 2002, 2003, 2004 Priručnik za Ventilaciju I klimatizaciju, EGE, 2003. Priručnik za grijanje, EGE, 2005					
Optional literature (at the time of submission of study programme proposal)	Časopis: EGE, Ener Časopis: ASHRAE J	getika marketing, Za lournal, ASHRAE, A	agreb .tlanta, USA				
Quality assurance methods that ensure the acquisition of exit competences Other (as the	 Evaluation of Feedback from Self-evaluation Institutional a 	 Evaluation of results in accordance with the above learning outcomes Feedback from students via surveys Self-evaluation of teachers Institutional and non-institutional evaluations 					
proposer wishes to add)							

NAME OF THE COURSE	MACHINE TOOLS								
Code	FETL18	Year of study	1						
Course teacher	Dražen Bajić, Ph. D., Full Professor Sonja Jozić, Ph. D., Assistant Professor	Credits (ECTS)	5						
Associate teachers	Mario Veić, Teaching assistant	Type of instruction (number of hours)	L 45	S 0	AE 0	LE 15	DE 0		
Status of the course	Obligatory	Percentage of application of e-learning							
	COURSE	E DESCRIPTION							
Course objectives	 Training students for: understanding of basic possible application. acquisition of knowledge controlled machine too 	machine tool parts, types ge about the modular cons ls.	of mach	nine to of mo	ools a odern	nd the numei	ir rically		
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)	 present the principles of operation and application of machine tools characterize features of machine tools categorize features of mechanisms and systems management machine tools examine the exploitation characteristics of machine tools identify motives of high speed and multi-operation machine tools development designing of driving systems and mechanism in machine tools according to 						ols nent o		
	Course content				_ or S	/ bc	λE		
	Introduction to machine too	ols. State of the art and ma	chine		3				
	Basics of construction mac	ls	3						
	accuracy. Main parts of machine tools. Bearing elements, guides, apindle bearings								
	Driving system of machine	tools.			3				
	Machine tools control syste	em.			3				
Course content	Turning machines: Classifi	cation and basic concepts			3				
detail by weekly	Milling machines: Classifica	ation and basic concepts			3				
class schedule (syllabus)	First midterm exam Machine tools for drilling, b	roaching, sawing, grinding	J.		2				
(0)10000)	Machines for gear wheels Technical calculations relations	manufacturing. ted to the machine as the v	whole u	nit	3				
	and its particular parts.	omatic workniece change			3				
	Machine tools for high perf	ormance machining opera	tion.		3				
	High Speed machine tools.	Parallel kinematics for ma	achine		3				
	Basic concept of CNC proc	gramming. CAD/CAM intro	duction		3				
	Second midterm exam	-							

	List of laboratory or o	ist of laboratory or design exercises						
	Movement, typical pa the laboratory. Detern efficency	arts and minatior	mechani n of degre	sms of ee of ma	machine achine to	e tools installed ool workspace	in	2
	Determination of gea	rbox eff	iciency o	n drillin	g machi	ne.		2
	Testing of geometric on the machining acc	accurac	cy lathes	and dril	ls. Influe	ence of machine	e tool	2
	Rigidity of the system	n machir	ne-tool-w	oorkpie	ce.			2
	Determination of gea	rbox eff	iciency o	n turnin	g machi	ne.		2
	Zero point of the wor	kpiece a	and zero	point of	the tool	at vertical		2
	machining center.	rammin		ation a	ad mode	al production us	ina	
	3D printer.	lannin	g. Fiepai	allon al	iu moue	er production us	ing	2
	⊠ lectures						I	
	□ seminars and wor	rkshops			ependen	it assignments		
	⊠ exercises	-		⊠ mui	timedia			
Format of Instruction	□ on line in entirety				Jialory k with m	ontor		
	□ partial e-learning				K WIUT II			
	\Box field work				(Othe	<i></i>		
Student responsibilities	The presence on lect Performed all require	tures in ed labor	the amo atory exe	unt of a prcises.	t least 7	0 % of the time	s sche	duled.
Screening student	Class attendance	2	Researc	h		Practical trainir	ng	
proportion of ECTS credits for each activity so that the total number of ECTS credits is	Experimental work	0.5	Report I		Reports from the laboratory exercises		0.25	
	Essay		Seminar essay		(Other)		2.25	
	Tests		Oral exam		(Other)			
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 that did not pass the the entire exam. The tests. The requirement 5. Positive ass 6. 50 % points Grade (in percentag Grade(%) = 0,5 M1, M2 – test results Final grade is detern Percentage G 50% do 61% su 62% do 74% go 75% do 87% ve 88% do 100% ex	 There are two midterms and final exams. The first midterm exam is after 7 wee ecturing and the second one is after the next 6 weeks. In the final exams students hat did not pass the midterm exams take part. In the makeup exam students he entire exam. The midterm, final and makeup exams are carried out as wests. The requirements for passing grade is: 5. Positive assessment of laboratory exercises 6. 50 % points on each midterm exam or the final exam. Grade (in percentage) is formed according to the formula: Grade(%) = 0,5 (M1 + M2) M1, M2 – test results of first and second midterm exam. Final grade is determined according to: Percentage Grade 50% do 61% sufficient (2) 62% do 74% good (3) 75% do 87% very good (4) 						' weeks of s students dents take as written
Required literature		Title	•			Number of copies in	Availa	ability via
(available in the						the library	othe	r media
library and via other media)	Ekinović S., "Alatne Zenica, 2004.	mašine"	', Mašins	ki fakult	et,			

	Lopez de Lacalle, Lamikiz "Machine tools for high		
	performance machining", Springer, 2008.		
	Bajić, D., Jozić, S., Predavanja objavljena na		eLearning
	eLearning portalu, 2015.		portal
Optional literature (at the time of submission of study programme proposal)	Cebalo, R., "Alatni strojevi – Odabrana poglavlja", Vla - Pahole, I., Balič, J., "Obdelovalni stroji", Univerza	astito izdanje, . a v Mariboru, N	Zagreb, 2001. Iaribor 2003.
Quality assurance methods that ensure the acquisition of exit competences	 Evaluation of results in accordance with the abov Feedback from students via surveys Self-evaluation of teachers Institutional and non-institutional evaluations 	e learning out	comes
Other (as the proposer wishes to add)			

NAME OF THE COU	IRSE	ENGINEERII	NG MAINTENANCE					
Code	FETLC)4	Year of study	2				
Course teacher	Jani B Full Pr	arle, Ph. D., ofessor	Credits (ECTS)	5				
Associate teachers	Stipe F	Perišić,	Type of instruction	L	S	AE	LE	CE
	Teaching assistant (number of hours)	45	0	0	15	0		
Status of the course	Obliga	tory	Percentage of application of e-learning	0				
COURSE DESCRIPTION								
Course objectives	Upon completion the student will be able to critically evaluate and compare various concepts related to technical system life assessment, usage, maintenance and safety.							
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)	Stude 1. Eva 2. Cor 3. Linl 4. Est 5. Cor	nts will be able aluate different mment mainter k different relia imate availabil mpare impacts	e to: actions and suggest mainten nance procedures and risks bility and availability modeli ity and maintenance costs. on technical system endura	enance s associa ng conc ance.	strategy. ated with epts.	usage.		
Course content	Cours	e content					L hours	LE hours
detail by weekly	The role and scope of the maintenance engineering. Historical aspects, principles and applications of maintenance actions					3		

class schedule	(corrective, pre	eventive, p	predictive, pro	active). RCM a	and TPM		
(syllabus)	strategies. Bat						
	Maintenance-r	elated cas	se studies.				1
	Standards (IEC EN 61508). Maintenance assets register. Technical						
	performance ir	dicators.	Failure, failur	e cause, failure	e mode and	3	
	consequence. Failure Mode and Effect Analysis (FMEA) and Root						
	Cause Analysi	S (RCA).					4
	FMEA example	es.	<u> </u>	· · ·			1
	An overview of Nonparametric	the failur	e modes. Hur ate procedure	nan errors in n es and parame	tric life models.	3	
	Nonparametric	life data	analysis proc	edures - 1.			1
	Reliability and	availabilit	y data source	s, standards a	nd	2	
	recommendation	ons. Analy	sis of comple	ete and censor	ed data.	3	
	Nonparametric	life data	analysis proce	edures - 2.			1
	Parametric reli	ability mo	dels of compo	onent. Constar	t and time-		
	dependent fail	ure model	s (Exponentia	al, Weibull, Log	-normal).	3	
	Probability pion	data anal		Confidence in	leivai.		1
	Palametric life	uala alla	ysis - i.	diagrama (DE			1
	configuration a	nd redund	dancy models	diagrams (RE	su): serial	3	
	Parametric life data analysis - 2.						1
	Maintainability and Availability. Overview of the factors that						
	Maintainability case studies.						1
	Repairable iter	Repairable items. Markov model fundamentals. Load-sharing.					
System deterioration models with and without repair. Counting					. Counting	3	
	processes (HP	P and NH	IPP).		5		
	Examples of th	e repairal	ble items.				1
	Data sources a	and/or exp	ert judgment	s. Burn-In. Bay	esian analysis in	3	
	formal safety a	ssessmer	nt (FSA).			•	
	Reliability data	sources ·	- examples.				1
	The role and applications of technical diagnostics. Procedure, types,					3	
	Indicators and sensors.						1
	rechnical diagnostics case studies.						I
	Physical reliability models. Accelerated testing and burn-in procedures.					3	
	Covariate damage models.						1
	Planning, purchasing and storage of maintenance-related actions					3	
	and inventory.					5	
	Width and depth of spare parts stock.						1
	Optimal preventive maintenance scenarios and models.					•	
	Maintenance information system, documents and organization					3	
	Structure.						1
			ninai prevent		Se model.		I
				□ individual a	assignments		
	⊠ seminars an	d worksho	ops	🖂 multimedia			
Format of	⊠ exercises			⊠ laboratory			
Instruction		tirety		work with r	nentor		
	⊔ partial e-lear	ning		□ individual r	project (other)		
	⊔ tield work				,,		
Student responsibilities	Class attendar	ice, tests,	project prese	ntation and or	al exam.		
Screening student	Class	<u> </u>	. .		D		
work (name the	attendance	2,0	Research		Practical training		

proportion of ECTS credits for each	Experimental work		Report	0,5	Individual wor	k	2,0
activity so that the total number of	Essay		Seminar essay		Lab exercises	i	0,3
ECTS credits is equal to the ECTS	Tests	0,2	Oral exam		(Other)		
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-week sest classes and the second one is after the next 6 weeks. The first midterm is carried as written test on basic issues covered within the first session. The second midtern seminal paper on selected and more advanced topic. Selected topic must be discuss with respect to the course framework. The requirement for passing grade is the post assessment on each midterm exam (>49%) or the final exam. The final score is: $Score \ (\%) = 0, 35' \ A_1 + 0, 35' \ A_2 + 0, 20' \ A_3 + 0, 10' \ A_4$ $midterm 1: A_1 = 50 - 100 \ \%,$ $midterm 2 \ (seminal paper): A_2 = 50 - 100 \ \%,$ $class attendance: A_4 = 70 - 100 \ \%.$ Score $Grade$ $50\% - 62\% \ sufficient (2)$ $63\% - 76\% \ good (3)$ $77\% - 88\% \ very good (4)$ $89\% - 100\% \ excellent (5)$						
		Titl	e	c	opies in the library	other m	nedia
Required literature (available in the library and via other media)	Barle, J.: Reliat management, (<i>Pouzdanost u f</i> <i>sustava</i>), FESE	oility in ma student h <i>unkciji od</i> 8, Split, 20	aintenance andbook in Cro <i>ržavanja tehni</i> č)09.	oatian: Skih		e-learning	portal
Optional literature (at the time of submission of study programme proposal)	Rausand, M.; Høyland, A., "System Reliability Theory: Models, Statistical Methods, and Applications", 2nd ed., Wiley-Interscience, 2003. Ebeling, C., "An Introduction To Reliability and Maintainability Engineering", McGraw- Hill, 1996. Rausand, M., "Reliability of Safety-Critical Systems: Theory and Applications", Wiley, 2014						ods, :Graw- Wiley,
Quality assurance methods that ensure the acquisition of exit competences	 Evaluation of Feedback fro Self-evaluatic Institutional a 	results in m student on of teacl nd non-in	accordance w ts via surveys hers stitutional eval	ith the above uations	learning outco	nes	
Other (as the proposer wishes to							

NAME OF THE COURSE	NONCONVENTIONAL MACHINING PROCESSES								
Code	FETL22	Year of study	1						
Course teacher	Sonja Jozić, Ph. D., Assistant Professor	Credits (ECTS)	5						
		Type of instruction	L	S	AE	LE	DE		
Associate teachers		(number of hours)	45	0	0	15	0		
Status of the course	Elective	Percentage of application of e-learning	0						
	COURS	E DESCRIPTION							
Course objectives	Course objectives Training students for: - acquisition of basic knowledge of nonconventional methods in the field of machining acquisition of technical knowledge about possibilities of nonconventional machining processes in order to colving projecting problems in this area								
Course enrolment requirements and entry competences required for the course	None	None							
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	 Students will be able to: identify nonconventional machining processes and their application analyze the role of different types of energy in nonconventional machining processes identify the motive of application of nonconventional machining processes from the viewpoint of workpiece material create a diagram of nonconventional machining processes that connects the power source, working fluid and interaction with the workpiece material present machining system and the effects of nonconventional machining processes combine nonconventional machining processes according to the product requirements present application of nonconventional machining processes in modern 								
	Course content	Irse content							
	Introduction. Main terms, definitions and classification of						Juis		
	Mechanical processes. Ultrasonic machining. Water jet machining. Abrasive jet machining.								
Course content	Mechanical processes. Abrasive water jet machining. Ice jet machining. Magnetic abrasive finishing.								
broken down in detail by weekly	Chemical processes. Cher Electropolishing.	al millin	g.	3					
class schedule (syllabus)	Electrochemical processes Electrochemical drilling.	ng.		3					
(0)10000)	Thermal processes. Electro material removal. The mac	hanism	of	3					
	I nermal processes. Electro machining. Application of E	odiscarge machining. Type EDM.	es of		3				
	Thermal processes. Laser LBM. Types of industrial la material.		3						

	Thermal processes.	Thermal processes. Laser beam machining. Mechanism of material removal. Application of the LBM						
	Thermal processes. Electron beam machining. Plasma beam							
	machining. Ion beam	<u>n machir</u>	ning.			5		
	Comparison of differ	ent non	convention	onal ma	chining	3		
	nonconventional ma	quality a chining	nio eneci processe	s	01			
	Hybrid nonconventio	nal mac	chining pr	ocesse	S	3		
	Thermal assisted co	nventior	nal machi	ning pro	ocesses. Trends	3		
	of development of no	onconve	entional m	nachinin	g processes.			
	Second midterm exa	am						
	List of laboratory or o	design e	exercises				LE or DE hours	
	Mechanical processe Brodosplit	es - orga	inized stu	idents v	isit to the Shipyard	1	3	
	Thermal processes -	organiz	ed stude	nts visit	to the Shipyard Br	odosplit	3	
	Chemical processes	- demor	nstration				2	
	Electrochemical proc	esses -	demonst	ration	<u> </u>		2	
	Determining of the pa	aramete	rs of ultra	sound	and abrasive mach	nining	2	
	machining of the pa	aramete		liochen		schargeu	2	
	☑ lectures			🖂 inde	pendent assignme	ents		
Format of instruction	\Box seminars and wo	rkshops		⊠ mul	timedia			
				⊠ laboratory				
	□ on line in entirety			\Box work with mentor				
	□ partial e-learning □ (other)			(other)				
0								
responsibilities	Performed all require	ad labor	the amo	unt of a rcises.	least 70 % of the	times sche	eduled.	
Screening student	Class attendance	2	Researc	h	Practical tr	aining		
work (name the proportion of ECTS credits for each	Experimental work	0,25	Report		Reports fro laboratory (Other)	Reports from the laboratory exercises (Other)		
activity so that the total number of	Essay		Seminar essay		Preparatio lecturing	Preparation for lecturing		
ECTS credits is	Tests		Oral exa	ım	Individual	Individual work		
value of the course)	Written exam		Project		(Otl	(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 lecturing and the second one is after the next 6 weeks. In the final exams studen that did not pass the midterm exams take part. In the makeup exam students tak the entire exam. The midterm, final and makeup exams are carried out as writte tests. The requirements for passing grade is: 7. Positive assessment of laboratory exercises 8. 50 % points on each midterm exam or the final exam. Grade (in percentage) is formed according to the formula: Grade(%) = 0,5 (M1 + M2) M1, M2 – test results of first and second midterm exam. Final grade is determined according to: Percentage Grade 50% do 61% sufficient (2)						7 weeks of s students dents take as written	

	75% do 87%very good (4)88% do 100%excellent (5)Examination terms: according to the timetable.					
	Title	Number of copies in the library	Availability via other media			
Required literature (available in the library and via other media)	S. Jozić: "Nonconventional machining processes" lecturing, eLearning, 2015.	0	eLearning portal			
	H.A.G. El-Hofy, "Advanced Machining Processes", McGraw-Hill, 2005.	0				
	Walker, J., R., "Machining Fundametals", The Goodheart-Willcox Company, Inc. Tinley Park, Illinois, 2000.	0				
Optional literature (at the time of submission of study programme proposal)	 Hocheng H., Tsai H.Y. (editors) H.A.G. "Advanced An Machining", Springer Science+Bussiness Media New Čuš, F., "Postopki odrezavanja", Univerza v Mari Maribor, 2009. 	nalysis of Non VYork, 2013. boru, Fakultet	traditonal a za strojništvo,			
Quality assurance methods that ensure the acquisition of exit competences	 Keeping records of class attendance Evaluation of results in accordance with the above learning outcomes Feedback from students via surveys Self-evaluation of teachers Feedback information from graduated students 					
Other (as the proposer wishes to add)						

NAME OF THE COURSE	MANUFACTURING PRO	CESS PLANNING								
Code	FETL25	Year of study	1.							
Course teacher	Nikola Gjeldum, Ph. D., Assistant Professor	Credits (ECTS)	5							
	Marina Crniac, Teaching	Type of instruction	L	S	AE	LE	DE			
Associate teachers	assistant	(number of hours)	45	0	0	0	15			
Status of the course	Obligatory	Percentage of application of e-learning	0							
	COURSE DESCRIPTION									
	Training students to:									
Course objectives	 select raw material and machine tools for specific production batch design optimal manufacturing process know how to measure, sort and analyze process times in manufacturing process 									
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)	 analyze product design for manufacturing process design purposes select optimal size and shape of raw material determine type of production in relation to batch size determine elements of process times for batch production suggest contemporary manufacturing process and its ability test objectivity and accuracy of time measurement personnel detect cyclical, periodical and random production steps 									
	Course content					Lh	ours			
	Definition of production sys	stem, production and manu	ufactur	ing pro	cess.		2			
	Fundamentals of material flow design in the production process.									
	and group process steps, process step.									
	Definition of technology and technique. Cutting technologies.									
	Characteristics and levels of technologies and manufacturing									
	processes. Manufacturing	process capability.					-			
	The basic principles of mai	nufacturing process design	٦.				3			
Course content	Optimal sequence of man	idi. Ifacturing processes and p	rocoss	stone			∠ 3			
detail by weekly	Factors influencing on erro	rs in manufacturing processes and p	1000000	sieps			2			
class schedule	Selection of manufacturing	baselines	5505.				2			
(svllabus)	First midterm exam						2			
(),	Group technology.						2			
	Basics of Work and Time S	Study in production enterpr	ise.				2			
	The scale of business succ	cess in the enterprise.					1			
	Time standard. Componen	ts of working time.					2			
	Methods for determining th	e production (working) tim	e.				6			
	Performance rating.						1			
	The work of a worker on m	ultiple machines.					2			
	Types and analysis of loss	es during the work.					1			
	Implementation of better w	ork method.					2			
	Second midterm exa	am						2		
--------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------	-------------------------------------------------------	---------------------------------------------------------	----------------------------------------------------------------------------------------	---------------------------------------------------	-------------------------------------------------------------------		
	List of design exercises D							DE hours		
	Design example of m	anufact	uring pro	cess.				3		
	Detailed elaboration	of manu	ufacturing	proces	s, raw r	naterial selection	on,	ر م		
	tools selection and ca	alculatic	on of proc	ess tim	e.			5		
	Autonomous student individual project tasl	s work (<s< td=""><td>on manuf</td><td>acturing</td><td>) docum</td><td>entation for</td><td></td><td>7</td></s<>	on manuf	acturing) docum	entation for		7		
	☑ lectures			⊠ inda	nondor					
	□ seminars and wor	rkshops			pender	it assignments				
	⊠ exercises			⊠ Inui ⊠ lobo	unieula					
Format of Instruction	□ <i>on line</i> in entirety				natory kuwith n	antar				
	□ partial e-learning									
	☐ field work				(Our	51)				
Student	The presence on lec	tures in	the amo	unt of a	t least 7	0 % of the time	s sche	eduled.		
Sludeni	The presence exerci	ses in t	he amoui	nt of at l	east 80	% of the times	sched	uled.		
responsibilities	Individual project tas	sks com	pleted.							
Screening student work (name the	Class attendance	1	Researc	h		Practical traini	ng			
proportion of ECTS	Experimental work		Report			Individual work	K	2,7		
activity so that the	Essay		Semina essay	·		(Other)				
ECTS credits is	Tests	0,2	Oral exa	am		(Other)				
value of the course)	Written exam	0,1	Project		1	(Other)	(Other)			
	Positive assessmen minimal 50% points pass at least one of students take the wh conducted in writter questions and nume	t repres on final the mid- ole exa form. rical pro	sents mil exam. Ir term exar m regard Midterm oblems.	nimal 5 n the firs ns take less res exams	0% poi st two fi part. In ults of r and fin	nts on each m nal exams stud the third and fo nidterm exams. al exams cons	idterm lents tl ourth fi Final ist of	n exam or nat did not nal exams exams are theoretical		
Grading and			Grade (%) = 0,4	4D + 0,0	6E				
evaluating student work in class and at the final exam	 D – Individual project E – average points number of points act 	t grade achiev nieved c	(%) ed on m on the fina	idterm o al exam	exams expres	expressed as sed as a percer	a perc ntage.	entage or		
	E = (M1 + M2)/2 M1, M2 – average p	oints ac	hieved or	n midter	m exan	ns expressed as	s a pei	centage.		
	Grade (%): Final mark: 50% - 60% sufficient (2) 61% - 75% good (3) 76% - 90% very good (4) 91% - 100% excellent (5)									
						Number of	۵vəil	ability via		
Required literature		Title	•			copies in the library	othe	er media		
(available in the	Gjeldum, N.: "Tehno	loška pi	riprema p	roizvod	nje".		Ir	iternet		
library and via other	lectures on e-learnin	g, FESI	3 Split		. .		(e-l	earnina)		
media)	Gačnik, V., Vodenik	F.:Pro	piektirani	e tehnol	oških	10	(37		
	procesa". Tehnička l	kniida 7	Zagreb. 1	990						
	It									

	Taboršak, D., "Studij rada", Orgadata, Zagreb,	2					
	1994.						
	Car, M., Krznar, M., Šimon, K., "Studij rada – zbirka	1					
	zadataka i rješenja", Liber, Zagreb, 1983.						
Optional literature (at the time of submission of study programme proposal)	 Toboršak, D., Gornik, B., Čala, I., "Priprema pro Zagreb, 1974. Buchmeister, B., Polajnar, A.: "Priprava proizvoo Fakulteta za strojništvo, Maribor, 2000. Polajnar, A., "Študij dela", Univerza v Mariboru, Maribor, 1999 WEB catalogues 	izvodnje", Inže Inje za delo v Fakulteta za s	enjerski biro, praksi", trojništvo,				
Quality assurance methods that ensure the acquisition of exit competences	 keeping records of the attendance of students annual evaluation of teachers periodical evaluation of individual project advance feedback from students via surveys self-evaluation of teachers institutional and non-institutional evaluations 	ment					
Other (as the proposer wishes to add)							

NAME OF THE COURSE	MATERIAL SELECTION										
Code	FETL27	ETL27 Year of study 1									
Course teacher	Dražen Živković, Ph. D., Full Professor	Dražen Živković, Ph. D., Full Professor 5									
Associato toachore	Nikša Čatipović, mag.ing.	Type of instruction	L	S	AE	LE	DE				
Associate teachers	Zvonimir Dadić mag.ing.	(number of hours)	30	16	14	0	0				
Status of the course	Obligatory	Percentage of application of e-learning	30								
	COURSE	E DESCRIPTION									
Course objectives	Introducing studen - lifecycle of product - technical materials - factors influencing - diagrams of materials aesthetic condition - material selection r - optimization metho - selection of product	ts with: s and materials, and their properties, the choice of the material al properties, according to legal, techni s, methods, ods for materials selection, ction processes.	produc cal, ecc	ct, onomic	s, hum	nan and	d				
Course enrolment	Completed undergraduate	Mechanical engineering s	tudies.								
entry competences											

required for the					
course	Students will be able to:				
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	 determine the selecting methodology for real products materials, chose the methods for selecting materials both from the point of view of and production processes, analyze the life cycle of the product, describe and identify the factors that influence the selection of materials 	products			
	Course content	L hours			
	Lifecycle of material. Materials and energy. Ecological factors in materials selection. Materials and industrial design. Development of engineering materials.	2			
	Surfaces and their contacts. The basics of friction theory.	2			
	Significance of wear mechanisms in material selection. Selection Materials selection according with tribological principles.	2			
	development technologies. Original shape. Adaptive - developmental design. Design tools and material data.	2			
	Engineering materials. Material properties (mechanical, thermal, electrical, optical, ecological).	2			
	Materials property diagrams: thermal conductivity - thermal capacity; thermal expansion - thermal conductivity; thermal expansion - Young- module; strength - maximum working temperature;	2			
	Materials property diagrams: tear and wear; friction coefficient; consistency of wear - hardness; material cost chart; Young's module - cost of materials; strength - cost of materials				
	The basics of material selection. Selection principles. Harmonization of shape requirements. Selection of appropriate material groups according to the shape limitation.				
Course content	Selection ranking using the goal function. Searching for detailed information. Material Indexes. Material selection procedure.				
broken down in detail by weekly class schedule	Materials selection by computer program. Structure indexes. Selection of production procedure. Classification of production procedures. Shaping procedures. Joining procedures. Finishing operations.	2			
(syllabus)	Systematic selection process for material processing. Selection process diagram. Diagrams: materials - processes; process - shape; processes - mass area; processes - wall thickness; processes - tolerances; processes - surface roughness.	2			
	Ranking the cost-cutting process. Economic criteria for selection of producing processes. Cost forming. Search and selection of producing process using a computer program.	2			
	Material selection in case of multi-criteria limitations. Usability and constant conversion function.	2			
	Materials selection and shapes. Factors of shape. Micro structural factors of shape. Shapes usability limits.	2			
	Materials and industrial design. Pyramid requirement. Product characterization. Use of materials and producing processes to achieve product uniqueness.	2			
	List auditory exercises	AE hours			
	Analysis of tribological system and materials selection.	2			
	Concept - development - detailed elaboration.	2			
	Material selection procedure.	2			
	Application of material property diagrams.	2			
	Multiple limitations and contradictory goals.	2			
	Solving computer tasks using CES-EduPack - demo software	2			
	Selection of material handling procedures. Materials selection and shapes. Economic criteria for process selection.	2			

	Ecological principles	in mate	erials sele	ection.				
Format of instruction	 ☑ lectures ☑ seminars and workshops ☑ exercises ☑ on line in entirety ☑ partial e-learning ☐ field work ☑ independent assignments ☑ multimedia □ laboratory □ work with mentor □ (other) 							
Student responsibilities	The presence in lect	ures an	d exercis	es in th	e amou	nt of at least 70)%.	
Screening student work (name the	Class attendance	1	Researc	:h		Practical traini	ng	
proportion of ECTS	Experimental work		Report			Self-directed le	earning	2,5
activity so that the total number of	Essay		Seminai essay	•	0,53	Auditory exerc	ises	0,47
ECTS credits is	Tests	0,5	Oral exa	ım		(Other)		
equal to the ECTS value of the course)	Written exam		Project			(Other)		
Grading and evaluating student work in class and at the final exam	During the semeste after 7 weeks of cla final exam students test is carried out as evaluation are: posit earned on each test term exams. Percentage - Rating 50% to 61% - suff 62% to 74% - goo 75% to 87% - very 88% to 100% - exc The final grade is de students who did no final exam in the aut the whole lectures. To obtain it on an additi	During the semester there will be two mid-term exams (tests). The first mid-term, after 7 weeks of classes and the second after the next 6 weeks of classes. At the final exam students have to take part material that did not pass the mid-term. Each test is carried out as written exam lasting 45 minutes. The requirements for a positive evaluation are: positively evaluated seminar papers and at least 50% of the points earned on each test. The final grade is based on the resulting percentage on mid-term exams. Percentage - Rating 50% to 61% - sufficient (2) 62% to 74% - good (3) 75% to 87% - very good (4) 88% to 100% - excellent (5) The final grade is determined at the end of the examination deadlines. The students who did not pass the exam in the summer exam period have a correction final exam in the autumn exam period. At the final exam the students have to pass the whole lectures. The exam lasts 90 minutes. Students wanted higher grade may						id-term, . At the positive e points on mid- o pass de may
Required literature (available in the		Title	•			Number of copies in the library	Availabi other r	ility via nedia
media)	D. Živković, the auth	ior's lect	ure, FES	В			E-lear port	rning tal
Optional literature (at the time of submission of study programme proposal)	1.Filetin, T., Izbor ma 2.Ashby, M.F., Mate Science & Techno	aterijala rials Sel plogy Bo	pri razvo lection ar poks, 201	ju proiz Id Mecł I6.	voda, F nanical I	SB, Zagreb, 20 Design, 5 th editi	000. Ion, Elsev	vier
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 COU	IRSE	HYDRAULIC	AND PNEUMATIC SYSTE	MS					
Code	FETL1	7	Year of study	1					
Course teacher	Jani B Full Pr	arle, Ph. D., ofessor	Credits (ECTS)	5					
Associate teachers	Alen K Teach	lovač, ing assistant	Type of instruction (number of hours)	L 30	S 0	AE 0	LE 15	CE 15	
Status of the course	Electiv	/e	Percentage of application of e-learning	0					
		(COURSE DESCRIPTION						
Course objectives	Upon hydra schen syster solvin	completion the ulic or pneuma natic diagram a m elements by g.	e student will be introduced tic systems. They will be at and to demonstrate ability to symbol and function and to	to esser ole to dra o identify o use tha	ntial feat aw, expla hydraul t skills fo	ures of ain and lic or pn or fault f	industria assemb eumatic inding a	il le nd	
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)	Stude 1. Pre pn 2. Ide 3. Arra 4. Cor 5. Crit sy 6. Dev	ents will be able esent general neumatics. ntify component ange and asse mbine various tically assess stems. velop hydraulic	e to: concepts associated with in the of the system and draw mble simple hydraulic and p elements with respect to siz workability and supportabilit or pneumatic system.	ndustrial related s oneumat e and d ty of con	l appliac symbols. tic syste esign co nplex hy	ms. ms. draulic	hydrauli and pne	ics and	
	Cours	e content				L	LE	CE	
	Histor Introd pneur	ical aspect and uction to pneu natics.	d scope of hydraulics and p matics. Basic physical princ	neumation iples of	CS.	2	nours	nours	
	Typica	al pneumatic s	ystems demonstrations.				2		
	Comp Symb	oressed air gen ols.	eration and distribution. Sta	Indards	and	2			
	Comp	pressed air gen	eration and distribution.					2	
Course content	contro	ol and direction	al control valves).	ressure		2			
broken down in	Metho	ods for develop	ment of pneumatic systems	6.				2	
detail by weekly	Basic	elements of p	neumatic systems (direction	nal contr	ol	2			
(syllabus)	valves	s, valve actuati	on types, accessories).		toni	-			
	exerci	complex pneul ises)	matic circuits (introduction to	o labora	tory			2	
	Basic	elements of p	neumatic systems (cylinders	s and mo	otors).	2			
	Circuit assembling on pneumatic didactic table (auided).								
	Electr pneur	ic valves and e natics.	electropneumatic systems. F	Proportic	onal	2			
	Circui	t assembling o	n pneumatic didactic table.				2		
	Introd hydra of hyd	uction to hydra ulics, oils and t traulic systems	aulics. Basic physical princip theoretical background. Ene s. Fundamental hydraulic pro	oles of ergy effic oblem <u>s:</u>	ciency	2			

	cleanness, tem	perature,	cavitation - b	pubble entrainm	nent and			
	evacuation.			4:				
	I ypical hydrau	lic system	is demonstra				2	
	Hydraulic elem	ents for e	nergy conver	rsion: cylinders	, pumps	2		
	Hydraulic elem	5111.		2				
	Basic control e	lements i	n hydraulics:	check valves, o	direct	-	-	
	acting and pilot	t operated	d pressure-re	lief valves.		2		
	Hydraulic elem	ents and	their most im	portant parts.			2	
	Basic control e	lements in tional con	n hydraulics: trol valves, p	direct acting a	nd pilot ors. flow	2		
	control valves.		, p.		,			
	Hydraulic cyline	ders - par cylinder n	allel and seri	es circuit. d load				2
	Typical design	solutions	of hydraulic	elements for er	nerav			
	conversion (cyl	linders, pu	umps and mc	otors with const	ant and	2		
	Typical hydrau	lic circuits	: accumulato	r holding, pum	р			2
	unloading, brak	king, cour	ter balance.	Hydraulic press	ses.	0		-
	Pressure contr	ol circuits	. Flow and sp	beed control cir	CUITS.	2		0
	Flow control cil	rcuits (intr		aboratory exerc	cises).	0		2
	Closed flow hy	draulic cir	Cults. Load s	ensing (LS) sys	stems.	2		
	throttle valve. S	Speed cor	ntrol with two	and three-way	flow		2	
	⊠ lectures				<u> </u>			
	\square seminars and workshops							
Format of	⊠ exercises			⊠ Inditineuta ⊠ laboratory	L			
instruction	□ <i>on line</i> in entirety			\Box work with mentor				
	partial e-lear	ning		□ individual p	project (oth	er)		
	☐ field work				- J (- /		
Student	Minimum of 70	percent l	ecture attend	lance. Complet	ing all the r	equired	laborato	ory
responsibilities	exercises.							
Screening student work <i>(name the</i>	Class attendance	2,0	Research		Practical	training		
proportion of ECTS credits for each	Experimental work		Report		Individual	work		2,0
activity so that the total number of	Essay		Seminar essay		Preparation exercises	on for		0,8
ECTS credits is	Tests	0,2	Oral exam		(Other)			
value of the course)	Written exam		Project		(Other)			
	There are two r	nidterms	and final exar	ns. The first mid	dterm exam	n is after	7-week	session
	classes and the	e second	one is after th	ne next 6 week	s. The mid	terms are	e carried	d out as
	written tests, m	hade up o	of three quest	ions relating to	the basic	Issues a Is Tho r	nd sche	matics.
	passing grade	is the po	sitive assess	ment on each	midterm ex	(am (>49	9%) or t	he final
Grading and	exam.							
work in class and at	The final score	is:						
the final exam	2	Score (%)	$= 0,35' A_1$	+ 0,35' A_2 + 0), 20′ A ₃ +	0,10′ A	4	
	midterm 1	$A_1 = 50$	- 100 %.					
	midterm 2	$A_2 = 50$	– 100 %,					
	oral exam	$: A_3 = 50$	– 100 %.					
	• class attendance: $A_4 = 70 - 100 \%$.							

	Score Grade 50% - 62% sufficient (2) 63% - 76% good (3) 77% - 88% very good (4) 89% - 100% excellent (5)		
	Title	Number of copies in the library	Availability via other media
Required literature (available in the	Barle, J.: Hydraulics and pneumatics, (student handbook and workbook in Croatian: <i>Hidraulika i pneumatika</i>), FESB, Split, 2010.		e-learning portal
media)	Nikolić, G.: Pneumatika, Školske novine, Zagreb, 1994.		
	Koroman, V.; Mirković, R.: Hidraulika i pneumatika, Školska knjiga, Zagreb, 1991.		
Optional literature (at the time of submission of study programme proposal)	Lang, R.A. (ed.): Hydraulic Trainer 1; Planning Systems, Mannesmann Rexroth AG, 1998. Rabie, M.: Fluid Power Engineering, McGraw-H	and Design of Hydra Iill, 2009.	aulic Power
Quality assurance methods that ensure the acquisition of exit competences	 Evaluation of results in accordance with the at Feedback from students via surveys Self-evaluation of teachers Institutional and non-institutional evaluations 	oove learning outco	mes
Other (as the proposer wishes to add)			

NAME OF THE COURSE	DESIGN FOR ASSEMBLY								
Code	FETL26	Year of study	2						
Course teacher	Nikola Gjeldum, Ph. D., Assistant Professor	Credits (ECTS)	5						
	Marina Crnjac, Teaching		L	S	AE	LE	DE		
Associate teachers	assistant. Ivan Peko, Teaching assistant.	Type of instruction (number of hours)	30	0	0	0	30		
Status of the course	Elective	Percentage of application of e-learning	0 %						
	COURSE	DESCRIPTION							
Course objectives	 Objectives: Understanding and app Teach students to design software Teach student to design of assembly process 	lication of Design for Asse on a product with its eleme n a product taking into acc	embly ents in ount a	basic p Sieme simpli	orincipl ens NX icity an	es CAD id suit	ability		
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: design a product eleme connect designed product generate designed product redesign a product accord make an assembly product 	nts in Siemens NX CAD s uct elements in assembly (luct drawings ("drawing") ording to assembly proces cess plan for designed pro	oftwar ("asse s requ duct	e ("pa mbly d iiremer	rt desig lesign'' nts	gn"))			
	Course content					L ho	ours		
	Introduction and basic princ	iples. Historical developm	ent of	produ	ct		2		
	assembly process	SS							
	Product architecture						2		
	Product design for assembly								
	Methods of product design for assembly								
	Measures and tolerances in assembly process								
Course content	Product design modification	S					1		
broken down in detail by weekly	Assembly process						2		
class schedule	First midterm exam					2	2		
(syllabus)	Making a plan for manual as	ssembly process				2	2		
	Chart of assembly process	traceability					2		
	Organizational structures in	manual assembly process	S			2	2		
	Lean methods for assembly	r processes				2	2		
	vevelopment from primary working groups	abor division phase to aut	onom	ous			2		
	Balancing of assembly proc	ess workstations				2	2		
Second midterm exam							2		

	List of design exerc	ises					DE	hours
	Introduction in Siem	nens NX	CAD soft	ware				2
	Part design in Siem	ens NX						8
	Assembly design in	Siemer	ns NX					10
	Generating product	drawing	gs in Sieme	ens NX				4
	Simulation in Sieme	ens NX						2
Format of instruction	 ☑ lectures ☑ seminars and workshops ☑ exercises ☑ on line in entirety ☑ partial e-learning ☑ field work □ independent assignments ☑ multimedia ☑ laboratory □ work with mentor □ (other) 							
Student responsibilities	The presence on le scheduled.	ctures a	and exercis	es in th	e amoui	nt of at least 70) % of the	times :
Screening student work (name the	Class attendance	1	Research			Practical traini	ng	1
proportion of ECTS credits for each	Experimental work		Report			Individual work	ĸ	2,7
activity so that the	Essay		Seminar e	essay		(Other)		
ECTS credits is	Tests	0,2	Oral exam	exam (Other)				
value of the course)	Written exam	0,1	Project			(Other)		
	weeks of lecturing a exams students tha third and fourth fin midterm exams. Th individual project ar minimal 50% points Final exams are co of theoretical quest	and the and the al exan ne requ nd positi s on ea nductections and	s two mide second on t pass at le ns student irements fu ive assess ch midtern d numerica	e is afte ast one s take or pass ment in n exam form. N I proble	or minimum er the ne of the r the who ing grad exam. F or minimum Aidterm ms.	e hist miderin ext 6 weeks. In nidterm exams ble exam rega de are positive Positive assess mal 50% point exams and fina	the first tr take par rdless re assessr ment rep s on fina al exams	wo final t. In the sults of nent of resents I exam. consist
Grading and evaluating student work in class and at the final exam	Grade (%) = (D + E) / 2 D – Individual project grade (%) E – average points achieved on midterm exams expressed as a percentage or							
	number of points achieved on the final exam expressed as a percentage. E = (M1 + M2)/2 M1, M2 – average points achieved on midterm exams expressed as a percentage.							
	Grade (%): Final mark: 50% - 61% sufficient (2) 62% - 74% good (3) 75% - 87% very good (4) 88% - 100% excellent (5)							
Required literature (available in the		Tit	le			Number of copies in the library	Availabi other r	lity via nedia
library and via other media)	Gjeldum, N.: "Dizaji learning, FESB Spl	n za mo it	ontažu", lec	tures or	n e-		Interne learn	ət (e- ing)

	Marinescu, I., Boothroyd, G.: "Product design for	1						
	manufacture and assembly", Marcel Dekker, New							
	York, 2002.							
	Whitney Daniel E .: "Mechanical Assemblies – Their	1						
	Design, Manufacture, and Role in Product							
	Development", Massachusetts Institue of							
	Technology, Oxford University Press, 2004.							
Optional literature (at the time of submission of study programme proposal)	 A.J.D.Lambert Surendra M. Gupta: "Disassembly Maintenance, Reuse, and Recycling", CRC Press Molloy, O., Tilley, S., Warman, E.: "Design for ma Concepts, architectures and implementation, Spr Media, 1998. WEB publications on DFA 	/ Modeling for s, 2000. anufacturing a inger Science	Assembly, Ind assembly – I + Bussines					
Quality assurance methods that ensure the acquisition of exit competences	 keeping records of the attendance of students annual evaluation of teachers periodical evaluation of individual project advancement feedback from students via surveys self-evaluation of teachers institutional and non-institutional evaluations 							
Other (as the proposer wishes to add)								