U N I V E R S I T Y O F S P L I T

FACULTY OF ELECTRICAL ENGINEERING, MECHANICAL ENGINEERING AND NAVAL ARCHITECTURE

DETAILED PROPOSAL OF THE STUDY PROGRAMME

GRADUATE UNIVERSITY STUDY IN AUTOMATION AND SYSTEMS

SPLIT, July 2017

CONTENT

GENERAL INFORMATION OF HIGHER EDUCATION INSTITUTION

Name of higher education institution	FACULTY OF ELECTRICAL ENGINEERING, MECHANICAL ENGINEERING AND NAVAL ARCHITECTURE
Address	Ulica Ruđera Boškovića 32
Phone	021 305 777
Fax	021 305 776
E.mail	dekanat@fesb.hr
Internet address	htpp://www.fesb.hr

GENERAL INFORMATION OF THE STUDY PROGRAMME

Name of the study programme	AUTOMATICS AND SYSTEMS		
Provider of the study programme	FACULTY OF ELECTRICAL ENGINEERING, MECHANICAL ENGINEERING AND NAVAL ARCHITECTURE		
Other participants			
Type of study programme	Vocational study programme ☐	University study programme ☒	
Level of study programme	Undergraduate ☐	Graduate ☒	Integrated ☐
	Postgraduate ☐	Postgraduate specialist ☐	Graduate specialist ☐
Academic/vocational title earned at completion of study	Master of Engineering in Automation and Systems; mag. ing. el.		

1. INTRODUCTION

1.1. Reasons for starting the study programme

Automation is a branch of science which deals with problems of automatic control of engineering systems and encompasses analysis, synthesis and implementation of control units, as well as wide area of control theory. As multidisciplinary and interdisciplinary systematic field, automation uses and consolidates scientific achievements and practical knowledge from electrical engineering, electronics, computing, information-communication technologies, mechanical engineering, materials technology, information systems, biosystems and advancements in mathematics and physics. With the aim of emphasising this systematic approach, the graduate study is titled *Automation and Systems*.

Graduates who complete the graduate university study programme in Automation and Systems acquire the competencies for research and application of methods, conceptions, and contemporary information technologies in modelling, simulation and control of systems in the wide scope of human activities. There is virtually no area of human activity in which there is no need for automated systems or automated procedures (engineering, economic, social, medical systems). Through development of new technologies that enable the remote transfer of information, voice, image and data transfer using wireless networks and through development of microelectronics, new and almost indefinite possibilities are opened, providing access to new procedures which facilitate day-to-day work activities and life, but also influence the advancement of economy. The knowledge of these type of experts is the foundation for healthy economy and advancement of any contemporary society, this being the reason why this area is often emphasised as priority development area in a number of countries.

An important feature of the graduate university study programme in Automation and Systems is the wide scope of application of fundamental knowledge acquired during the undergraduate studies in electrical engineering and information technology, and which knowledge is deepened during the graduate university studies, through completing the coursework at professional courses.

Following the completion of the graduate university study programme in Automation and Systems, employment opportunities are open in the industrial sector as well as various public institutions. The study programme can also be followed by further academic advancement of students at postgraduate studies in research or specialist fields.

1.2. Relationship with the local community (economy, entrepreneurship, civil society, etc.)

The goal of the proposed university study programme Automation and Systems is to educate professional staff in the area of automatic control of systems to meet the demands of the industry, governmental and other public institutions. As multidisciplinary and interdisciplnary systematic field, automation uses and

consolidates scientific achievements and practical knowledge from electrical engineering, electronics, computing, information-communication technologies, mechanical engineering, materials technology, information systems, biosystems and advancements in mathematics and physics. With the aim of emphasising this systematic approach, the graduate study is titled *Automation and Systems*.

One of the basic tasks of the Faculty is the education of young professionals who will use their knowledge, skills and abilities to become stakeholders in the economic and general development of local and wider community. Having been training leading professionals for more than 55 years, the Faculty successfully accomplished its task, providing necessary staff to participate in the development of economy sectors based on different branches of engineering. The Faculty trained professionals who significantly contributed to economic development in the region, thus supporting the region to initiate and successfully develop high-tech based production activities with its own human resources potential. Successful development of new technologies influenced the development of all engineering sciences, especially the interdisciplinary areas such as automatic control. Experts educated at FESB have been designing automated systems based on new technologies, especially the information technology. Early developments started back in 1966, with the purchase of the first computer funded by local enterprises and establishment of the Computer Centre at FESB. This was the first computer purchased in town and the first installed computer at a higher education institution in Croatia, representing a major breakthrough which allowed for gaining valuable experience, not only in teaching and research activities at the Faculty, but also in IT education and can be considered as the starting point in development of IT sector in the region. Professionals trained at FESB are the founders of a number of companied based on automation technology and ICT companies in the Split-Dalmatia County and town of Split.

There is virtually no area of human activity in which there is no need for automated systems or automated procedures (engineering, economic, social, medical systems). Through development of new technologies that enable the remote transfer of information, voice, image and data transfer using wireless networks and through development of microelectronics, new and almost indefinite possibilities are opened, providing access to new procedures which facilitate day-to-day work activities and life.

Following the completion of the graduate university study programme in Automation and Systems, employment opportunities are open in the industrial sector as well as various public institutions. The study programme can also be followed by further academic advancement of students at postgraduate studies in research or specialist fields.

Split is the economic and university hub of the entire Dalmatian region, as well as one part of the neighbouring region of Bosnia and Herzegovina. FESB is the only higher education institution in the region which delivers the university graduate study programme awarding the master's degree in automatics and systems.

1.3. Compatibility with requirements of professional organizations

The study programme is compatible with the requirements of the Croatian chamber of electrical engineers.

1.4. Name possible partners outside the higher education system that expressed interest in the study programme

FESB is a signatory to a number of cooperation agreements with the aim of promoting academic and educational activities, concluded with private enterprises and public organisations, e.g. Ericsson Nikola Tesla, Hrvatska elektroprivreda (national power company), Split-Dalmatia County, Ministry of Defence, Energy institute “Hrvoje Požar”, Croatian Telecom, Croatian academic and research network - CARNet, Technology Centre Split, Brodosplit, Siemens, VIPnet, Microsoft Croatia, etc. It is important to note that the Croatian Armed Forces expressed a special interest in cooperation, since prospective officers are trained at the Faculty.

1.5. Financing

The study programme is financed by the Ministry of Science, Education and Sports

1.6. Comparability of the study programme with other accredited programmes in higher education institutions in the Republic of Croatia and EU countries

During the implementation of the university study programme in Automation and Systems, careful consideration is given to following the developments of higher education on the global level and especially in Europe. In the process of developing the new curriculum, special attention was given to consolidating the curriculum and course contents with other renowned foreign higher education institutions. There is an established system of educating experts in the field of automated systems, i.e. wider area of automation and systems in the world and in Europe, with different approaches. As a rule, the first stage is acquiring knowledge of mathematics and fundamental natural sciences, followed by specialist courses and certain non-engineering courses, of which courses in economics are of special interest. The study programme proposal is consolidated with the recommendations given in the framework of the ERASMUS project THEIERE (Towards the Harmonisation of Electrical and Information Engineering Education in Europe, http://www.eaeeie.org/theiere/).

The curriculum of the university study programme in Automation and Systems highly corresponds to the curricula of related fields of study and study programmes at renowned Croatian and European universities, e.g.:

- Faculty of Electrical Engineering and Computing at the University of Zagreb,
- Faculty of Electrical Engineering at the University of Osijek,
- Faculty of Engineering at the University of Rijeka,
- Faculty of Electrical Engineering at the University of Ljubljana,
- Faculty of Electrical Engineering and Computer Science, University of Maribor,

- Technische Univerzität Münich/ Technical University of Munich,
- Universita degli studi di Trieste/ University of Trieste, Italy.

The following study programmes should be specially listed: **L'Ecole doctorale en "Automatique et systèmes"** (System and Control) at Université catholique de Louvain in Belgium (http://www.ucl.ac.be/recherche/ecoles/ausy.html), which is titled indentically to the proposed study programme and the graduate study **Automaatio- ja systeemitekekniikan koulutusohjelma** (Automation and System Technology) at the Helsinki University of Technology, Finland (http://www.hut.fi/Units/AS/Studies/)

1.7. Openness of the study programme to student mobility (horizontal, vertical in the Republic of Croatia, and international)

Graduate university study programme in Automation and Systems enables vertical and horizontal mobility of students. In terms of vertical mobility, the programme can primarily be followed by the postgraduate university study in Electrical Engineering and Information Technology at FESB. Vertical mobility is enabled also for other related postgraduate study programmes. In terms of horizontal mobility, the graduate university study is open for mobility of students of related studies at all Croatian universities, including the Faculty of Electrical Engineering and Computing at the University of Zagreb, Faculty of Engineering at the University of Rijeka and the Faculty of Electrical Engineering at the University of Osijek. Students have the opportunity to complete a part of the study programme at a similar institution in Croatia or abroad. The comparability of the study programme with similar study programmes at the same level enables the students to fulfil a part of their course requirements at other higher education institutions in Croatia or abroad.

1.8. Compatibility of the study programme with the University mission and the strategy of the proposer, as well as with the strategy statement of the network of higher education institutions

Graduate university study programme in Automation and Systems Engineering conforms with the Strategy of the University of Split 2015-2020. In addition to mission and vision of the University of Split, in the process of defining strategic goals, the following strategic documents were taken into account as guidelines:

- EUROPA 2020 strategy for smart, sustainable and inclusive growth,
- Strategic documents of the European Research Area (ERA),
- Strategic documents of the European Higher Education Area (EHEA),
- Strategy of Education, Science and Technology of the Republic of Croatia.

Preparation of the study programme was done in line with the mission, vision and goals which are partly derived from the Scientific Strategy of the University of Split 2009 – 2014, document which promotes creation of internal development plans at the level of University constituents.

Graduate university study programme in Automation and Systems conforms with the development guidelines of the Faculty, as well as mission, vision and strategic goals defined in the FESB Development Strategy for the period 2012 – 2016, and is the only programme of this type at the University of Split and the wider region.

The proposed study programme conforms with the strategic document Network of Higher Education Institutions and Study Programmes in the Republic of Croatia, which encourages launching new study programmes in STEM area, as automation is one of STEM disciplinary program areas.

1.9. Current experiences in equivalent or similar study programmes

FESB has extensive experience in delivering courses at similar programmes. Faculty of Electrical Engineering in Split was established in 1960, implementing a 2nd level study programme in electrical engineering, with programme duration of 8 semesters. After the integration with the studies in mechanical engineering and naval architecture, the Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture (FESB) was established in 1971. Since 1974 the Faculty has been a constituent part of the University of Split.

Continuous work at developing the curricula resulted in establishing a number of study programmes at undergraduate and graduate level. At the undergraduate study programmes in Electrical Engineering the programme was implemented in the following fields of study: Power Engineering and Electronic Engineering. The first three semesters of the study programme are identical for both fields of study, and the following semesters provide specialist courses with elective disciplines of study. The disciplines of study in Power Engineering are: Electric Drives and Facilities and Power Engineering Systems, and in Electronic Engineering: Automation and Systems, Electronic Communication Systems, Applied Electronic Engineering and Computer Technology.

In 1979 vocational study programmes were established at the Faculty (former level VI study programme) which are implemented since, with a pause during years 1998-2001.

Postgraduate study in the scientific field of electrical engineering was first introduced in 1969, in cooperation with the Faculty of Electrical Engineering in Zagreb, and since 1989 the programme is delivered independently at the Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture of the University of Split. The programme provided specialisation in the areas of telecommunications and computer information systems, electronics, power engineering and electromechanical engineering, automation and computing.

Continuous work at developing the curricula resulted in establishing a number of study programmes at undergraduate, graduate and postgraduate level, which are constantly supplemented by new elective courses.

Quality of education at FESB is confirmed by success and excellence of FESB engineers worldwide, including the most highly developed countries of the world. However, the most important is the fact that professionals trained at FESB represent a foundation of highly educated engineering labour force in the region.

2. DESCRIPTION OF THE STUDY PROGRAMME

2.1. General information

Scientific/artistic area of the study programme	Engineering sciences
Duration of the study programme	2 years
The minimum number of ECTS required for completion of study	120
Enrolment requirements and admission procedure	Completed undergraduate study programme in Electrical Engineering and Information Technology or completed other related undergraduate study programme with acquired at least 180 ECTS credits, with applicable classification procedure. For students who completed other related study programmes, in addition to requirements for enrolling specific courses, the Faculty Council may define additional admission requirements.

2.2. Learning outcomes of the study programme (name 15-30 learning outcomes)

The learning outcomes of the study programme are directly related to the learning outcomes of an individual course and represent learning outcomes to be achieved by each student who completes the graduate university study programme in *Automation and Systems*. The learning outcomes are aligned with the Croatian Qualification Framework Act and are listed as common learning outcomes and additional learning outcomes depending on the selected elective courses, in the areas of knowledge, skills and corresponding independence and responsibility.

KNOWLEDGE

1. To apply appropriate mathematical, physical and scientific principles in solving highly complex problems of controlled automated systems.
2. To apply advanced engineering knowledge and engineering principles in presenting and solving highly complex and original problems of controlled systems. To apply methods of standard and digitally controlled systems.
3. To apply acquired knowledge in identifying, formulating and solving highly complex engineering problems.
4. To develop innovative analytical methods and advanced modelling procedures in solving highly complex engineering problems.

5. To critically review the features of new and upcoming products and processes, as well as methods that enable independent and purposeful work.
6. By applying scientific principles, to design innovative experiments with the use of state-of-the-art technological solutions in the area of controlled systems, specifically the methods of remotely controlled systems.
7. To select optimal economically viable engineering solutions in the design and construction of highly complex automated systems, which require compromise between theoretical solutions and the practical possibilities.
8. To critically assess and provide arguments for the possibilities of applied techniques and methods and their limitations.

SKILLS

9. To apply advanced programming skills in solving highly complex controlled systems problems, especially using the possibilities of the internet environment.
10. To conduct complex experiments and measurements, analyse and interpret collected data and measurement results and give conclusions and proposals for solutions.
11. To manage simple multidisciplinary and international teams.
12. To prepare design documents and technical reports, using modern technologies.
13. To use the literature, databases and other sources of information.
14. To give a public presentation, to prepare a written report and present project results in Croatian and English.

INDEPENDENCE

15. To manage and lead development activities in the environment with unforeseen conditions.
16. To make decisions in uncertain conditions.
17. To work in the field and under unforeseen conditions

RESPONSIBILITY

18. To demonstrate awareness of the influences of engineering practice on the individual, society and environment.
19. To assume personal and team responsibility for strategic decision-making and successful performance and completion of tasks in unforeseen conditions.
20. To assume social and ethical responsibility during performance of tasks and the consequent results of those tasks.
21. To adopt and transfer new knowledge and technology.

ADDITIONAL LEARNING OUTCOMES ACHIEVED THROUGH ELECTIVE COURSES (APPLYING KNOWLEDGE ON AUTOMATION AND SYSTEMS)

1. To consolidate theoretical knowledge and practical skills in solving highly complex problems in the area of telemedicine, bio-cybernetics and bioelectrical systems.
2. To propose new procedures and new solutions for modernisation of industrial robots.
3. To develop innovative methods and software solutions for AI and digital processing and analysis of images and computers graphics.
4. To design advanced algorithmic solutions for regulating and controlling of vessels and vehicles.
5. To analyse physical phenomena in conceptions of modern physics.
6. To organise and manage the investigation of complex problems, in general the measurements and processing of signal, specifically in solar cells.
7. To design innovative solutions in the development, design, implementation and investigation of elements and devices of electronic and virtual instruments.

2.3. Employment possibilities

Following the completion of studies, the acquired knowledge enables the students to find employment in the industry, research institutes, software and ICT companies, education, healthcare, service industry, etc. There is virtually no working environment in which experts with completed university degree in Automation and Systems could not find employment and the labour market demand for this profile of experts are very high. This is especially relevant in this moment, with social and economic changes driving the development of new, small and medium technologically advanced enterprises that could serve as the new driving force for economic development. Graduates who complete the graduate university study programme in Automation and Systems are equipped with knowledge and skills for research and application of methods, concepts and stat-of-the-art information technology in modelling, simulation and control of systems in the wide scope of human activities. Following the completion of studies, fully educated experts are capable of solving the most complex engineering tasks and participating in scientific research. The demand for experts with these competences considerably exceeds the available number of educated experts in the region, Croatia and the world.

2.4. Possibilities of continuing studies at a higher level

After completing the graduate university study programme in Automation and Systems, graduates may continue their studies at the postgraduate study programme in Electrical Engineering and Information Technology at FESB or at any other related postgraduate study programme.

2.5. Name lover level studies of the proposer or other institutions that qualify for admission to the proposed study

Undergraduate university study programme in Electrical Engineering and Information Technology, field of study Automation and Systems or completed any other related study programmes with acquired at least 180 ECTS credits, with applicable classification procedure.

2.6. Structure of the study

The study programme is structured per semesters, lasting 4 semesters, two in each academic year. Each semester corresponds to 30 ECTS credits. Through first two semesters of the first year of study and the winter semester of the second year of study, in addition to required courses, the students select two elective courses per semester from the provided lists. The final component of the study programme is preparing and defending the diploma thesis. Preparing of the diploma thesis is the only workload in the summer semester of the second year of study. The conditions for enrolling a course are listed in the course table. Lectures are delivered in groups up to 100 students, auditory exercises and seminars in groups of 30 students and laboratory exercises in groups of 10 students.

2.7. Guiding and tutoring through the study system

During the course of study programme activities, students have access to all the Faculty services. For the purpose of timely and effective communication, notifications and information are provided to students through the e-learning portal.

2.8. List of courses that the student can take in other study programmes

The educational and research field of automation and systems is interdisciplinary, therefore in the list of required and elective courses for all semesters there is a list of courses from other university graduate study programmes at the Faculty (Electrical Engineering, Communication and Information Technology, Computer Engineering, Mechanical Engineering and Industrial Engineering) which students can select to expand the knowledge and skills acquired during the core courses. In accordance with the study programme, students may select any course from the provided list of elective courses, within the limits of planned ECTS credits. Students may, according to their personal preference, choose courses from other study programmes that are not part of the list, as elective courses which are not included in the standard workload of 30 ECTS credits per semester.

2.9. List of courses offered in a foreign language as well

Course tables for individual courses list the option of teaching a course in a foreign language.

2.10. Criteria and conditions for transferring the ECTS credits

Transfer or recognition of ECTS credits between related graduate university study programmes is allowed. The criteria and conditions for transferring the ECTS credits are regulated by the *Regulations on Studies and Study System at the University of Split*.

2.11. Completion of study

Final requirement for completion of study	Final thesis ☐ Diploma thesis ☒	Final exam ☐ Diploma exam ☐
Requirements for final/diploma thesis or final/diploma/exam	The requirement for applying for the diploma thesis is acquired 60 ECTS credits.	
Procedure of evaluation of final/diploma exam and evaluation and defence of final/diploma thesis	The diploma thesis is evaluated by the commission and the defence is public and held in the presence of the commission.	

2.12. List of mandatory and elective courses

List of courses								
Year of study: 1.								
Semester: I.								
STATUS	CODE	COURSE	HOURS IN SEMESTER*					ECTS
			L	S	AE	LE	DE	
Mandatory	FEMG01	Modern physics	30	0	0	30	0	4
	FELG01	Linear control systems	45	0	15	15	0	6
	FELG02	Computer systems	30	0	0	30	0	5
	FELG03	System identification	30	0	0	30	0	5
		Elective course 1**						
		Elective course 2**						
	Total		135	0	15	105	0	20
	*L = predavanja, S = seminar, AE = auditorne vježbe, LE = laboratorijske vježbe, DE = konstrukcijske vježbe							
****Izborni se predmeti mogu birati s predložene liste izbornih predmeta ovog studija.**								
Elective**	FELG32	Telemedicine and Biocybernetics	30	0	0	30	0	5
	FELG05	Industrial robotics	30	0	0	30	0	5
	FELG07	Electronic and virtual instrumentation	30	0	0	30	0	5
	FELG20	Computer methods in bioengineering	30	0	0	30	0	5
	FELH11	Artificial intelligence	30	0	0	30	0	5
	FELG30	Introduction to machine learning	30	0	0	30	0	5
	FETG01	Project management	30	0	30	0	0	5
	FELK04	Computer graphics	30	0	0	30	0	5
	FENI03	Measurements and signal processing	30	0	0	30	0	6
	FEMK01	Numerical analysis	30	0	30	0	0	5
	FELG09	Digital image processing and analysis	30	0	30	0	0	5
	Bira se: - **2 Elective courses**							
	*L = predavanja, S = seminar, AE = auditorne vježbe, LE = laboratorijske vježbe, DE = konstrukcijske vježbe							

List of courses								
Year of study: 1.								
Semester: II.								
STATUS	CODE	COURSE	HOURS IN SEMESTER*					ECTS
			L	S	AE	LE	DE	
Mandatory	FELG10	Digital control	45	0	30	0	0	6
	FELG11	Nonlinear control systems	30	0	30	0	0	5
	FELG12	Practicum of automatic control	15	0	0	45	0	4
	FELG13	Programmable logic controllers	30	0	0	30	0	5
		Elective course 1**						
		Elective course 2**						
	Total		120	0	60	75	0	20
	*L = predavanja, S = seminar, AE = auditorne vježbe, LE = laboratorijske vježbe, DE = konstrukcijske vježbe							
****Izborni se predmeti mogu birati s predložene liste izbornih predmeta ovog studija.**								
Elective**	FELG14	Operations research	30	0	0	30	0	5
	FELG15	CAD in automatic control	30	0	0	30	0	5
	FELG16	Digital instrumentation 2	30	0	0	30	0	5
	FETG02	Hydraulic and pneumatic systems	30	0	0	30	0	5
	FELG27	Modelling and control of vessels and ground vehicles	30	0	0	30	0	5
	FELG18	Computational intelligence (neuro-fuzzy-genetic systems)	30	0	0	30	0	5
	FELG19	Programming agents	30	0	0	30	0	5
	FELH35	Solar cells	30	0	0	30	0	5
	FENG01	Engineering economy	30	0	0	30	0	5
	FELH07	Digital systems projecting	30	0	0	30	0	5
	FENG02	Adaptive control	30	0	0	30	0	5
	FELG33	Optoelectronic measurement methods	30	0	0	30	0	5
	Bira se: -**2 Elective courses**							
	*L = predavanja, S = seminar, AE = auditorne vježbe, LE = laboratorijske vježbe, DE = konstrukcijske vježbe							

List of courses								
Year of study: 2.								
Semester: III.								
STATUS	CODE	COURSE	HOURS IN SEMESTER*					ECTS
			L	S	AE	LE	DE	
Mandatory	FELG21	Process control	45	0	30	0	0	6
	FELG22	Process control laboratory	15	0	0	30	0	4
	FELG23	Optimization and optimal systems	30	0	30	0	0	5
	FELG24	Microcontrollers and network embedded systems	30	0	0	30	0	5
		Elective course 1**						
		Elective course 2**						
	Total		120	0	60	30	0	20
	*L = predavanja, S = seminar, AE = auditorne vježbe, LE = laboratorijske vježbe, DE = konstrukcijske vježbe							
****Izborni se predmeti mogu birati s predložene liste izbornih predmeta ovog studija.**								
Elective**	FELG17	Bioelectrical systems and equipment	30	0	0	30	0	5
	FELG25	Mobile robotics	30	0	0	30	0	5
	FELG26	Multivariable control	30	0	0	30	0	5
	FENG03	Electric servo drives	30	0	0	30	0	5
	FELG29	Computer aided process control	30	0	0	30	0	5
	FETL23	Production management	30	0	30	0	0	5
	FELH13	Electronic circuits	15	0	15	30	0	5
	FEOG01	English language for academic purposes***	0	45	0	0	0	3
	FENG04	Energy storage systems	30	0	0	15	0	5
	FEXX06	Professional Training						5
	Bira se: - **2 Elective courses**							
	*L = predavanja, S = seminar, AE = auditorne vježbe, LE = laboratorijske vježbe, DE = konstrukcijske vježbe ***Može se upisati kao dodatni predmet jer mu je opterećenje 3 ECTS-a i s njime se **ne može zamijeniti neki od stručnih izbornih** predmeta koji imaju opterećenje 5 ECTS-a.							

List of courses								
Year of study: 2								
Semester: IV.								
STATUS	CODE	COURSE	HOURS IN SEMESTER*					ECTS
			L	S	AE	LE	DE	
	FEXX02	Diploma thesis						30
	Total							
*L = predavanja, S = seminar, AE = auditorne vježbe, LE = laboratorijske vježbe, DE = konstrukcijske vježbe								

2.13. Course description

NAME OF THE COURSE	ADAPTIVE CONTROL						
Code	FENG02	Year of study	2				
Course teacher	Ozren Bego, Ph.D., Associate Professor	Credits (ECTS)	5				
Associate teachers	Danijel Jolevski, Ph.D., Assistant Professor	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	30	0
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - understanding concept of adaptive control system and parameter identification, - analyze of adaptive control systems, - design of adaptive controller, - design of advanced digital control structures based on adaptive control principles.		
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: - define structure of adaptive control systems, - choose adaptive control concept according to defined requirements, - identify process parameters, - design control system with adaptive controllers, - analyze advances that results from adaptive control concept.		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L or S hours	AE hours
	Introduction in adaptive control systems. Concept of time variable process control.	2	0
	Structures od adaptive control systems.	2	0
	Process parameters identification. Defining of process structure.	2	0
	Recursive identification, least square method. Experiment execution, identification result validation.	2	0
	Deterministic adaptive controllers.	2	0
	Stochastic adaptive controllers.	2	0
	Self-adaptive controllers.	2	0
	First midterm exam	2	0
	Adaptive controllers with reference model (MRAS)	2	0
	Adaptive controller with gain scheduling.	2	0
	Predictive controllers – part 1.	2	0
	Predictive controllers – part 2.	2	0
	Examples of adaptive controller design.	2	0
	Examples of adaptive controller design.	2	0
	Second midterm exam	2	0
	List of laboratory or design exercises		LE or DE hours
	Identification of water tank parameters – experiment preparation		3
	Identification of water tank parameters – experiment execution, validation, analyze.		3
	Pole placement adaptive controller		3

	Gain scheduling controller -experiment preparation	3
	Gain scheduling controller -experiment execution, validation	3
	Self-adaptive controller with relay method	6
	Predictive controller	9

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		

Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*						
	Class attendance	1	Research		Practical training	
	Experimental work		Report		Laboratory attendance	1
	Essay		Seminar essay		Independent work	2
	Tests	0.5	Oral exam		Preparation for laboratory work	0.5
	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. In the final exams students that did not pass the midterm exams take part. The requirement for passing grade is the positive assessment of laboratory exercises and 50 % points on each midterm exam or the final exam. Grade (in percentage) is formed according to the formula: Grade(%) = 0,05 NP + 0,15 LV + 0,4 (M1 + M2) the activities in percentage: • NP - attendance at lectures, • LV – laboratory assessment, • M1, M2 – test results.

Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	O. Bego: Predavanja iz predmeta Adaptivno upravljanje, FESB		e-learning portal

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

<table>
<tr><td>NAME OF THE COURSE</td><td colspan="6">ARTIFICIAL INTELLIGENCE</td></tr>
<tr><td>Code</td><td>FELH11</td><td>Year of study</td><td colspan="5">1</td></tr>
<tr><td>Course teacher</td><td>Darko Stipaničev, Ph.D., Full Professor (60%)
Ljiljana Šerić, Ph.D., Assistant Professor (40%)</td><td>Credits (ECTS)</td><td colspan="5">5</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2">Toni Jakovčević, Ph.D., Assistant Professor</td><td rowspan="2">Type of instruction (number of hours)</td><td>L</td><td>S</td><td>AE</td><td>LE</td><td>DE</td></tr>
<tr><td>30</td><td>0</td><td>0</td><td>30</td><td>0</td></tr>
<tr><td>Status of the course</td><td>Elective</td><td>Percentage of application of e-learning</td><td colspan="5">80</td></tr>
<tr><td colspan="7">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="6">The aim of the course is to teach students basic knowledge in the field of artificial intelligence, ways of collecting and storing knowledge, to methods and algorithms by which this knowledge is used in solving complex tasks. In addition to an introduction to the theoretical foundations of artificial intelligence and illustrate the many applications in science and economy.</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="6">Basic knowledge of computers and programming.
To follow the College is necessary knowledge of English.</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="6">Students will be able to successfully mastering the subject:
1. Explain the differences between biological intelligence, artificial intelligence, computational intelligence and distributed intelligence.
2. Present complex tasks and prepare them for automatic solving them.
3. Understand the difference between data, information and knowledge and systems based on knowledge.
4. Explain the procedures of knowledge elicitation and knowledge storing using different types of mathematical logic (propositional logic, predicate logic, non-standard logic).
5. Apply the structural representation of knowledge, particularly semantic networks, frames, scenarios, stereotypes, and production rules.
6. Describe and present standard methods of solving tasks of artificial intelligence, especially methods of searching the knowledge base (undirected and directed search)
7. Apply logical reasoning, probabilistic reasoning, fuzzy reasoning
8. Apply simple machine learning tasks (unsupervised and supervised).
9. Write simple programs in programming languages and tools of artificial intelligence (Prolog, LISP, AIXML, Jess).
10. Describe the application of artificial intelligence, in particular through expert systems.</td></tr>
</table>

<table>
<tr><td rowspan="11">Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="4">Course content</td><td>L or S hours</td><td>LE hours</td></tr>
<tr><td colspan="4">Introduction to Artificial Intelligence - the name, history, related disciplines. Biological intelligence, the theory of multiple intelligences. The research area of artificial intelligence. The techniques of artificial intelligence and success criteria.</td><td>4</td><td>0</td></tr>
<tr><td colspan="4">Complex tasks and their preparation for solving using AI methods. Problem solving techniques using search (undirected and directed search)</td><td>4</td><td>0</td></tr>
<tr><td colspan="4">Knowledge and storage of knowledge – I part introduction, data, information, knowledge. Knowledge-based systems. Knowledge and storage of knowledge - II part mathematical logic (standard and non-standard logic).</td><td>4</td><td>0</td></tr>
<tr><td colspan="4">Logical reasoning. Probabilistic reasoning (probability, conditional probability, Bays networks, hidden Markov models). Fuzzy (fuzzy) reasoning.</td><td>6</td><td>0</td></tr>
<tr><td colspan="4">Knowledge and storage of knowledge - Part III structure storage knowledge (semantic networks, stereotypes, the script, frames, production systems).</td><td>2</td><td>0</td></tr>
<tr><td colspan="4">Machine learning (unsupervised and supervised)</td><td>4</td><td>0</td></tr>
<tr><td colspan="4">Examples of applications of artificial intelligence. Expert systems. Processing and understanding speech. Computer vision.</td><td>2</td><td>8</td></tr>
<tr><td colspan="4">The programming language LISP</td><td>0</td><td>15</td></tr>
<tr><td colspan="4">The programming language Prolog and expert system shell</td><td>0</td><td>15</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td>Format of instruction</td><td colspan="3">☒ ☒ lectures
☐ ☒ seminars and workshops
☒ ☒ exercises ☐ on line in entirety
☐ partial e-learning
☐ field work</td><td colspan="3">☐ independent assignments
☒ multimedia
☒ ☒ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">The presence on lectures in the amount of at least 70 % of the times scheduled. Performed all required laboratory exercises.</td></tr>
<tr><td rowspan="5">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>1,5</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Individual work</td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>Laboratory exercises</td><td>1,5</td></tr>
<tr><td>Tests</td><td></td><td>Oral exam</td><td></td><td>Preparation for laboratory exercises</td><td></td></tr>
<tr><td>Written exam</td><td>2</td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">The exam consists of a written part and if necessary additional oral exam. During the semester will be two tests. The first colloquium in 8 weeks of classes, the second at 18 weeks. A student can pass the course by these tests. In the two final exams in June and July, students who have not collected inadequate number of points through colloquia take the whole subject covered by the two tests. The condition for taking the final exam is successfully finished practical lab exercises.

The exam is comprehensive and includes the theoretical part of the material and tasks with auditory exercises. The condition for positive assessment is that the student has a total of at least 50% on the exam or when it must have a minimum 25% passing the theoretical part of the material and 25% of the deposited duties. If a student has less than 25% of the points on the tasks and / or less than 25% points from the theoretical part of the material again taken the entire exam.</td></tr>
</table>

<table>
<tr><td></td><td colspan="3">Students who did not pass the exam after two final exams can pass the exam in autumn periods. All test questions students will be known before the exam.

These rules apply equally to students who are enrolled this course for the first time and to those students who enter college for the second time.

The final grade is determined as follows:
percentage Rating
50% to 61% is sufficient (2)
62% to 74% good (3)
75% to 87% of very good (4)
88% 100% Excellent (5)

The first colloquium will take the material to the teaching units to the seventh week inclusive, and on the other the rest of the teaching weeks. Examinations are held in terms of the anticipated calendar of classes.

Under Article 65 of the Statute of the Faculty, the student is required to participate in all forms of teaching and attend: lectures at least 70% of classes. If she or he do not meet these requirements, the student will not be able to take the exam and get a signature.</td></tr>
<tr><td rowspan="6">Required literature (available in the library and via other media)</td><td>Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td>D.Stipaničev, Lj. Seric, Lectures from artificial intelligence, lecturing notes and internal textbook</td><td></td><td>e-learning portal</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">- A.Cawsey, The Essence of Artificial Intelligence, Prentice Hall, 1998.
- S.Russel, P.Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, 2nd Ed. 2002.
- AI on the Web (http://http.cs.berkeley.edu/%7Erussell/ai.html)
- American Association for Artificial Intelligence (www.aaai.org)</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">- Evaluation of results in accordance with the above learning outcomes
- Feedback from students via surveys
- Self-evaluation of teachers
- Institutional and non-institutional evaluations</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="3"></td></tr>
</table>

NAME OF THE COURSE	BIOELECTRICAL SYSTEMS AND EQUIPMENT						
Code	FELG17	Year of study	2.				
Course teacher	Mirjana Bonković, Ph.D., Full Professor	Credits (ECTS)	5				
Associate teachers	Zoran Valić, Ph.D., Full Professor	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	30	0
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for adoption and understanding of the basic knowledge of: - foundations of biomedical engineering as area that impinge on the various scientific disciplines such as biomechanics, biomaterials, medical imaging, rehabilitation engineering, biotechnology, tissue engineering and so on. - physiological principles underlying the formation of bioelectric signals which is necessary precondition for the functionality of medical diagnostic devices. - basic methods for bioelectric signals analysis and processing - functional components of typical diagnostic devices based on these analysis.	
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: - define the reasons and the principles causing the bioelectric signals formation. - define the sensors and their functionality for measuring the bioelectrical activity. - define the functionality of some of the typical medical diagnostic devices. - define and comment procedures which should be applied to the measured bioelectric signals to make them useful in diagnosis. - apply the appropriate procedures to remove the noise and / or detect specific occurrence from the measured signal	
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L or S hours
	Biomedical engineering: historical perspective.	2
	Anatomy and physiology.	2
	Bioelectric phenomenon.	2
	Biomedical sensors.	2
	Biomedical devices.	2
	Bioelectrical signals analysis and processing.	2
	Characteristics and methods for ECG, EMG, EEG and respiratory signals processing.	6
	Analysis and processing medical images.	4
	Devices for medical diagnostics.	4
	List of laboratory or design exercises	LE hours
	Biomedical sensors.	6
	Biomedical devices. Functional components (Sensors, ADC, processing unit)	4
	Bioelectrical signals analysis and processing.	6
	Physiological modeling.	2
	Biomechanics.	2
	Analysis and processing of medical images .	6

<table>
<tr><td>Format of instruction</td><td colspan="6">☒ lectures
☐ seminars and workshops
☒ exercises
☐ on line in entirety
☐ partial e-learning
☐ field work</td><td colspan="6">☐ independent assignments
☒ multimedia
☒ laboratory
☒ work with mentor
☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="12"></td></tr>
<tr><td rowspan="5">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td colspan="2">Class attendance</td><td>2</td><td colspan="2">Research</td><td></td><td colspan="2">Practical training</td><td></td></tr>
<tr><td colspan="2">Experimental work</td><td></td><td colspan="2">Report</td><td></td><td colspan="2">Individual work</td><td>0,6</td></tr>
<tr><td colspan="2">Essay</td><td></td><td colspan="2">Seminar essay</td><td>1</td><td colspan="2">Laboratory exercises</td><td>0,8</td></tr>
<tr><td colspan="2">Tests</td><td>0,2</td><td colspan="2">Oral exam</td><td></td><td colspan="2">Preparation for laboratory exercises</td><td>0,2</td></tr>
<tr><td colspan="2">Written exam</td><td>0,2</td><td colspan="2">Project</td><td></td><td colspan="2">(Other)</td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="12">During the semester there are two midterm exams. The first midterm exam is after 7 weeks of lectures and the second one is after 13 weeks of lectures (in a form of presentation and defense of the project assignment). Each midterm test (as well as the final test) is carried out in a written format with duration of 90 minutes. The requirement for passing grade is the positive assessment of laboratory exercises and 50 % points on average midterm exam ((M1 + M2)/2) or the final exam. Students are allowed to have at least 45% of total points on each midterm exams, as long as the final midterm average is at least 50% of total points.
Grade (in percentage) is formed according to the formula:

Grade(%) = 0,1L + 0,45M1 + 0,45M2

where:
• L – laboratory assessment,
• M1, M2 – midterm test results.

According to Article 65. of Faculty's Bylaw, student is required to participate in all teaching activities attending at least 70% of lectures, and 100% of laboratory exercises. If student does not meet these criteria, she or he won't be able to take part in the final exam, and will be required to enroll in the course the next year.</td></tr>
<tr><td rowspan="3">Required literature (available in the library and via other media)</td><td colspan="8">Title</td><td colspan="2">Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td colspan="8">J.D.Enderle, S.M.Blanchard, J.D.Bronzino: Introduction to biomedical engineering, Academic Press, 1999</td><td colspan="2"></td><td>e-learning</td></tr>
<tr><td colspan="8">Ante Šantić: Biomedicinska elektronika, Školska knjiga, Zagreb, 1995.</td><td colspan="2"></td><td>e-learning</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="12">- R. Palaniappan: Biological Signal Analysis (http://bookboon.com/en/introduction-to-biological-signal-analysis-ebook#download)</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="12">- Keeping records of student attendance.
- Annual analysis of course statistics in terms of midterm and finals exams.
- Feedback from students via surveys.
- Teacher self-evaluation.
- Feedback from graduated students (or senior students) on course content relevance.
- Periodic institutional evolution of course teachers.</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="12"></td></tr>
</table>

NAME OF THE COURSE	CAD IN AUTOMATIC CONTROL						
Code	FELG15	Year of study	1.				
Course teacher	Mojmil Cecić,. Ph.D., Full Professor Ana Kuzmanić Skelin, Ph.D., Assistant Professor	Credits (ECTS)	5				
Associate teachers	Tomislav Pezelj, mag. ing.	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	30	0
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students: - to develop an understanding of computers role in design of automatic control systems - to understand techniques and apply CAD tools for analysis and design of feedback control systems - to understand techniques and apply CAD tools for analysis and design of analog and digital electronic circuits
Course enrolment requirements and entry competences required for the course	- completed undergraduate course in classic linear control theory
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will able to: - apply knowledge of design process in classical control problems - use analytical methods and experimental simulation to solve simple automatic control tasks - use CAD tools to aid the design process - apply the MATLAB environment for modeling and simulating the automatic control system - apply EWB software for simulation of electronic components and circuits - apply PROTEL software for schematic capture

Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	Introduction: computers in automatic control	1	n/a
	VISSIM: fundamentals, block diagrams and its properties	1	n/a
	VISSIM: block arrangements and operations, simulation properties and parameters, basic mathematical operations	2	n/a
	VISSIM: setting and solving advanced mathematical operations, solving differential equations	2	n/a
	VISSIM: creating models hierarchy, advanced block diagrams, replacement blocks	2	n/a
	VISSIM analysis of different systems	2	n/a
	MATLAB-Simulink: fundamentals, block diagrams and its properties	1	n/a
	MATLAB-Simulink: block arrangements and its properties, simulation properties and parameters, basic mathematical operations, solving differential equations	2	n/a
	ELECTRONIC WORKBENCH (EWB): fundamentals, building elements and its properties	1	n/a
	ELECTRONIC WORKBENCH (EWB): simulation of analogue electronic circuits	2	n/a

	ELECTRONIC WORKBENCH (EWB): simulation of digital electronic circuits (TTL)	2	n/a
	ELECTRONIC WORKBENCH (EWB): simulation of digital electronic circuits (CMOS)	2	n/a
	PROTEL (Schematic Editor): fundamentals, representation of basic components	2	n/a
	PROTEL (PCB Editor): osnove, representation of basic components and it's characteristics	2	n/a
	PROTEL: simulation of analog and digital circuits	2	n/a
	List of laboratory or design exercises		LE hours
	VISSIM: block diagrams, solving differential equations		2
	VISSIM: simulation of simple configurations		2
	VISSIM: simulation of complex configurations		3
	MATLAB-Simulink: block diagrams, solving differential equations		2
	MATLAB-Simulink: simulation of simple systems		2
	MATLAB-Simulink: simulation of complex systems		3
	EWB: simulation of analogue circuit		3
	EWB: simulation of digital circuit		3
	PROTEL (Schematic Editor): drawing electric circuit scheme		3
	PROTEL (PCB Editor): drawing printed circuit scheme		3

Format of instruction	☒ lectures ☐ seminars and workshops ☐ exercises ☐ *on line* in entirety ☐ partial e-learning ☐ field work	☒ independent assignments ☐ multimedia ☒ laboratory ☒ work with mentor ☐ (other)
Student responsibilities	At least 70% attendance of the scheduled lecture hours is required. All laboratory assignments must be completed.	

Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*	Class attendance	2	Research		Practical training	
	Experimental work		Report		Independent work	2,5
	Essay		Seminar essay	0,2	(Other)	
	Tests	0,2	Oral exam		(Other)	
	Written exam	0,1	Project		(Other)	

Grading and evaluating student work in class and at the final exam	There are two midterm exams and final exam. The first midterm exam is after 7 weeks of lecturing and the second one is after next 6 weeks. Each midterm test consists of 3 problem questions. Students carry out tests using computers. Students that did not pass the midterm exams take part in final exam. Final exam consist of 6 problem questions. Grade is formed according to the number of correctly solved problem questions: 50 % points on midterm exams or the final exam is required for passing grade.

	Title	Number of copies in the library	Availability via other media
Required literature (available in the library and via other media)	VISSIM, User Guide	1	
	MATLAB-Simulink, User Guide	1	
	Electronics Workbench, User Guide	1	
	Cecić, M.: PROTEL, Interna skripta, FESB, Split, 2001	0	e-learning portal
Optional literature (at the time of submission of study programme proposal)	1. Zanchi, V.; Cecić, M.; Cecić, M.: Programska podrška linearnoj teoriji automatske regulacije, FESB-Split, 1990.		
Quality assurance methods that ensure the acquisition of exit competences	- Evaluation of results in accordance with 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	COMPUTATIONAL INTELLIGENCE (NEURO-FUZZY-GENETIC SYSTEMS)						
Code	FELG18	Year of study	1				
Course teacher	Darko Stipaničev, Ph.D., Full Professor (40%) Toni Jakovčević,Ph.D., Assistant Professo (30%) Marin Bugarić,Ph.D.(30%)	Credits (ECTS)	5				
Associate teachers	Dunja Gotovac,mag.ing (100%)	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	30	0
Status of the course	Elective	Percentage of application of e-learning	80				

COURSE DESCRIPTION

Course objectives	The aim of the course is to teach students basic knowledge in the field of computational intelligence, and above all in the theory and application of fuzzy (fuzzy) sets, artificial neural networks and genetic algorithms.
Course enrolment requirements and entry competences required for the course	Basic knowledge of computers and programming. To follow the College is necessary knowledge of English.
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to successfully mastering the subject: 1. Explain what is intelligence, computational intelligence, artificial intelligence and distributed intelligence. 2. Understand the theoretical basis of the theory of fuzzy sets. Basic definitions and mathematical operations. Fuzzy set, fuzzy relations, composition of fuzzy relations. Fuzzy production systems. Linguistic modelling based on fuzzy sets. The application of fuzzy sets in modelling, control, forecasting, decision-making. 3. Understand the theoretical foundations of artificial neural networks (ANN). Types of networks and their division. Setting weight. The activation functions. Hebb network. Perceptron. Associates sample. Learning algorithms (Hebbean rule, delta rule). Neural networks based on competition. Adaptive Resonance Theory. The neural network of the type "Back-propagation". Application of ANN in signal processing, pattern recognition, business. 4. Understand the theoretical foundations of evolutionary processes in nature (genetic code, cross correlation and mutation). Genetic algorithms as an example of artificial evolutionary process. A simple genetic algorithms (the fitness function, selection procedures, genetic operators). Adaptive genetic algorithms. Parallel genetic algorithms. Selection Procedures (proportional selection, ranking selection, elimination tournament selection). Application of genetic algorithms.

	Course content	L or S hours	LE hours
Course content broken down in detail by weekly class schedule (syllabus)	Intelligence, computational intelligence, artificial intelligence and distributed intelligence.	2	0
	Introduction to the theory of fuzzy sets. Basic definitions and mathematical operations. Fuzzy set, fuzzy relations, composition of fuzzy relations. Fuzzy production systems. Linguistic modelling based on fuzzy sets. The application of fuzzy sets in modelling, contol, forecasting, decision-making.	8	0
	Introduction to the theory of artificial neural networks (ANN). Types of networks and their division. Setting weight. The activation functions. Hebb network. Perceptron. Associates sample. Learning algorithms (Hebbean rule, delta rule). Neural	8	0

	networks based on competition. Adaptive Resonance Theory. The neural network of the type "Back-propagation". Application of ANN in signal processing, pattern recognition, business.		
	Introduction to the theory of of evolutionary processes in nature (genetic code, cross correlation and mutation). Genetic algorithms as an example of artificial evolutionary process. A simple genetic algorithms (the fitness function, selection procedures, genetic operators). Adaptive genetic algorithms. Parallel genetic algorithms. Selection Procedures (proportional selection, ranking selection, elimination tournament selection). Application of genetic algorithms.	6	0
	Simulation exercises on the theory of fuzzy sets (Matlab)	0	9
	Simulation exercises on the theory of artificial neural networks (Matlab)	0	9
	Simulation exercises on the theory of genetic algorithms (Matlab)	0	8

Format of instruction	☒ ☒ lectures ☐ ☒ seminars and workshops ☒ ☒ exercises ☐ *on line* in entirety ☐ partial e-learning ☐ field work	☐ independent assignments ☒ multimedia ☒ laboratory ☐ work with mentor ☐ (other)
Student responsibilities	The presence on lectures in the amount of at least 70 % of the times scheduled. Performed all required laboratory exercises.	

Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*						
	Class attendance	1,5	Research		Practical training	
	Experimental work		Report		Individual work	
	Essay		Seminar essay		Laboratory exercises	1,5
	Tests		Oral exam		Preparation for laboratory exercises	
	Written exam	**2**	Project		(Other)	

Grading and evaluating student work in class and at the final exam	The exam consists of a written part and if necessary additional oral exam. During the semester will be two tests. The first colloquium in 8 weeks of classes, the second at 18 weeks. A student can pass the course by these tests. In the two final exams in June and July, students who have not collected inadequate number of points through colloquia take the whole subject covered by the two tests. The condition for taking the final exam is successfully finished practical lab exercises. The exam is comprehensive and includes the theoretical part of the material and tasks with auditory exercises. The condition for positive assessment is that the student has a total of at least 50% on the exam or when it must have a minimum 25% passing the theoretical part of the material and 25% of the deposited duties. If a student has less than 25% of the points on the tasks and / or less than 25% points from the theoretical part of the material again taken the entire exam. Students who did not pass the exam after two final exams can pass the exam in autumn periods. All test questions students will be known before the exam. These rules apply equally to students who are enrolled this course for the first time and to those students who enter college for the second time. The final grade is determined as follows: percentage Rating 50% to 61% is sufficient (2) 62% to 74% good (3) 75% to 87% of very good (4)

<table>
<tr><td></td><td colspan="3">88% 100% Excellent (5)

The first colloquium will take the material to the teaching units to the seventh week inclusive, and on the other the rest of the teaching weeks. Examinations are held in terms of the anticipated calendar of classes.

Under Article 65 of the Statute of the Faculty, the student is required to participate in all forms of teaching and attend: lectures at least 70% of classes. If she or he do not meet these requirements, the student will not be able to take the exam and get a signature.</td></tr>
<tr><td rowspan="6">Required literature (available in the library and via other media)</td><td>Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td>lectures on FESB e-learning system</td><td></td><td>e-learning portal</td></tr>
<tr><td>W.Pedrycz, Fuzzy Control and Fuzzy Systems, J.Wiley & Sons Inc. New York 1989.</td><td></td><td></td></tr>
<tr><td>Laurene V. Fausett, Fundamentals of Neural Networks, Prentice Hall, 1994.</td><td></td><td></td></tr>
<tr><td>D.E.Goldberg, Genetic Algorithms in Search, Optimisation and Machine Learning, Addison-Wesley Pub. Co., Inc., Reading, Mass., 1989.</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">Computational Intelligence – the logical approach (http://www.cs.ubc.ca/spider/poole/ci.html)</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">- Evaluation of results in accordance with the above learning outcomes
- Feedback from students via surveys
- Self-evaluation of teachers
- Institutional and non-institutional evaluations</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="3"></td></tr>
</table>

FELG29	Computer aided process control - BETTI

NAME OF THE COURSE	COMPUTER GRAPHICS						
Code	FELK04	Year of study	1.				
Course teacher	Vladan Papić, Ph.D., Full Professor	Credits (ECTS)	5				
Associate teachers	Denis Štajduhar, mag. ing.	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	30	0
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - understanding of basic principles and algorithms of computer graphics, - understanding of computer graphics technologies, - design and applications of computer graphics algorithms in C programming language and utilization of graphical libraries in programming..
Course enrolment requirements and entry competences required for the course	None
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - explain graphical pipeline, - analyse basic algorithms of computer graphics, , - connect sequence of graphical transformations in order to achieve needed transformation for view, - recommend type of shading and animation in order to achieve desired result, - critical argue on possibilities and limitations of various display and hardcopy technologies, - model simpler objects with computer modelling software tools, , - create simpler animations with software tools, - create simpler computer programs for object presentation using graphical libraries.

Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	Uvod	2	
	Image elements, vector and raster systems, interactive graphics concept	2	
	Basic algorithms of computer graphics	2	
	Primitives filling and clipping	2	
	Graphical hardware	4	
	Antialiasing	2	
	Geometric transformations	2	
	Objects in 3D space	2	
	Curves and surfaces	3	
	Lightning and shading	3	
	Animation	2	
	List of laboratory exercises		LE hours
	Introducton to OpenGL		4
	OpenGL exercise: Animation		2
	OpenGL exercise: Textures		2
	OpenGL exercise: Texture filters		2
	OpenGL exercise: Ligthing and interaction		2
	OpenGL exercise: Color blending		2
	OpenGL exercise: 3D		4
	Blender: modelling		4
	Blender: animation		4

<table>
<tr><td>Format of instruction</td><td colspan="3">☒ lectures
☐ seminars and workshops
☐ exercises
☐ on line in entirety
☐ partial e-learning
☐ field work</td><td colspan="3">☒ independent assignments
☒ multimedia
☒ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">The presence on lectures in the amount of at least 70 % of the times scheduled. Performed all required laboratory exercises.</td></tr>
<tr><td rowspan="5">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>1,5</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Individual work</td><td>1,4</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>0,8</td><td>Laboratory exercises</td><td>0,5</td></tr>
<tr><td>Tests</td><td>0,2</td><td>Oral exam</td><td></td><td>Preparation for laboratory exercises</td><td>0,5</td></tr>
<tr><td>Written exam</td><td>0,1</td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">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. In the final exams students are answering parts they did not pass in the midterms. The midterm and final exams are carried out as written tests and it lasts for max. 60 minutes.
The requirement for passing grade is 50% points on each midterm exam or final exam, written and accepted seminar work and positive assessment of laboratory exercises. In final grading (in percentage), each midterm exam contributes with max. 30%, seminar work with max. 30%, lab. exercises with max. 10% out of total possible points (30%+30%+30%+10%).
Final grade is formed in the following way:
Percentage Grade
50% to 61% sufficient (2)
62% to 74% good (3)
75% to 87% very good (4)
88% to 100% excellent (5)</td></tr>
<tr><td rowspan="4">Required literature (available in the library and via other media)</td><td colspan="3">Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td colspan="3">T Papić, V.: Introduction to computer graphics, Faculty textbook, 2013. (in Croatian)</td><td></td><td>e-learning portal</td></tr>
<tr><td colspan="3"></td><td></td><td></td></tr>
<tr><td colspan="3"></td><td></td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6">J.D.Foley, A.Dam, S.K.Feiner, J.F.Hughes, Computer Graphics: Principles and Practice (second edition in C), Addison-Wesley Publishing Company, 1996.
D.Hearn, M.P.Baker, Computer Graphics, C Version, Prentice Hall; 2nd edition, 1996.
F.S.Hill, Jr. i S.M. Kelley, Computer Graphics Using OpenGL, 3rd edition, Pearson education, 2007.
Shreiner, D., Woo, M., Neider, J., Davis, T., OpenGL vodič za programere, Kompjuter biblioteka, 2007.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="6">- Evaluation of results in accordance with the above learning outcomes
- Feedback from students via surveys
- Self-evaluation of teachers
- Institutional and non-institutional evaluations</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="6"></td></tr>
</table>

NAME OF THE COURSE	COMPUTER METHODS IN BIOENGINEERING						
Code	FELG20	Year of study	1.				
Course teacher	Vladan Papić, Ph.D., Full Professor	Credits (ECTS)	5				
Associate teachers	Josip Musić, Ph.D., Assistant Professor	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	30	0
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - understanding of standard computer-based methods used in biomechanics and bioengineering. - Application of simple data processing and visualization methods as well as system simulation methods in biomechanics.	
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 working principles of systems for data acquisition and processing; - Interpret standard signals measured during movements; - Compare measured and expected movement signals; - Critically discuss processed data; - Evaluate measured signals using digital image analysis; - Write computer program for calculation of anthropometric data using finite elements method.	
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L or S hours
	Introduction to measurements, data acquisition and processing.	2
	Signals and systems for human movement.	4
	Statistical methods of data interpretation.	4
	Digital image based processing and data interpretation.	8
	Data classification.	2
	Data visualization.	2
	Anthropometric data and calculation based on finite elements method..	2
	Examples.	6
	List of laboratory or design exercises	LE or DE hours
	Introduction to MATLAB	2
	Signal processing in MATLAB	2
	Image processing: Siluettes (Matlab)	2
	Image processing: Anthropometry (Matlab)	2
	Image processing: Movements (Matlab)	2
	Statistical classification methods I (Matlab)	2
	Statistical classification methods II (Matlab)	2
	Simulation of bilogical systems (Matlab – Simulink and Vissim)	2
	Individualn project – seminar work	14

<table>
<tr><td>Format of instruction</td><td colspan="3">☒ lectures
☐ seminars and workshops
☐ exercises
☐ on line in entirety
☐ partial e-learning
☐ field work</td><td colspan="3">☒ independent assignments
☒ multimedia
☒ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">The presence on lectures in the amount of at least 70 % of the times scheduled. Performed all required laboratory exercises.</td></tr>
<tr><td rowspan="6">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>1,5</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Laboratory exercises</td><td>1,2</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>1</td><td>Individual work</td><td>0,5</td></tr>
<tr><td>Tests</td><td>0,2</td><td>Oral exam</td><td></td><td></td><td>0,5</td></tr>
<tr><td>Written exam</td><td>0,1</td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td></td><td colspan="5"></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">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. In the final exams students are answering parts they did not pass in the midterms. The midterm and final exams are carried out as written tests and it lasts for max. 60 minutes.
The requirement for passing grade is 50% points on each midterm exam or final exam and positive assessment of laboratory exercises. In final grading (in percentage), each midterm exam contributes with max. 25%, seminar work with max. 40%, lab. exercises with max. 10% out of total possible points (25%+25%+40%+10%).
Final grade is formed in the following way:
Percentage Grade
50% to 61% sufficient (2)
62% to 74% good (3)
75% to 87% very good (4)
88% to 100% excellent (5)</td></tr>
<tr><td rowspan="3">Required literature (available in the library and via other media)</td><td colspan="3">Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td colspan="3">V.Papić, Computer methods in bioengineering, FESB (in Croatian)</td><td></td><td>e-learning portal</td></tr>
<tr><td colspan="3"></td><td></td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6">MATLAB tutorial, Mathworks.
M. Seul, L. O'Gorman, M.J. Sammon, Practical Algorithms for Image Analysis: Description, examples and code, Cambridge University Press, 2000.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="6">- Keeping records of student attendance.
- Annual analysis of course statistics in terms of midterm and finals exams.
- Feedback from students via surveys.
- Teacher self-evaluation.
- Feedback from graduated students (or senior students) on course content relevance.</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="6">/</td></tr>
</table>

NAME OF THE COURSE	COMPUTER SYSTEMS						
Code	FELG02	Year of study	1				
Course teacher	Maja Štula, Ph.D., Full Professor Toni Jakovčević, Ph.D., Assistant Professor	Credits (ECTS)	5				
Associate teachers		Type of instruction (number of hours)	L	S	AE	LE	DE
			30			30	
Status of the course	Obligatory	Percentage of application of e-learning	10%				

COURSE DESCRIPTION

Course objectives	Training students for: - Acquiring knowledge on computer architectures (PC, microcontrollers) and their usage - Understanding execution of automatization applications - Acquiring basic knowledge necessary for developing automatization applications on PC architecture
Course enrolment requirements and entry competences required for the course	Knowing at least one programming language
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - Explain computer architecture and computer systems working principles - Present bus protocols and periphery units - Explain computer application flow of execution and interaction with users - Use PC-control systems for automatization of simple processes - Develop PC application for automatization with GUI - Compare different PC architectures for automatization system realization

Course content broken down in detail by weekly class schedule (syllabus)

Course content	L or S hours	AE hours
Computer architectures	2	0
Operating systems role	2	0
Visual studio IDE tool	2	0
C# programming language basics	4	0
User interface	3	0
Event-driven applications development	3	0
Permanent data storage	2	0
Periodic application execution	2	0
PC-control computer system, architecture, working mode and possibilities	2	0
Developing PC-control .NET application	4	0
Distributed control systems	2	0
Communication standards (RS-232, USB, CAN)	2	0

List of laboratory or design exercises	LE hours
IDE tools usage	2
Developing basic .NET application with user interface	2
Developing basic .NET application with event handling	2
Adding user controls	2
Developing .NET application with permanent data storage	3
Periodic application execution with C# Timer control	3

	Developing application with PC MotorBee system for DC motor control	4
	Developing application with PC SteperBee system for step motor control	4
	Developing application with sound sensor	4
	Developing application with light sensor	4

Format of instruction	☒ lectures ☐ seminars and workshops ☒ exercises ☐ *on line* in entirety ☐ partial e-learning ☐ field work	☐ independent assignments ☐ multimedia ☒ laboratory ☐ work with mentor ☐ (other)
Student responsibilities	The presence on lectures in the amount of at least 70 % of the times scheduled. Performed and uploaded on e-learning portal all required laboratory exercises.	

Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*						
	Class attendance	2	Research		Practical training	0,5
	Experimental work		Report		(Other)	
	Essay		Seminar essay	1	(Other)	
	Tests	0,5	Oral exam	1	(Other)	
	Written exam		Project		(Other)	

Grading and evaluating student work in class and at the final exam	There are two midterms and final exams duration of 90 minutes. The first midterm exam is after 7 weeks of lecturing and the second one is after the next 6 weeks. In the final exams students that did not pass the midterm exams take part. The requirement for passing grade is 50 % points on each midterm exam or the final exam and positive laboratory assessment. Grade (in percentage) is formed according to the formula: Grade(%) = (M1 + M2)/2 the activities in percentage: • M1, M2 – test results.

Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	M. Štula, Authorized lecture materials		e-learning portal

Optional literature (at the time of submission of study programme proposal)	- Kevin James, PC Interfacing and Data Acquisition, Newnes An imprint of Butterworth-Heinemann, 2000. - Jan Axelson, Serial Port Complete: COM Ports, USB Virtual COM Ports, and Ports for Embedded Systems Second Edition, Lakeview Research, 2000.
Quality assurance methods that ensure the acquisition of exit competences	- Students' surveys for teacher evaluation - Students attendance track - Annual statistic on passed exam
Other (as the proposer wishes to add)	

<table>
<tr><td>NAME OF THE COURSE</td><td colspan="6">DIGITAL CONTROL</td></tr>
<tr><td>Code</td><td>FELG10</td><td>Year of study</td><td colspan="5">1</td></tr>
<tr><td>Course teacher</td><td>Darko Stipaničev, Ph.D., Full Professor</td><td>Credits (ECTS)</td><td colspan="5">6</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2">Josip Musić, Ph.D., Assitant Professor</td><td rowspan="2">Type of instruction (number of hours)</td><td>L</td><td>S</td><td>AE</td><td>LE</td><td>DE</td></tr>
<tr><td>45</td><td>0</td><td>30</td><td>0</td><td>0</td></tr>
<tr><td>Status of the course</td><td>Obligatory</td><td>Percentage of application of e-learning</td><td colspan="5">80</td></tr>
<tr><td colspan="7">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="6">The acquisition of advance knowledge about the processes of analysis and design of digital control.</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="6">Completed course Linear control systems.</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="6">Students will be able to successfully mastering the subject:
1. Describe the historical development of digital management
2. Identify the difference between continuous and discrete signals and systems.
3. Explain quantisation of continuous signal by time, sampling, A / D converter.
4. Apply techniques for restoring continuous signal from discrete signals, 0-order holder, D / A converter.
5. To model discrete systems using equations difference. Z-transformation. Modified-Z transform. Impulse transfer functions. The equivalent system.
6. Know how to identify impulse transfer function.
7. Describe the discrete by system state variables.
8. Analyse discrete system as follows: Stability. Analysis of transient response. Accuracy and error steady state.
9. Analyse discrete system in the frequency domain, in complex areas (root locus of discrete system), and analyse discrete system by state variables.
10. Apply various discrete control systems design procedures: Sampling of the continuous controller. Design of discrete controllers based on continuous data (setup poles and zeros, the procedure based on the definition of the desired response). The design of discrete controllers in the pseudo-frequency domain. State feedback design principles.
11. Establish and implement digital control through realization of impulse transfer function of a discrete controller.
12. Recognise potential problems of implementation of digital control (scaling, quantization noise).
13. Understand hoe digital control could be applied.</td></tr>
<tr><td rowspan="6">Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="4">Course content</td><td>L or S hours</td><td>AE hours</td></tr>
<tr><td colspan="4">Introduction to digital control, continuous and discrete signals and systems, sampling and recovery, A / D and D / A</td><td>6</td><td>0</td></tr>
<tr><td colspan="4">Modeling of discrete systems - difference equations, Z transform, modified Z transform</td><td>3</td><td>8</td></tr>
<tr><td colspan="4">Impulse transfer function and equivalent impulse transfer function. Parameter identification of equivalent impulse transfer function</td><td>6</td><td>2</td></tr>
<tr><td colspan="4">Description of discrete systems by state variables</td><td>3</td><td>2</td></tr>
<tr><td colspan="4">Analysis of discrete control systems in the time domain - transients. Analysis of discrete control systems in complex domain. Analysis of discrete control systems in pseudo-frequency domain. Analysis of discrete control systems in state space domain.</td><td>6</td><td>6</td></tr>
</table>

<table>
<tr><td></td><td colspan="3">Design of discrete controllers - discretization of continuous controllers. Discrete PID controller</td><td>3</td><td>2</td></tr>
<tr><td></td><td colspan="3">Discrete controller design by continous data (Dahlin and Kalman method)</td><td>6</td><td>2</td></tr>
<tr><td></td><td colspan="3">Discrete controller design in state space domain</td><td>3</td><td>2</td></tr>
<tr><td></td><td colspan="3">Realization of implementation of digital control systems.</td><td>3</td><td>2</td></tr>
<tr><td>Format of instruction</td><td colspan="2">☒ ☒ lectures
☐ seminars and workshops
☒ ☒ exercises ☐ on line in entirety
☐ partial e-learning
☐ field work</td><td colspan="3">☐ independent assignments
☒ multimedia
☒ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="5">The presence on lectures in the amount of at least 70 % of the times scheduled. Performed all required laboratory exercises.</td></tr>
<tr><td rowspan="6">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>2,5</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Individual work</td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>Laboratory exercises</td><td></td></tr>
<tr><td>Tests</td><td></td><td>Oral exam</td><td></td><td>Preparation for laboratory exercises</td><td></td></tr>
<tr><td>Written exam</td><td>3,5</td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="5">The exam consists of a written part and if necessary additional oral exam. During the semester will be two tests. The first colloquium in 8 weeks of classes, the second at 18 weeks. A student can pass the course by these tests. In the two final exams in June and July, students who have not collected inadequate number of points through colloquia take the whole subject covered by the two tests. The condition for taking the final exam is successfully finished practical lab exercises.

The exam is comprehensive and includes the theoretical part of the material and tasks with auditory exercises. The condition for positive assessment is that the student has a total of at least 50% on the exam or when it must have a minimum 25% passing the theoretical part of the material and 25% of the deposited duties. If a student has less than 25% of the points on the tasks and / or less than 25% points from the theoretical part of the material again taken the entire exam. Students who did not pass the exam after two final exams can pass the exam in autumn periods. All test questions students will be known before the exam.

These rules apply equally to students who are enrolled this course for the first time and to those students who enter college for the second time.

The final grade is determined as follows:
percentage Rating
50% to 61% is sufficient (2)
62% to 74% good (3)
75% to 87% of very good (4)
88% 100% Excellent (5)

The first colloquium will take the material to the teaching units to the seventh week inclusive, and on the other the rest of the teaching weeks. Examinations are held in terms of the anticipated calendar of classes.

Under Article 65 of the Statute of the Faculty, the student is required to participate in all forms of teaching and attend: lectures at least 70% of classes. If she or he do not meet these requirements, the student will not be able to take the exam and get a signature.</td></tr>
</table>

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

<table>
<tr><td>NAME OF THE COURSE</td><td colspan="6">DIGITAL IMAGE PROCESSING AND ANALYSIS</td></tr>
<tr><td>Code</td><td>FELG09</td><td>Year of study</td><td colspan="4">1</td></tr>
<tr><td>Course teacher</td><td>Damir Krstinić, Ph.D., Associate Professor
Darko Stipaničev, Ph.D., Full Professor</td><td>Credits (ECTS)</td><td colspan="4">5</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2">Maja Braović, Ph.D.</td><td rowspan="2">Type of instruction (number of hours)</td><td>L</td><td>S</td><td>AE</td><td>LE</td><td>DE</td></tr>
<tr><td>30</td><td></td><td></td><td>30</td><td></td></tr>
<tr><td>Status of the course</td><td>Elective</td><td>Percentage of application of e-learning</td><td colspan="4">30%</td></tr>
<tr><td colspan="7">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="6">Training students for:
Understanding the biological and machine vision
Understanding acquisition, encoding and storage of digital image
Understanding and using of mathematicam model of digital image
Application of aritmetic, gemoetric and logical operations to manipulate and improve digital images
Understanding statistical parameters of digital images and extracting features useful for image interpretation
Application of mathematical operations for processing image sequences</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="6">Knowledge of mathematics</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="6">Students will be able to:
Describe the principles of biological and machine vision
be aware of standards for retrieving, storage and transfer of digital images
understand the mathematical representation of digital image
understand and apply techniques for digital image analysis based on statistical features and image histogram
apply image processing techniques based on local features
describe and apply morphological operations on binary image
understand and apply method for object extracting based on image segmentation
understand methods for feature extraction
understand techniques for processing image sequences</td></tr>
<tr><td rowspan="9">Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="3">Course content</td><td>L or S hours</td><td colspan="2">AE hours</td></tr>
<tr><td colspan="3">Introduction to digital image processing and applications</td><td>2</td><td colspan="2"></td></tr>
<tr><td colspan="3">Biological and machine vision, basic concepts of the theory of vision</td><td>2</td><td colspan="2"></td></tr>
<tr><td colspan="3">CCD camera and conversion of an analogue to electrical signal. Standards: RGB, Y-C (SuperVHS), composite video signal (NTSC, PAL). System components for aquisition and digitalization of digital images</td><td>2</td><td colspan="2"></td></tr>
<tr><td colspan="3">The theory of digital images. Elements of digital images. Types of digital images. Color images in RGB and HSI color space. The mathematical representation of digital image. Storage of digital image. Histograms</td><td>2</td><td colspan="2"></td></tr>
<tr><td colspan="3">Processing of digital images: optimization, reconstruction and transformation</td><td>2</td><td colspan="2"></td></tr>
<tr><td colspan="3">Unary operations and LUT. Geometric operations</td><td>2</td><td colspan="2"></td></tr>
<tr><td colspan="3">Binary and multi-modal operations, arithmetic and logical operations on digital images.</td><td>2</td><td colspan="2"></td></tr>
</table>

	Preliminary exam	2	
	Convolution and filtering	2	
	Analysis of digital images: image feature extraction. Extracting objects, Image segmentation	2	
	Mathematical morphology, processing binary images	2	
	Form analysis, counting, sorting, identification, classification	2	
	Color and luminescent analysis	2	
	Preliminary exam	2	
	List of laboratory or design exercises		LE hours
	Image processing and analysis software		2
	Using Matlab for image processing		2
	Histograms, RGB and HSI color space		2
	Color space transformation		2
	Unary operations and LUT		2
	Geometrical operations on images		2
	Binary operations on images		2
	Preliminary exam		2
	Convolution and filtering		2
	Segmentation		2
	Mathematical morphology		2
	Shape analysis		2
	Counting and sorting		2
	Shape identification, analysis of brighthes and color		2
	Preliminary exam		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		

Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*	Class attendance	1	Research		Practical training	1
	Experimental work		Report		(Other)	
	Essay	1	Seminar essay		(Other)	
	Tests	2	Oral exam		(Other)	
	Written exam		Project		(Other)	

Grading and evaluating student work in class and at the final exam	The final grade is determined based on: • assesment of laboratory exercices • assesment of written seminar essay and its oral presentation • grade achieved in two peliminary exams, or grade achieved in final exam, if positive grade was not achieved in one or both preliminary exams

	Title	Number of copies in the library	Availability via other media
Required literature (available in the library and via other media)	Stipaničev, Darko; krstinić, Damir, Uvod u digitalnu obradu i analizu slike, materijali s predavanja, FESB 2011.		
	A. K. Jain, Fundamentals of Digital Image Processing, ISBN: 0-13-336165-9, Prentice Hall Int., London, 1989.		
	B. Jahne, Digital Image Processing, ISBN: 978-3-662-11565-7, Springer-Verlag, Berlin, 1991.		
	L.J. Galbiati, Machine Vision and Digital Image processing Fundamentals, PrenticeHall, London 1990.		
Optional literature (at the time of submission of study programme proposal)	• Digital Image Analysis abnd processing, http://www.ph.ac.uk/~wjh/teaching/dia • CVIPtools http://www.ee.siue.edu/CVIPtools/ • Course pages on internal e-learnign portal		
Quality assurance methods that ensure the acquisition of exit competences	• Evaluation of resutls in accordance with the above learning outcomes • Feedback from student via surveys • Self-evaluation of teachers • Institutional and non-institutional evaluations		
Other (as the proposer wishes to add)			

NAME OF THE COURSE	DIGITAL INSTRUMENTATION 2						
Code	FELG16	Year of study	1				
Course teacher	Tihomir Betti, Ph.D., Assistant Professor Ivan Marasović, Ph.D., Assistant Professor	Credits (ECTS)	5				
Associate teachers		Type of instruction (number of hours)	L	S	AE	LE	DE
			30			30	
Status of the course	Elective	Percentage of application of e-learning					

COURSE DESCRIPTION

Course objectives	Training students for: - Understanding, recognition and classifying digital signal processing problems. - Using frequency and time-frequency for signal analysis. - Understanding and using wavelet transformations for signal analysis.
Course enrolment requirements and entry competences required for the course	Completed course Digital instrumentation 1.
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - Describe digital signal acquisition methods, - Design appropriate digital filter, - Explain reconstruction signal techniques, - Use time-frequency transformations for signal analysis, - Use wavelet transformation in non-stationary signal analysis - Develop and implement algorithm for digital signal processing in MATLAB

Course content broken down in detail by weekly class schedule (syllabus)

Course content	L hours
Introduction. Time and frequency signal representation.	2
Digital signal acquisition techniques.	2
Time and amplitude signal quantization.	2
Aliasing and anti-aliasing filter.	2
Signal reconstruction.	2
Mathematical representation of discrete signals.	2
Frequency transformations for signal analysis.	2
Algorithms and windows for spectral analysis.	2
Correlation and spectral analysis.	2
Time-frequency transformations for signal analysis.	2
Wavelet transformation for non-stationary signal analysis.	2
CWT and DWT algorithms for signal decomposition.	2
Adaptive wavelet analysis.	2
List of laboratory or design exercises	**LE hours**
Introduction in MATLAB. Time and frequency signal representation.	3
Time and amplitude signal quantization in MATLAB.	3
Signal reconstruction and aliasing.	3
Frequency transformations for signal analysis.	3
Algorithms and windows for spectral analysis.	3
Correlation and spectral analysis.	3
Time-frequency transformations for signal analysis.	3
Wavelet transformation for non-stationary signal analysis.	3
CWT and DWT algorithms for signal decomposition.	3

<table>
<tr><td></td><td colspan="6">Adaptive wavelet analysis in MATLAB.</td><td>3</td></tr>
<tr><td>Format of instruction</td><td colspan="3">☒ lectures
☐ seminars and workshops
☒ exercises
☐ on line in entirety
☐ partial e-learning
☐ field work</td><td colspan="4">☐ independent assignments
☒ multimedia
☒ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="7">Students should attend at least 70% of the lectures. Students must complete all laboratory exercises.</td></tr>
<tr><td rowspan="6">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>1</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Individual work</td><td>2</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>Laboratory exercises</td><td>1</td></tr>
<tr><td>Tests</td><td>0.15</td><td>Oral exam</td><td></td><td>Preparation for laboratory exercises</td><td></td></tr>
<tr><td>Written exam</td><td>0.1</td><td>Project</td><td>0,75</td><td>(Other)</td><td></td></tr>
<tr><td colspan="6"></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">There are two midterm exams and a final exam. The first midterm exam is scheduled after 7 weeks of classes and the second one after the following 6 weeks. Each midterm exam is written and consists of theoretical questions. Each midterm exam lasts 90 minutes. To pass an exam, the student should score at least 50% and also have a positive assesment of the laboratory exercises.
The final grade (in percentage) is determined according to the formula:
Grade(%) = 0.3(T1+T2)+0.4P
where:
• T1, T2 – grade from theoretical questions in midterms given in percentage,
• P – grade from final project given in percentage,

Students not passing the midterm exams take part in the final exam. It consists of theoretical questions problems and lasts 165 minutes. For passing the final exam, students must score at least 50%, as well as have a positive assesment of the laboratory exercise. The grade on final exams is determined by the formula:
Grade(%) = 0.6(T)+0.4(P),
where:
• T – grade from theoretical questions given in percentage,
• P – grade from final project given in percentage,</td></tr>
<tr><td rowspan="6">Required literature (available in the library and via other media)</td><td colspan="3">Title</td><td>Number of copies in the library</td><td colspan="2">Availability via other media</td></tr>
<tr><td colspan="3">S. Beroš: Digitalna instrumentacija 2, autorizirana predavanja, FESB</td><td></td><td colspan="2">e-learning portal</td></tr>
<tr><td colspan="3">J.M. Candy: Signal Processing – The Modern Approach, McGraw-Hill</td><td></td><td colspan="2"></td></tr>
<tr><td colspan="3">I. Daubechies: Ten lectures on wavelets, Society for Industrial and Applied Mathematics, Philadelphia</td><td></td><td colspan="2"></td></tr>
<tr><td colspan="3"></td><td></td><td colspan="2"></td></tr>
<tr><td colspan="3"></td><td></td><td colspan="2"></td></tr>
</table>

Optional literature (at the time of submission of study programme proposal)	- A.V. Oppenheim, R.W. Schafer: Discrete-time Signal Processing, Prentice-Hall - D. Brook, R.J. Wynne: Signal Processing, Edward Arnold, London - L.B. Jackson: Digital Filters and Signal Processing, Kluwer Academic Press, Boston - M.V. Wicherhauser: Adapted Wavelet Analysis from Theory to Software, IEEE Press
Quality assurance methods that ensure the acquisition of exit competences	- Record of number of students attending the classes - Evaluation of results in accordance with expected learning outcomes - Feedback from students via student surveys - Teachers self-evaluation - Institutional and non-institutional evaluations
Other (as the proposer wishes to add)	

NAME OF THE COURSE	DIGITAL SYSTEMS PROJECTING							
Code	FELH07	Year of study	1					
Course teacher	Julije Ožegović, Ph.D., Full Professor	Credits (ECTS)	5					
Associate teachers	Vesna Pekić, Ph.D. Ante Kristic, Ph.D.	Type of instruction (number of hours)	L	S	AE	LE	DE	
			30	0	0	30	0	
Status of the course	Obligatory	Percentage of application of e-learning	0					

COURSE DESCRIPTION

Course objectives	Training students for: - Course provides advanced knowledge of digital system projecting using hardware definition languages, block synthesis methods and structural synthesis using complex programmable logic structures.		
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 digital systems using program definition of hardware - organize HDL modeling and synchronization - create a system using HDL syntax and functions libraries - evaluate results of simulation measurements - justify application of CPLD and FPGA architectures		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	Approach to program specification of hardware. Verilog.	2	0
	Verilog basic syntax.	2	0
	Logic gate level modelling.	2	0
	Fields of logic gates.	2	0
	Bistables at the logic gate level.	2	0
	Delay, power and types of nets.	2	0
	Data flow level modelling.	2	0
	Behavioral level modelling.	2	0
	Behavioral level modelling techniques.	2	0
	Control structures on behavioral level.	2	0
	Functions and tasks. User defined elements.	2	0
	Transistor level modeling.	2	0
	Development system management.	2	0
	Advanced digital structures.	2	0
	CPLD and FPGA programmable structures architecture.	2	0
	List of laboratory or design exercises		LE hours
	Programmable logic development environment.		4
	Verilog language syntax applications.		4
	Signal power, fields of logic gates.		4
	Data flow level modelling.		4
	Behavioral level modeling.		4
	Functions and tasks. User defined elements.		4
	Advanced digital structures. Finite automata.		4

<table>
<tr><td>Format of instruction</td><td colspan="3">☒ lectures
☐ seminars and workshops
☒ exercises
☐ on line in entirety
☐ partial e-learning
☐ field work</td><td colspan="3">☒ independent assignments
☐ multimedia
☒ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Attend all forms of teaching, pass ingress and egress tests, perform 100% laboratory exercises, pass preliminary exams or full exam (numeric and theory).</td></tr>
<tr><td rowspan="6">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>1</td><td>Research</td><td></td><td>Practical training</td><td>1</td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Auditory exercises</td><td>0,5</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>Individual learning</td><td>2,5</td></tr>
<tr><td>Tests</td><td></td><td>Oral exam</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td></td><td colspan="5"></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">Continuous assessment: laboratory tests, practical tests, knowledge tests, preliminary exams. Exam: written and oral (numeric and theory) as unity.</td></tr>
<tr><td rowspan="6">Required literature (available in the library and via other media)</td><td colspan="3">Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td colspan="3">1. T. R. Padmanabhan, B. Bala Tripura Sundari: "Design Through Verilog HDL", The IEEE Press - Willey Interscience, 2004.</td><td></td><td>Internet</td></tr>
<tr><td colspan="3"></td><td></td><td></td></tr>
<tr><td colspan="3"></td><td></td><td></td></tr>
<tr><td colspan="3"></td><td></td><td></td></tr>
<tr><td colspan="3"></td><td></td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6">- Lecture notes: Ožegović, J., Projektiranje digitalnih sustava, continuously upgraded
- A. Kristić: Upute za laboratorijske vježbe, Internet</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="6">- Lecture attending evidence
- Annual exam passing analysis
- Student feedback with teacher evaluation
- Teacher self-evaluation
- Graduated students feedback</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="6"></td></tr>
</table>

NAME OF THE COURSE	ELECTRIC SERVO DRIVES							
Code	FENG03	Year of study	2.					
Course teacher	Božo Terzić, Ph.D., Full Professor	Credits (ECTS)	5					
Associate teachers	Goran Majić, Ph.D.	Type of instruction (number of hours)	L	S	AE	LE	DE	
			30	0	0	30	0	
Status of the course	Elective	Percentage of application of e-learning	0					

COURSE DESCRIPTION			
Course objectives	Training students for: - understanding the structure and operation principle of electric servo motors and drives		
Course enrolment requirements and entry competences required for the course	Entry competences: - Basic knowledge of the course Fundamental of Electrical Engineering 1 and 2 - Basic knowledge of the course Automation		
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - select the type, power and speed of the motor for defined duty cycle, - select power converter for servo drives, as well as speed and rotor position sensor of servo motor, - set basic parameters of power converter for simpler servo drives, - optimize parameters of speed and rotor position controllers using experimental methods, - measure and analyse motor current and voltage waveforms - detect and solve simpler problems and failures in electric servo drives.		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	The basic structures of classic and modern electric servo drives. Application of servo drives in machine tools, robotics and cars.	2	0
	Mechanical systems in servo drives. Calculation and reduction of moment of inertia. Mechanical transmissions, shafts, bearings and mechanical couplings.	2	0
	DC motors. Operation principle and methods of speed change. Dynamic characteristics and transfer function of DC motor.	2	0
	Speed control of DC motor. Thyristor rectifier for voltage control of DC motor. Control structures and for speed control DC motor. Methods for adjusting the controller parameters.	2	0
	Step motors. Operation principle and characteristics of the permanent magnet, reluctance and hybrid step motors. Stepper motor control circuit. The control of stepper motor in the microstep operation.	2	0
	Three-phase inverters for supplying AC motors. Sinus and space vector pulse width modulation of three-phase inverter.		
	The permanent magnet motors. Brushless DC motors (BLDCM). Voltage and current waveforms of the BLDCM. Control structures of BLDCM drives. Speed control of the BLDCM.	2	0
	Permanent magnet synchronous motor (PMSM). Basic structure and operation principle. Voltage and current waveforms of the PMSM. Vector control of PMSM.	2	0
	Servo drives with induction motor (IM). Rotor flux oriented vector control of the IM.	2	0
	Induction motors. Basic construction and operation principle.		

	Equivalent circuit and torque characteristics. Starting and speed control of induction motor.	2	0
	Presentation of student seminars.		
	Servo drives with induction motor. Rotor flux oriented control of induction motor.	2	0
	Linear motors. Operation principle. Power converters for linear motors. Basic control structures for linear motors.	2	0
	Motor speed and rotor position sensors. Incremental, absolute and sin/cos encoder. Resolver.	2	0
	Communication interfaces in servo drives (PROFIBUS, Industrial Ethernet, CAN open, Profinet)	2	0
	Examples of servo drives in machine tools and robotics.	2	0
	Presentation of students' practical work.		
	List of laboratory exercises		LE hours
	Stationary characteristics of DC motor		3
	Speed control of DC motor.		3
	Speed control of Brushless DC motor.		3
	Vector control of permanent magnet synchronous motor.		3
	Servo drive with stepper motor in microstep operation		3
	Stationary characteristics of induction motor		3
	Vector control of induction motor		3
	Rotor position measurement with incremental encoder		3
	Positioning system with permanent magnet synchronous motor		3
	Positioning system with induction motor		3

Format of instruction	☒ lectures ☐ seminars and workshops ☒ exercises ☐ *on line* in entirety ☐ partial e-learning ☐ field work	☒ independent assignments ☒ multimedia ☒ laboratory ☐ work with mentor ☐ (other)
Student responsibilities	The presence on lectures in the amount of at least 70 % of the times scheduled. Performed all required laboratory exercises.	

Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*						
	Class attendance	1	Research		Practical training	
	Experimental work		Report		Individual work	1
	Essay		Seminar essay	1	Laboratory exercises	1
	Tests		Oral exam		Preparation for laboratory exercises	1
	Written exam		Project		(Other)	

Grading and evaluating student work in class and at the final exam	During the semester, each student has seminar work which is taken after the first part of the semester, and the practical work which is presented on the final exam. Seminars and practical works are presented in front of other students, assistants and professor. The requirement for passing grade is the positive assessment of the both seminar and practical work. Final grade (in percentage) is formed according to the formula: Grade(%) = 0,2 LE + 0,4 SW + 0.4 PW where the activities in percentage: • LE – laboratory exercises, • SW – seminar work grade, • PW – practical work grade, The final grade is determined according to the following criteria: • 50-62% - sufficient (2) • 63-75% - good (3) • 76-88% - very good (4) • 89-100% - excelent (5)

<table>
<tr><td></td><td colspan="3">Students who did not pass the exam after two final exams take a makeup exam in the autumn period according to the same way as the final exam. The final grade is obtained by the same criteria as for two final exams.</td></tr>
<tr><td rowspan="2">Required literature (available in the library and via other media)</td><td>Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td>• B. Terzić: Authorized lectures, FESB</td><td></td><td>e-learning portal</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">• P. Gugić, Električni servomotori, Školska knjiga, Zagreb, 1987.
• N. Mohan, Electric Drives - an integrative approach, MNPERE, Minneapolis, SAD, 2001.
• T. J. E. Miller, Brushless Permanent Magnet and Reluctance Motor Drives, Clarendon Press, 1989.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">- Evaluation of results in accordance with the above learning outcomes
- Feedback from students via surveys
- Self-evaluation of teachers
- Institutional and non-institutional evaluations</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="3"></td></tr>
</table>

NAME OF THE COURSE	ELECTRONIC AND VIRTUAL INSTRUMENTATION						
Code	FELG07	Year of study	1.				
Course teacher	Ivo Mateljan, Ph.D., Full Professor	Credits (ECTS)	5				
Associate teachers		Type of instruction (number of hours)	L	S	AE	LE	DE
			30			30	
Status of the course	Obligatory	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - understanding and application of basic principles for electronic measurement, - programming for virtual instrumentation, - measurement with stochastic and deterministic signals - application of basic measurement sensors
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: - define fundamentat electronic instrumentation characteristics - define electronic circuit for measurement sensors application - define techniques used to measure stochastic and deterministic signals - apply digital algorithms for mean value, rms value, FFT, autocorrelation, crosscorrelation and spectrum estimation. - measure spectrum and system frequency response - make program for virtual instrumentation, with modules: oscilloscope, voltmeter and Fourier Analyzer

Course content broken down in detail by weekly class schedule (syllabus)

Course content	L hours	AE hours
Metrology	2	
Statistical analysis of measurements	2	
Uncertainity of measurements	2	
Analog signals and systems	2	
Discrete signals and systems	2	
Random signals, spectral and correlation analysis	2	
Analysis of system impulse and frequency response	2	
Basic electronic circuits for the instrumentation	2	
Signal generators	2	
AD and DA converters	2	
Standars interfaces	2	
Virtual instrumentation	2	
Distributed measurement systems	2	

List of laboratory or design exercises	LE hours
Spectral analysis and distortion of signals	2
PC souncard quality measurements	2
Deterministic and random signals	2
Frequency response measurement	2
Impulse response measurements	2
SFT and Wavelet signal analysis	2
Bandpass and heterodyned spectral analysis	2
Use of Matlab in measurements	2

<table>
<tr><td>Format of instruction</td><td colspan="3">☒ lectures
☒ seminars and workshops
☒ exercises
☐ on line in entirety
☐ partial e-learning
☐ field work</td><td colspan="3">☒ independent assignments
☐ multimedia
☒ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6"></td></tr>
<tr><td rowspan="6">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>2.5</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Individual work</td><td>1</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>0.5</td><td>Laboratory work</td><td>0.5</td></tr>
<tr><td>Tests</td><td></td><td>Oral exam</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td>0.5</td><td>(Other)</td><td></td></tr>
<tr><td></td><td colspan="5"></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">There are two seminar works and final exams. First seminar is theoretical with student presentation and second is program of virtual instrumentation. There are learning check out on every laboratory exercise. The requirement for passing grade is the positive assessment of laboratory exercises and 50 % points on each seminar work or the final exam. Grade (in percentage) is formed according to the formula:
Grade(%) = 0,1 SR + 0,1 LV + 0,8 UI
the activities in percentage:
• SR – seminar,
• LV – laboratory assessment,
• UI – final exam.</td></tr>
<tr><td rowspan="4">Required literature (available in the library and via other media)</td><td colspan="3">Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td colspan="3">Ivo Mateljan: Electronic and Virtual Instrumentation, script, FESB,</td><td></td><td>Internet</td></tr>
<tr><td colspan="3">Ivo Mateljan: Laboratory Exercise in Electronic and Virtual Instrumentation, script, FESB, 2007.</td><td></td><td>Internet</td></tr>
<tr><td colspan="3">Ivo Mateljan: ARTA software - Manual, ARTALABS, 2004-2017</td><td></td><td>Internet</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6"></td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="6">- Evaluation of results in accordance with the above learning outcomes
- Feedback from students via surveys
- Self-evaluation of teachers
- Institutional and non-institutional evaluations</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="6"></td></tr>
</table>

NAME OF THE COURSE	ELECTRONIC CIRCUITS						
Code	FELH13	Year of study	2.				
Course teacher	Ivan Marinović, Ph.D., Full Professor	Credits (ECTS)	5				
Associate teachers	Duje Čoko, Ph.D., Assistant Professor	Type of instruction (number of hours)	L	S	AE	LE	DE
			15		15	30	
Status of the course	Elective: 210 Obligatory: 221	Percentage of application of e-learning					

COURSE DESCRIPTION

Course objectives	Training students for: - synthesis of electronic circuits - analysis of complex electronic circuits - projecting of simple electronic device		
Course enrolment requirements and entry competences required for the course	Finished coarse *Electronic circuits*		
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - design electronic circuits - construct a prototype of the projected circuit - make measurements of electronic parameters applying oscilloscopes and analyzers - understand principles of operation of more complex circuits		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	Synthesis of electronic circuits	2	2
	Cutoff frequencies as parameters for synthesis	1	1
	Design of feedback amplifiers	1	1
	Operational amplifiers, slew-rate, LM741	3	3
	C-class, D-class and E-class power amplifiers	2	2
	Energy converters, rectifiers and stabilizers of voltage, LM723	3	3
	Switching regulators	1	1
	Timers, NE555	1	1
	Oscillators	1	1
	List of laboratory or design exercises		LE hours
	Electronic project: construction of given electronic circuit (design, simulation, PCB design and construction, soldering of components, measurements on the device, final report)		30
Format of instruction	☒ lectures ☐ seminars and workshops ☒ exercises ☐ *on line* in entirety ☐ partial e-learning ☐ field work	☐ independent assignments ☐ multimedia ☒ laboratory ☐ work with mentor ☐ (other)	
Student responsibilities	The presence on lectures and exercises in the amount of at least 70% of the times scheduled. Performed all required laboratory exercises.		

<table>
<tr><td rowspan="5">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>2</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Exercises</td><td>1</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>Individual work</td><td>2</td></tr>
<tr><td>Tests</td><td></td><td>Oral exam</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">The course will be graded according to outcomes of the project and oral exam. The absolute grading is applied.</td></tr>
<tr><td rowspan="3">Required literature (available in the library and via other media)</td><td colspan="3">Title</td><td>Number of copies in the library</td><td colspan="2">Availability via other media</td></tr>
<tr><td colspan="3">• P. Biljanović: Elektronički sklopovi, Školska knjiga, Zagreb</td><td>5</td><td colspan="2"></td></tr>
<tr><td colspan="3">• U. Tietze, C. Schenk, Advanced electronics circuits</td><td></td><td colspan="2"></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6"></td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="6">- Evidence of students attendance
- Annual analysis of grades achieved
- Teachers self-evaluation
- Students feedback via questionnaires and surveys</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="6"></td></tr>
</table>

NAME OF THE COURSE	ENERGY STORAGE SYSTEMS						
Code	FENG04	Year of study	2.				
Course teacher	Ozren Bego, Ph.D., Associate Professor	Credits (ECTS)	5				
Associate teachers	Danijel Jolevski, Ph.D., Assistant Professor	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	15	0
Status of the course	Elected	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - understanding terms and concepts of different energy storage systems, - selection of energy storage system regard to technical, technological and economical aspects, - analyse of advanced store system functions in order to stabilize electrical grid.
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: - analyse needs for energy storage, - select energy storage technology according to requirements from grid system, - build mathematical model of: • battery based energy storage, • impact of energy store on grid - define requirements on energy storage advanced functions

Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	Energy storage – concept, technologies, applications	2	
	Application of energy storage system in grid stabilization. Especial overview on applications in weak and isolated grids, microgrids.	2	
	Separation and overview of storage technologies on short-term and long- term systems.	2	
	Techno-economical aspects of energy storage implementation.	2	
	Thermal energy storage. Compressed air energy storage (CAES).	2	
	Mechanical energy storage: with potential energy (reversible hydro power plants) and kinetic energy (flywheel).	2	
	Reversible chemical reaction for energy storage: hydrogen and methane.	2	
	Energy storage in electromagnetic systems. Construction and application of supercapatitors. Application in electric vehicles.	2	
	Electrochemical energy storage: batteries. Technology and characteristics	2	
	Supervision of battery state of charge (SOC), SOC estimators, hardware for battery monitoring.	2	
	Battery based energy storage application in grid stabilization. Concept of whole system (battery, monitoring, connection to grid, grid state supervision)	2	
	Active devices for connecting battery storage to grid: active front end (AFE).	2	
	Applications in grid stabilization: load levelling, rotating reserve, UPS, voltage regulation,…	2	

	List of laboratory exercises	LE hours
	Supercapacitors – modelling	3
	Supercapacitors – monitoring system	3
	Batteries – modelling	3
	Batteries – monitoring SOC	3
	Presentation of independent assignments	3

Format of instruction	☒ lectures ☐ seminars and workshops ☒ exercises ☐ *on line* in entirety ☐ partial e-learning ☐ field work	☒ independent assignments ☐ multimedia ☒ laboratory ☐ work with mentor ☐ (other)
Student responsibilities	The presence on lectures in the amount of at least 70 % of the times scheduled. Performed all required laboratory exercises.	

Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*						
	Class attendance	1	Research		Practical training	
	Experimental work		Report		Individual work	1
	Essay		Seminar essay	2	Laboratory exercises	0,5
	Tests	0	Oral exam	0,5	Preparation for laboratory exercises	
	Written exam	0	Project		(Other)	

Grading and evaluating student work in class and at the final exam	During semester students get independent assignments which should be presented in last week of semester. After that oral exam will be done. Final grade (in percentage) is formed according to the formula: Grade(%) = 0,4 IA + 0,6 OE the activities in percentage: • IA – independent assignments, • OE – oral exam.

Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	O. Bego: Predavanja iz predmeta Sustavi za pohranu energije		e-learning portal

Optional literature (at the time of submission of study programme proposal)	Robert A. Huggins: Energy storage, Springer, 2010.
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	ENGINEERING ECONOMY						
Code	FENG01	Year of study	3.				
Course teacher	Ranko Goić, Ph.D., Full Professor	Credits (ECTS)	5				
Associate teachers	Josip Vasilj, Ph.D., Damir Jakus, Ph.D., Assistant Professor Stipe Vodopija, Teaching Assistant	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	30	0
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - understanding and application of basic knowledge of engineering economy and understanding of time value of money, - cost estimation and bill of quantity preparation - analysis of feasibility calculations for investment decisions - evaluation of projects feasibility - preparation of spreadsheet models for decision making
Course enrolment requirements and entry competences required for the course	None
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - describe and apply calculations for compound interest, - describe and apply methods for analysis of investment decisions - prepare terms of reference and key input parameters for feasibility calculation and overall decision making models - design and make spreadsheet models for analysis of feasibility calculation and overall decision making models - design and make spreadsheet models for analysis of alternatives, sensitivity analysis and risk analysis

Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours
	Introduction in engineering economy	2
	Theory of costs	2
	Time value of money (1st part - theory)	2
	Time value of money (2nd part - examples)	2
	Methods for calculation of profitability of investments (1st part – theory)	2
	Methods for calculation of profitability of investments (2nd part – theory)	2
	Analysis of alternatives	2
	Analysis of equipment replacement	2
	Decision models	2
	Income taxes and depreciation	2
	Bill of quantity, contracting	2
	Feasibility studies	2
	Sensitivity analysis, risk analysis	2
	Case study (1)	2
	Case study (2)	2
	List of laboratory exercises	LE hours
	Basic spreadsheet models (MS Excel)	2
	Basic of programming in MS Excel	2
	Example of cost analysis (1)	2
	Example of cost analysis (2)	2
	Compound interest calculation (1)	2
	Compound interest calculation (2)	2
	Model for loan repayment	2

	Model for profitability calculation (1)	2
	Model for profitability calculation (2)	2
	Model for analysis of alternatives	2
	Model for analysis of equipment replacement	2
	Model for sensitivity analysis	2
	Model for risk analysis	2
	Model for analysis of profitability with depreciation	2
	Making of BoQ	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 lectures in the amount of at least 70 % of the times scheduled. Performed all required laboratory exercises.	

Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*						
	Class attendance	1	Research		Practical training	
	Experimental work		Report		Individual work	2,2
	Essay		Seminar essay		Laboratory exercises	1
	Tests	0,2	Oral exam		Preparation for laboratory exercises	0,5
	Written exam	0,1	Project		(Other)	

Grading and evaluating student work in class and at the final exam	During semester, students are solving colloquiums through homeworks based on additional tasks over the basic spreadsheet models form laboratory exercises. Final exam is possible in three ways: 1. Making of seminar – advanced spreadsheet model 2. Making on spreadsheet model on computer, based on existing model from laboratory exercises (max. grade 4) 3. Making on spreadsheet model on computer, new model (max. grade 5) In 2nd and 3rd option, first possibility to take the exam is during last week of lecturing. After that, there are two final exams. Students who did not pass the entire exam after two final exams can pass the exam in the two additional exams. The requirement for passing grade of the course is at least 50 % in all options of final exam. Grade is formed according to following: • 50 % to 61 % - pass (2) • 62 % to 74 % - good (3) • 75 % to 87 % - very good (4) • 88 % to 100 % - excellent (5)

Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	1. Goić, R., "Predavanja iz Inženjerske ekonomike", Sveučilište u Splitu, FESB, Split, 2014. (internal script)		e-learning portal
	2. W.G. Sullivan, J.A. Bontadelli, E.M. Wicks: Engineering economy, Prentice Hall, 1999.	1	-

Optional literature (at the time of submission of study programme proposal)	• W. L. Winston, S. C. Albright: Practical Management Science, Duxbury Press, 2001. • F. Khan, R. Parra: Financing Large Projects: Using Project Finance Techniques and Practices, Pearson Education Asia Pte., 2003. • Lj. Vidučić: Financijski menadžment, RRIF-plus d.o.o., 2002. • http://www.ise.ufl.edu/ein6357/downloads.html
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	ENGLISH LANGUAGE FOR ACADEMIC PURPOSES						
Code	FEOG01	Year of study	2.				
Course teacher	Daniela Matić, Ph.D., Assistant Professor	Credits (ECTS)	3				
Associate teachers	/	Type of instruction (number of hours)	L	S	AE	LE	DE
				45			
Status of the course	Elective	Percentage of application of e-learning	0%				

COURSE DESCRIPTION

Course objectives	This course is aimed at: - introducing students to basic scientific discourse in English with a view of improving their writing and speaking skills needed for work in academic environment or further education at foreign institutions - helping students acquire and enhance knowledge on foreign language structures; - help students improve English for special purposes knowledge at receptive level (written and oral reception) depending on the course of studies; - help students raise awareness of their own responsibility in learning 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)	Students will be able to: - recognize and eventually use various grammar structures and lexis typical in discourse of science and technology; - recognize various text types, textual patterns and language activities; - apply various reading techniques (skimming, scanning) when analyzing authentic texts; - identify and explain professional vocabulary; - recognize key ideas, words and sentences; - use various g and listening methods in order to comprehend the context of authentic general English and professional texts; - present various topics orally and in written form; - analyze various professional materials and present them within professional communication procedures.		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L or S hours	AE hours
	Unit 1 – *Education*- 1A – reading and understanding short informative texts; reading for the main idea and for detail; note-taking, writing a summary; 1B understanding essay titles; paraphrasing	3	
	Unit 1 – 1C Listening for the main idea; note-taking; noun phrases	3	
	Unit 1 – 1D Speaking –preparing for and taking part in a seminar discussion; summarizing and reporting on a seminar discussion, using a dictionary;	3	
	Reading a scientific paper-analyzing the organization of the paper, explaining, paraphrasing Unit 2 – *Systems* – 2A - understanding and extracting key information; recognizing and writing definitions; summarizing key factual information	3	
	Reading a scientific paper Unit 2 – 2B- identifying the language and features of visual	3	

	information; writing a short description of visual information; using noun phrases containing relative clauses.		
	Reading a scientific paper Unit 2 – 2C- recognizing key factual information in a lecture, recognizing definitions in a lecture, note-taking with abbreviations and symbols; 2D - recognizing language for referring to visual information; recognizing noun phrases in explanations; presenting visual information	3	
	Unit 2 – building academic vocabulary Unit 4 – *Order* – 4D-Presentations-evaluating presentation guidelines; using signposting language to refer to visual information;	3	
	8. Mid-term exam	3	
	Unit 3 – *Communication* – 3A - identifying main ideas and supporting evidence in a text; building word families, using adverbs to express stance; 3B - analyzing and writing topic sentences; adding supporting evidence using reasons and examples; writing and evaluating a paragraph	3	
	Unit 3 – 3C - understanding the main ideas in a lecture; recognizing the language for introducing main ideas and supporting evidence, analyzing types of supporting evidence: examples, definitions and explanations.	3	
	Reading a scientific paper Unit 3 – 3D - reading a text to prepare for a tutorial; identifying assumptions in questions; participating in tutorial discussions; inferring the meaning of unknown words in sentences.	3	
	Reading a scientific paper Unit 4 – *Order* – identifying the purpose and structure of a text; using classification to make notes; 3B – analyzing an essay introduction; writing and evaluating a thesis statement and an essay introduction.	3	
	Reading a scientific paper Unit 4 – 4C – understanding the organization of a lecture; recognizing and practicing signposting language; note-taking using diagrams. Academic vocabulary in use.	3	
	Presentations Unit 4 – Categorizing words; creating and using classification phrases. Academic vocabulary in use.	3	
	15. End-of-term exam	3	
Format of instruction	☐ lectures ☒ seminars and workshops ☐ exercises ☐ *on line* in entirety ☐ partial e-learning ☐ field work	☒ independent assignments ☐ multimedia ☐ laboratory ☐ work with mentor ☐ (other)	
Student responsibilities	In order to take an exam and eventually obtain a grade, each student has to fulfill the following requirements: - minimum class attendance of 70%; - delivered and positively graded presentation in English before other students during regular classes.		

<table>
<tr><td rowspan="5">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>1</td><td>Research</td><td>0.5</td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td>/</td><td>Report</td><td>0.5</td><td>(Other)</td><td></td></tr>
<tr><td>Essay</td><td>/</td><td>Seminar essay</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td>1</td><td>Oral exam</td><td>/</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td>/</td><td>(Other)</td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">During regular classes students are supposed to prepare and deliver a presentation on a topic of their choice, which will also be graded.
During the semester, students will be continuously assessed as they will take two exams, a mid-term and an end-of term exam. The former will be held in week 8 and the latter in week 15. Both exams will test their knowledge of English naval architecture lexis from the educational materials and grammar structures specific for their profession. If they fail at either of these exams or do not sit for them, they have to take the final exam scheduled in the examination period after the classes have finished.
The final grade is calculated as follows:
- written exam (mean of mid-term and end-of term exam positive results, or final exam) – 70%
- positively graded presentation – 20%
- regular attendance – 5%
- written assignments (homework) – 5%
All exams are scheduled according to the current academic year calendar.</td></tr>
<tr><td rowspan="6">Required literature (available in the library and via other media)</td><td colspan="3">Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td colspan="3">de Chazal, Edward, Sam McCarter. (2012). Oxford EAP: A Course in English for Academic Purposes. Upper-intermediate/B2. Oxford: OUP.</td><td></td><td></td></tr>
<tr><td colspan="3">McCarthy, Michael, Felicity O'Dell. (2008). Academic Vocabulary in Use. Cambridge: CUP.</td><td></td><td></td></tr>
<tr><td colspan="3">Master, Peter. (2004). English Grammar and Technical Writing. Washington: Office of English Language Programs of the United States Department of State.</td><td></td><td></td></tr>
<tr><td colspan="3">Paterson, Ken, Roberta Wedge. (2013). Oxford Grammar for EAP. Oxford University Press.</td><td></td><td></td></tr>
<tr><td colspan="3">Oxford Learner's Dictionary of Academic English. Oxford University Press.</td><td></td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6">• Powell, Mark. (2010). Dynamic Presentations. Cambridge: CUP.
• Silobrčić, Vlatko. (2003[5]). Kako sastaviti, objaviti i ocijeniti znanstveno djelo. Zagreb: Medicinska naklada.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="6">- Regular class attendance records
- Tutorials
- Evaluation of results in accordance with the above learning outcomes
- Feedback from students via surveys
- Self-evaluation of teachers
- Institutional and non-institutional evaluations</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="6">/</td></tr>
</table>

NAME OF THE COURSE	HYDRAULIC AND PNEUMATIC SYSTEMS						
Code	FETG02	Year of study	1				
Course teacher	Jani Barle, Ph.D., Full Professor	Credits (ECTS)	5				
Associate teachers	Alen Kovač	Type of instruction (number of hours)	L	S	AE	LE	CE
			30	0	0	30	0
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	To develop ability to identify hydraulic or pneumatic system elements by symbol and function and to use that skills for fault finding and solving.
Course enrolment requirements and entry competences required for the course	None
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: 1. Present general concepts associated with industrial application of hydraulics and pneumatics. 2. Identify components of the system and draw related symbols. 3. Combine various elements with respect to size and design concept. 4. Critically assess workability and supportability of complex hydraulic and pneumatic systems. 5. Determine faults and failure causes. 6. Arrange and assemble simple hydraulic and pneumatic systems.

Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	LE hours
	Introduction to pneumatics. Basic physical principles of pneumatics.	2	
	Standards and Symbols. Compressed air generation and distribution.	2	
	Typical pneumatic systems demonstrations.		2
	Basic elements of pneumatic systems (check, pressure control and directional control valves).	2	
	Methods for development of pneumatic systems.		4
	Basic elements of pneumatic systems (directional control valves, valve actuation types).	2	
	Basic elements of pneumatic systems (cylinders and motors).	2	
	Circuit assembling on pneumatic didactic table.		4
	Valve combinations. Electropneumatic systems.	2	
	Introduction to hydraulics. Basic physical principles of hydraulics. Fundamental hydraulic problems: cleanness, temperature, cavitation.	2	
	Typical hydraulic systems demonstrations.		2
	Hydraulic elements for energy conversion: cylinders, pumps and motors with constant and adjustable displacement..	2	
	Basic control elements in hydraulics: check valves, direct acting and pilot operated pressure-relief valves.	2	
	Hydraulic elements and their most important parts.		4
	Basic control elements in hydraulics: direct acting and pilot operated directional control valves, pressure regulators, flow control valves.	2	
	Hydraulic cylinders - parallel and series circuit. Synchronizing cylinder movement and load.		4

	Typical design solutions of hydraulic elements for energy conversion (cylinders, pumps and motors with constant and adjustable displacement).	2	
	Typical hydraulic circuits: accumulator holding, pump unloading, braking, counter balance. Hydraulic presses.		4
	Pressure control circuits. Flow and speed control circuits.	2	
	Piloted and electrically controlled hydraulic systems.	2	
	Examples: actuator speed adjustments with throttle valve vs. speed control with flow regulators.		2

Format of instruction	☒ lectures ☐ seminars and workshops ☒ exercises ☐ *on line* in entirety ☐ partial e-learning ☐ field work	☒ individual assignments ☒ multimedia ☒ laboratory ☐ work with mentor ☐ individual project (other)
Student responsibilities	Minimum of 70 percent lecture attendance. Completing all the required laboratory exercises.	

Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*						
	Class attendance	2,0	Research		Practical training	
	Experimental work		Report		Individual work	2,5
	Essay		Seminar essay		Preparation for exercises	0,3
	Tests	0,2	Oral exam		(Other)	
	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 session classes and the second one is after the next 6 weeks. The midterms are carried out as written tests, made up of three questions relating to the basic issues and schematics. The oral exam is focused on the student's interpretation skills. The requirement for passing grade is the positive assessment on each midterm exam (>49%) or the final exam.
The final score is:

$$Score\ (\%) = 0,35 \cdot A_1 + 0,35 \cdot A_2 + 0,20 \cdot A_3 + 0,10 \cdot A_4$$

- *midterm 1:* A_1 *= 50 – 100 %,*
- *midterm 2 (seminal paper):* 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 library and via other media)	• Barle, J.: Hydraulics and pneumatics, (student handbook and workbook in Croatian: *Hidraulika i pneumatika*), FESB, Split, 2010.		e-learning portal
	• Nikolić, G.: Pneumatika, Školske novine, Zagreb, 1994.		
Optional literature (at the time of submission of study programme proposal)	Koroman, V.; Mirković, R.: Hidraulika i pneumatika, Školska knjiga, Zagreb, 1991. Lang, R.A. (ed.): Hydraulic Trainer 1; Planning and Design of Hydraulic Power Systems, Mannesmann Rexroth AG, 1998. Rabie, M.: Fluid Power Engineering, McGraw-Hill, 2009.		
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	INDUSTRIAL ROBOTICS						
Code	FELG05	Year of study	1				
Course teacher	Mojmil Cecić, Ph.D., Full Professor	Credits (ECTS)	5				
Associate teachers	Stanko Kružić, Teaching Assistant	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	30	0
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - understanding and application of basic principles and laws of kinematics and dynamics of robots, - setting up and solving kinematics and dynamics problem of simple manipulator structures, - trajectory planning, - simulations using MATLAB, - using different methods for robot control, - develop the ability to work independently and work in a small group.
Course enrolment requirements and entry competences required for the course	None
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - describe the different mechanical structures of robots, - calculate kinematics of typical manipulator structures, - calculate dynamics of typical manipulator structures, - programming manipulators to perform simple tasks, - understand the different simulation principles, - understand the functionality of the actuators and sensors.

Course content broken down in detail by weekly class schedule (syllabus)

Course content	L hours	AE hours
Introduction, History of Robotics, Classification of Robots	2	
Robot Mechanical Structure, Degress of Freedom	2	
Kinematics, Rotation Matrix, Translation Matrix, Homogeneous Transformations	3	
Direct Kinematics, Denavit-Hartenberg Representation	3	
Kinematics of Typical Manipulator Structures	3	
Inverse Kinematics Problem	2	
Differential Kinematics and Statics, Jacobian	2	
Trajectory Planning	2	
Manipulator Dynamics, Lagrange Formulation, Inverse Dynamic Problem	3	
Joint Actuating System, Drivers	2	
Sensors	2	

List of laboratory or design exercises	LE hours
Homogeneous Transformations	2
Direct Kinematics	3
Inverse Kinematics Problem	3
Analytical Jacobian	2
Dynamics	2
Kinematics and Dynamics of Typical Manipulator Structure	4

	Programing languages	2
	Programming of mobile robot	2
	Trajectory generation, Motion Control of Mobile Robots	2
	The Visual Servoing Problem	4

Format of instruction	☒ lectures ☐ seminars and workshops ☐ exercises ☐ *on line* in entirety ☐ partial e-learning ☐ field work	☒ independent assignments ☐ multimedia ☒ laboratory ☐ work with mentor ☐ (other)
Student responsibilities	The presence on lectures in the amount of at least 70 % of the times scheduled. Performed all required laboratory exercises.	

Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*						
	Class attendance	2	Research		Practical training	0,2
	Experimental work		Report		(Other)	2,5
	Essay		Seminar essay		(Other)	
	Tests	0,2	Oral exam		(Other)	
	Written exam	0,1	Project		(Other)	

Grading and evaluating student work in class and at the final exam

There are two midterms and final exams. The first midterm exam is after 7 weeks of lecturing and the second one is after the next 6 weeks.
The requirement for passing grade is the positive assessment of laboratory exercises and 50% points on each midterm exam or the final exam. Grade (in percentage) is formed according to the formula:

Grade [%] =0,25*L+0.375* (M1 + M2)

where L is laboratory assessment and M1 and M2 are the results of the midterm exams in percentage.
Each midterm test consists of 10 theoretical questions and numerical problems and final test also consists of 10 theoretical questions and numerical problems divided into two groups (the first and the second part). The requirement for passing grade is 50% of the total number of questions. The students who did not pass the midterm exams take part in the final exam. The midterm and final exams are carried out as written tests. Finally grade is determined as follows:

from 50% to 62.5% - dovoljan (2)
from 62.5% to 75% - dobar (3)
from 75% to 87.5% - vrlodobar (4)
from 87.5% to 100% - izvrstan (5)

Midterm and final exams are held in the terms provided by the time table.

Required literature (available in the library and via other media)

Title	Number of copies in the library	Availability via other media
• Saeed B. Niku: Introduction to Robotics: Analysis, Systems, Applications, Prentice Hall, 2001.	1	
• Craig: Introduction to robotics, Mechanics and Control, Prentice Hill, 2010.	1	

Optional literature (at the time of submission of study programme proposal)

- Tadej Bajd: Osnove robotike, Fakulteta za elektrotehniko, Univerza v Ljubljani, 2000.
- Kovačić, Laci, Bogdan: Osnove robotike, Fakultet elektrotehnike i računarstva, Zagreb, 1999.
- Siciliano, Sciavicco, Villani, Oriolo> Robotics, Springer, 2010.

Quality assurance 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	INTRODUCTION TO MACHINE LEARNING						
Code	FELG30	Year of study	1				
Course teacher	Tamara Grujić, Ph.D, Full Professor	Credits (ECTS)	5				
Associate teachers	Ivo Stančić, Ph.D., Assistant Professor	Type of instruction (number of hours)	L	S	AE	LE	DE
			30			30	
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - Understanding and application of basic machine learning principles - Application of various algorithms of machine learning for data classification - Selection and application of adequate classification algorithm for each assignment - Implementation of classification algorithms in WEKA and MATLAB
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: - Define basic principles of machine learning - Describe and illustrate benefits and limitations of basic machine learning algorithms - Apply different classification algorithms - Estimate applicability of each machine learning algorithm for each assignment

Course content broken down in detail by weekly class schedule (syllabus)

Course content	L hours	AE hours
Introduction to machine learning: basic terms, applications of machine learning and software tools for machine learning	2	
Concept Learning and search in hypothesis	2	
Basic algorithm of machine learning: Find-S	2	
Algorithm of the candidate elimination	2	
Decision tree algorithm	2	
Bayesian Methods, naive Bayes classifier	2	
Linear Discriminant Analysis	2	
Support Vector Machine	2	
Artificial Neural Networks	6	
Evaluation of classification algorithms. Statistical trials	4	

List of laboratory or design exercises	LE hours
Algorithms: Find-S, candidate elimination , decision tree	6
Bayesian Methods, naive Bayes classifier	6
Linear Discriminant Analysis	6
Support Vector Machine	6
Artificial Neural Networks	6

Format of instruction		
	☒ lectures ☐ seminars and workshops ☒ exercises ☐ *on line* in entirety ☐ partial e-learning ☐ field work	☒ independent assignments ☒ multimedia ☒ laboratory ☐ work with mentor ☐ (other)
Student responsibilities	The presence on lectures in the amount of at least 70 % of the times scheduled. Performed all required laboratory exercises.	

Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*	Class attendance	2	Research		Practical training	
	Experimental work		Report		Individual work	1
	Essay		Seminar essay		Laboratory exercises	1
	Tests	0,25	Oral exam		Preparations for laboratory exercises	**0,5**
	Written exam	0,25	Project		(Other)	

Grading and evaluating student work in class and at the final exam	During the semester there are two midterm exams according to teaching calendar, followed with the final and correction exam. In the final exam student ale allowed to take part of course not passed by midterms. In correction exam students are required to take whole course. The requirement for passing grade is the positive assessment of laboratory exercises and 50 % points on average midterm exam ((M1 + M2)/2) or the final exam. Requirement for positive assessment of laboratory exercises is attendance to all laboratory exercises and positively graded reports. Each midterm is taking 105 min and consists of 8 questions and assignments. Final exam is taking 120 min and consist of 10 questions and assignments divided in two groups (5 questions and assignments from each midterm). Corrective exam, taking 120 min, consist of 8 questions and assignments. Requirement for passing midterms and final exam is 50% of total questions and assignments. Final grade is formed as follows: Grade(%)= 0,45 (M1 + M2) + 0,1 LE M1, M2 – midterm grades (in %) LE – grade from laboratory exercises (in %) Percentage Grade 50% do 61,9% sufficient (2) 62% do 74,9% good (3) 75% do 89,9% very good (4) 90% do 100% excellent (5)

	Title	**Number of copies in the library**	**Availability via other media**
Required literature (available in the library and via other media)	I. Kononenko, M. Kukar, Machine learning and Data mining: Introduction to principles and algorithms, Horwood Press, 2007.	5	e-learning portal
	Tom M. Mitchell, Machine Learning, McGraw – Hill, 1997.	5	e-learning portal
Optional literature (at the time of submission of study programme proposal)	- Ian H. Witten, Eibe Frank: Data Mining: Practical Machine Learning Tools and Techniques, 2nd edition, The Morgan Kaufmann, 2005. - Christopher M. Bishop, Pattern recognition and Machine learning, Springer, 2006.		
Quality assurance methods that ensure the acquisition of exit competences	- Keeping records of student attendance. - Annual analysis of course statistics in terms of midterm and finals exams. - Feedback from students via surveys. - Teacher self-evaluation. - Feedback from graduated students (or senior students) on course content relevance.		
Other (as the proposer wishes to add)	/		

NAME OF THE COURSE	LINEAR CONTROL SYSTEMS						
Code	FELG01	Year of study	1.				
Course teacher	Tamara Grujić, Ph.D., Full Professor	Credits (ECTS)	6				
Associate teachers	-	Type of instruction (number of hours)	L	S	AE	LE	DE
			45	0	15	15	0
Status of the course	Obligatory	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - Analysis of linear control systems in the time and frequency domain - Self-design of linear control systems using different methods in time and frequency domain, and state space
Course enrolment requirements and entry competences required for the course	- Completed course ‘‘System Theory’’ at the Undergraduate study - Matlab and Simulink skills
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - Define the basic concepts of analysis and synthesis of linear control systems - Analyze specific linear control system in time and frequency domain - Calculate the parameters of first or second order system for supplementing the higher order systems by first or second order system - Design a linear control system in the time domain, by implementing the root locus method - Design a linear control system in the frequency domain, by implementing the phase lead and lag compensators - Design a linear control system in state space

Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	Introductory concepts: analysis and synthesis of linear control systems (LC systems - abbreviated); LC systems analysis in time domain: time response, absolute and relative stability of LC systems	3	1
	LC systems analysis in frequency domain (specifications in the frequency domain): frequency response of systems, polar, Nyquist and Bode's diagrams	3	1
	Frequency analysis of LC systems with negative feedback: stability criterion in the frequency domain (Nyquist stability criterion), measures of relative stability: amplitude and phase margins	3	1
	Frequency response of 1 and 2 order systems, resonant peak, frequency bandwidth, M - circles. Supplementing the systems of higher orders by systems of 1 and 2 order, by using the M circles	3	1
	Root locus technique: basic properties of the Root loci; rules for construction of the Root Loci, examples of Root Loci construction	3	1
	Synthesis (design) of LC systems based on root locus technique	3	1
	Introduction to the synthesis (design) of LC systems in the frequency domain: phase-lag and phase-lead compensators	3	1
	First midterm exam		
	Design of LC systems in the frequency domain by using phase-lag compensators and Bode diagrams	3	1

	Design of LC systems in the frequency domain by using phase-lead compensators and Bode diagrams	3	1
	Modeling of the control system in state space	3	1
	Design of LC systems in state space: the general case, and the cases of the elimination of plant transfer function zeros and increasing the excess of poles over zeros	3	1
	Design of LC systems in state space: cases of moving and adding zeros to the plant transfer function	3	1
	Design of LC systems in state space with partially available state variables	3	1
	Second midterm exam		
	List of laboratory exercises		LE hours
	Supplementing the systems of higher orders by systems of 1 and 2 order, by using the M circles and Matlab programming		3
	Synthesis (design) of LC systems based on root locus technique		3
	Synthesis (design) of LC systems in the frequency domain by phase-lag and phase-lead compensators and Bode diagrams		3
	Design of LC systems in state space, Part 1: Creating the desired transfer function of LC system using state variables for two different cases (eliminating zeros and increase the excess of poles over zeros in plant transfer function), Matlab and Simulink		3
	Design of LC systems in state space, Part 2: Creating the desired transfer function of LC system using state variables for other two different cases (moving and adding zeros to the plant transfer function in plant transfer function), Matlab and Simulink		3

Format of instruction	☒ lectures ☐ seminars and workshops ☒ exercises ☐ *on line* in entirety ☐ partial e-learning ☐ field work	☒ independent assignments ☒ multimedia ☒ laboratory ☐ work with mentor ☐ (other)
Student responsibilities	The presence on lectures in the amount of at least 70 % of the times scheduled. Performed and positively assessed all required laboratory exercises.	

Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*	Class attendance	2,5	Research		Practical training	
	Experimental work		Report		Individual work	1
	Essay		Seminar essay		Laboratory exercises	1,5
	Tests	0,25	Oral exam		Preparation for laboratory exercises	0,5
	Written exam	0,25	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 8 theoretical questions and numerical problems and final tests consist of 10 theoretical questions and numerical problems. In the final exams students that did not pass the midterm exams take part. The midterm and final exams are carried out as written tests. The requirement for passing grade is the positive assessment of laboratory exercises and 50 % points on each midterm exam or the final exam. Grade (in percentage) is formed according to the formula: Grade(%) = 0,1 LV + 0,45 (M1 + M2) the activities in percentage: • LV – laboratory assessment, • M1, M2 – test results.

<table>
<tr><td></td><td>The final grade is determined as follows:
<table>
<tr><th>Percentage:</th><th>Grade:</th></tr>
<tr><td>50% do 61,9%</td><td>2</td></tr>
<tr><td>62% do 74,9%</td><td>3</td></tr>
<tr><td>75% do 89,9%</td><td>4</td></tr>
<tr><td>90% do 100%</td><td>5</td></tr>
</table></td></tr>
<tr><td rowspan="3">Required literature (available in the library and via other media)</td><td>Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td>• Tamara Grujić: "Linearni regulacijski sustavi – Predavanja sa zadacima", Interna skripta, FESB, Split, 2011.</td><td></td><td>e-learning portal</td></tr>
<tr><td>• Tamara Grujić: "Upute za laboratorijske vježbe iz kolegija Linearni regulacijski sustavi", interna skripta, FESB</td><td></td><td>e-learning portal</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">• J. J. D'Azzo, C. H. Houpis: "Linear control system analysis and design", McGraw – Hill International Editions, 4. edition, 1995.
• M. Fogiel (Editor): "The automatic control systems / Robotics; Problem solvers", Research & Education Association, 2000.
• R. C. Dorf. R. H. Bishop: "Modern control systems", Addison – Wesley Publishing Company, 1995.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">- Evaluation of results in accordance with the above learning outcomes
- Feedback from students via surveys
- Self-evaluation of teachers
- Institutional and non-institutional evaluations
- Keeping records of lectures attendance
- Keeping records of the presence of the laboratory exercises and a review and assessment of submitted reports</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="3"></td></tr>
</table>

NAME OF THE COURSE	MEASUREMENTS AND SIGNAL PROCESSING						
Code	FENI03	Year of study	1.				
Course teacher	Goran Petrović, Ph.D., Associate Professor	Credits (ECTS)	6				
Associate teachers	Juraj Alojzije Bosnić, m.e.	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	30	0
Status of the course	Elective	Percentage of application of e-learning	30				

COURSE DESCRIPTION

Course objectives	Training students for: - understand various devices for measurements and analog-digital conversion, - perform statistical signal processing and estimation, - perform analog and digital spectral analysis.
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: - data logging and data acquisition of various signals, - estimate errors of direct and indirect measuring quantities, - determine parameters of mathematical model, - determine spectral components of continuous and discrete periodic functions, - determine spectral components of continuous and discrete aperiodic functions, - distinguish basic sources of harmonics and others disturbances in power system, - suggest measure for reducing of harmonic distortions.

Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	Signals. Division and features of signals. Continuous, discrete and digital signal recording. Types of measuring instruments.	2	0
	Analog recorders. Data loggers. Data acquisition devices and interfaces. Digital oscilloscopes. Sample rate.	2	0
	Systematic errors and random errors. Quantization error. Signal noise ratio.Error budget of a linear sensor.	2	0
	Measurement error and probability theory. Some important density functions. Central limiting theorem. Chi square test.	2	0
	Two-dimensional random variable. Linear regression. Guide to the expression of uncertainty in measurement.	2	0
	The method of least squares. Linear and nonlinear relationship. Lagrange weighting matrix.	2	0
	Orthogonal functions analysis of continuous signals. Orthogonal polynomial analysis of discrete signals. Fourier series.	2	0
	First midterm exam		0
	Elementary digital signals. Properties of Dirac and sinc function. Exponential Fourier series.	2	0
	Fourier transform of aperiodic continuous function. Fourier transform of periodic continuous function.	2	0
	Fourier transform of discrete aperiodic and periodic function. Nyquist criterion and aliasing.	2	0
	Discrete time Fourier transform DTFT. Discrete Fourier transform DFT and Fast Fourier Transform FFT.	2	0
	Spectral leakage. Windowing. Virtual instrumentation.	2	0

	Transfer function and Filtering. Harmonic distortion in power system and industrial facilities.	2	0
	Second midterm exam		0
	List of laboratory exercises		LE hours
	Principles of Matlab coding		3
	Statistics processing		3
	Least square method. Linear and nonlinear problems.		3
	Trigonometric and Exponential Fourier series		3
	Voltage and Current transducers. Analog to digital converter.		3
	Root mean square RMS. Active and reactive power. Power factor.		3
	Using of window functions.		3
	Transfer function and filtering.		3
	Practical skills exam		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 lectures in the amount of at least 70 % of the times scheduled. Performed all required laboratory exercises.	

Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*						
	Class attendance	1	Research		Practical training	
	Experimental work		Report		Individual work	3
	Essay		Seminar essay		Laboratory exercises	0,5
	Tests	0,5	Oral exam		Preparation for laboratory exercises	0,5
	Written exam	0,5	Project		(Other)	

Grading and evaluating student work in class and at the final exam	There are two midterms and final exams that are carried out as written tests. 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 5 theoretical questions and numerical problems and final tests consist of 10 theoretical questions and numerical problems. In the final exams students that did not pass the midterm exams take part. The requirement for passing grade is the positive assessment of laboratory exercises and 40 % points on each midterm exam or the final exam. Grade (in percentage) is formed according to the formula: Grade(%) = 0,4 LV + 0,3 (M1 + M2) the activities in percentage: • LV – laboratory assessment, • M1, M2 – test results.

Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	• S. Milun, G. Petrović: Skripta s predavanja, FESB		e-learning portal

Optional literature (at the time of submission of study programme proposal)	• HP; The fundamentals of signal analysis, AN 243. • J. G. Proakis, D. G. Manolakis: Digital Signal Processing, Prentice Hall,New Jersey, 1996.
Quality assurance methods that ensure the acquisition of	- Evaluation of results in accordance with the above learning outcomes - Feedback from students via surveys - Self-evaluation of teachers - Institutional and non-institutional evaluations

exit competences	
Other (as the proposer wishes to add)	

NAME OF THE COURSE	MICROCONTROLLERS AND NETWORK EMBEDDED SYSTEMS						
Code	FELG24	Year of study	2.				
Course teacher	Mirjana Bonković, Ph.D., Full Professor	Credits (ECTS)	5				
Associate teachers	Ivo Stančić, Ph.D., Assistant Professor	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	30	0
Status of the course	Obligatory	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students: - to develop an understanding for the purpose and the design principles of the embedded systems - to develop an understanding of basic microcontroller architecture - to be familiar with concept of microcontroller interfaces - to be able to create embedded system that communicates via a local Ethernet network and the Internet	
Course enrolment requirements and entry competences required for the course	Finished programming course.	
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - define and understand the basic concepts related to the process of designing the embedded system. - define and understand the interfacing techniques - program the related microcontrollers' peripheral systems to establish the appropriate functionality of the embedded system - design the embedded system in the Arduino environment that reflect the functionality based on the information processing acquired from the sensors. - apply a procedure that provides network data transmission from sensor to the processing unit - apply a procedure which ensures the functionality of the embedded system through web interface.	
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours
	The purpose of a microcontroller. Embedded system design principles.	2
	Embedded system design in Arduino environment.	2
	Knowledge and understanding of fundamental embedded systems design paradigms, architectures, possibilities and challenges, both with respect to software and hardware.	2
	Microprocessor peripheral devices. General purpose input output.	2
	Serial communication: SPI, USART, IIC.	4
	Real time clock. Timers.	2
	A / D and D / A converters. Realization of A / D converters.	2
	Interrupts. Programming interrupts.	2
	Architecture and functional microprocessors' components for network communication.	2
	Using IP for local and Internet communications. Exchanging messages using UDP and TCP, e-mail. Alarm system.	2
	Using the Web interface.	2
	Optimization of the embedded system regarding the energy consumption	2

	List of laboratory or design exercises	LE hours
	Introduction to the Arduino development environment: hardware components and programming mode.	2
	Digital input - output. Serial Monitor.	2
	Analog input. PWM output.	2
	Speed control of DC motors.	2
	Using GPS module.	2
	Using NRF modules.	2
	Sensors: OneWire temperature sensor, analog sensor (gyroscope), IIC sensor.	2
	Ethernet shild. Exchanging messages using UDP and TCP.	2
	Web server (with and without feedback), e-mail, alarm system.	2
	Optimization of the embedded system regarding the energy consumption	2
	Student projects.	6

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		

Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*						
	Class attendance	2	Research		Practical training	
	Experimental work		Report		Individual work	0,6
	Essay		Seminar essay	1	Laboratory exercises	0,8
	Tests	0,2	Oral exam		Preparation for laboratory exercises	0,2
	Written exam	**0,2**	Project		(Other)	

Grading and evaluating student work in class and at the final exam	During the semester there are two midterm exams. The first midterm exam is after 7 weeks of lectures and the second one is after 13 weeks of lectures (in a form of presentation and defense of the project assignment). Each midterm test (as well as the final test) is carried out in a written format with duration of 90 minutes. The requirement for passing grade is the positive assessment of laboratory exercises and 50 % points on average midterm exam ((M1 + M2)/2) or the final exam. Students are allowed to have at least 45% of total points on each midterm exams, as long as the final midterm average is at least 50% of total points. Grade (in percentage) is formed according to the formula: Grade(%) = 0,1L + 0,4M1 + 0,5M2 where: • L – laboratory assessment, • M1, M2 – midterm test results. According to Article 65. of Faculty's Bylaw, student is required to participate in all teaching activities attending at least 70% of lectures, and 100% of laboratory exercises. If student does not meet these criteria, she or he won't be able to take part in the final exam, and will be required to enroll in the course the next year.

<table>
<tr><td rowspan="5">Required literature (available in the library and via other media)</td><td>Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td>Steven F. Barrett, Arduino Microcontroller Processing for Everyone!, Synthesis Lectures on Digital Circuits and Systems, Morgan & Claypool Publishers, 2010.</td><td></td><td></td></tr>
<tr><td>David Russeell, Introduction to Embedded Systems Using ANSI C and the Arduino Development Environment, Synthesis Lectures on Digital Circuits and Systems, Morgan & Claypool Publishers, 2010.</td><td></td><td></td></tr>
<tr><td>Michael Predko , Handbook of Microcontrollers, Tab Books, 1998.</td><td></td><td></td></tr>
<tr><td>M. Bonković, J. Musić, I. Stančić, Mikroregulatori i ugradbeni mrežni sustavi, FESB, 2014.</td><td></td><td>e-learning</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">1. Claus Kuhnel, Klaus Zahnert, BASIC Stamp : An Introduction to Microcontrollers,Newnes, 2000.
2. Han-Way Huang, PIC Microcontroller, Thomson Delmar Learning, 2004.
3. Jan Axelson: Embedded Ethernet and Internet complete, Lakeview Research LLC, 2003., ISBN: 1-931448-00-0
- Microcontroller links http://people.westminstercollege.edu/faculty/rerickson/control/stamplinks.html</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">- Keeping records of student attendance.
- Annual analysis of course statistics in terms of midterm and finals exams.
- Feedback from students via surveys.
- Teacher self-evaluation.
- Feedback from graduated students (or senior students) on course content relevance.
- Periodic institutional evolution of course teachers.</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="3"></td></tr>
</table>

NAME OF THE COURSE	MOBILE ROBOTICS						
Code	FELG25	Year of study	2.				
Course teacher	Mirjana Bonković, Ph.D., Full Professor	Credits (ECTS)	5				
Associate teachers	Miroslav Dujmović, BSc (external collaborator)	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	30	0
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - understanding basic working principles and limitations of individual robot components (actuators, sensors and control units). - understanding and applying number of different techniques for solving problems in the robotics domain such as control and navigation, as well as programming robot/drone to perform desired task.
Course enrolment requirements and entry competences required for the course	None
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - describe basic mobile robot and drone components. - describe properties of widely used sensors in mobile robotics. - explain different modes of mobile robot control. - develop PID controller for mobile robot control. - design algorithms for data fusion based on Kalman filter. - formulate algorithm for path planning, obstacle avoidance and simple navigation. - demonstrate application of computer vision in mobile robot control (visual servoing). - apply acquired knowledge in higher level programming languages (e.g. Visual C#, Python, Java). - evaluate efficiency of path planning and navigation algorithms.

Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours
	Introduction: mobile robot (drone) components.	2
	Microcontrollers. Arduino IDE for robot control.	2
	Sensors: sensor characteristics, uncertainty representation, sensor types: incremental encoders, position and orientation sensors, inertial sensors, vision sensors.	4
	Mobile robot kinematics. Drive. Mobile robot control modes: on-off control, PID controller, speed and position controller.	4
	Robot localization: Kalman, particle and information filter.	4
	Navigation: planning and control.	2
	Control with navigation error as input.	2
	Visual servoing.	2
	Selected practical examples of control of mobile robots and drones.	4
	List of laboratory or design exercises	LE hours
	Arduino development environment.	2
	Digital I/O – ultrasonic sensor.	3
	Motor control. Connection motors and sensors.	3
	Line following.	2
	Obstacle avoidance.	4
	Working on project assignments.	16

<table>
<tr><td>Format of instruction</td><td colspan="6">☒ lectures
☒ seminars and workshops
☐ exercises
☐ on line in entirety
☐ partial e-learning
☐ field work</td><td colspan="2">☐ independent assignments
☒ multimedia
☒ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="8">The presence on lectures in the amount of at least 70 % of the times scheduled. Performed all required laboratory exercises.</td></tr>
<tr><td rowspan="6">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>1,5</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Individual work</td><td>2</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>Laboratory exercises</td><td>1</td></tr>
<tr><td>Tests</td><td>0,2</td><td>Oral exam</td><td></td><td>Preparation for laboratory exercises</td><td>0,1</td></tr>
<tr><td>Written exam</td><td>0,2</td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td colspan="6"></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="8">During the semester there are two midterm exams. The first midterm exam is after 7 weeks of lectures and the second one is after 13 weeks of lectures (in a form of presentation and defense of the project assignment). Each midterm test (as well as the final test) is carried out in a written format with duration of 90 minutes. The requirement for passing grade is the positive assessment of laboratory exercises and 50 % points on average midterm exam ((M1 + M2)/2) or the final exam. Students are allowed to have at least 45% of total points on each midterm exams, as long as the final midterm average is at least 50% of total points.
Grade (in percentage) is formed according to the formula:

Grade(%) = 0,1L + 0,25M1 + 0,65M2

where:
• L – laboratory assessment,
• M1, M2 – midterm test results.

According to Article 65. of Faculty's Bylaw, student is required to participate in all teaching activities attending at least 70% of lectures, and 100% of laboratory exercises. If student does not meet these criteria, she or he won't be able to take part in the final exam, and will be required to enroll in the course the next year.</td></tr>
<tr><td rowspan="8">Required literature (available in the library and via other media)</td><td colspan="5">Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td colspan="5">• T Siegwart, R., Nourbakhsh, I. R., Scaramuzza D., Autonomous Mobile Robots, MIT Press, 2011.</td><td></td><td>teacher/Internet</td></tr>
<tr><td colspan="5">• Thomas Braunl, Embedded Robotics: mobile robot design and applications with embedded systems, Springer, 2006.</td><td></td><td>teacher/Internet</td></tr>
<tr><td colspan="5">• S. Thrun, W. Burgard, D. Fox, Probabilistic Robotics, MIT Press, 2006.</td><td></td><td>teacher/Internet</td></tr>
<tr><td colspan="5">• Saeed B. Niku: Introduction to Robotics: Analysis, Systems, Applications, Prentice Hall, 2001.</td><td></td><td>teacher</td></tr>
<tr><td colspan="5">• M. Bonković, J. Musić, I Stančić: "Mikroregulatori i ugradbeni mrežni sustavi u Arduino razvojnom okruženju", faculty book, FESB</td><td></td><td>e-learning portal</td></tr>
<tr><td colspan="5">• J. Musić, M. Bonković: Authorised lecture notes, FESB</td><td></td><td>e-learning portal</td></tr>
</table>

Optional literature (at the time of submission of study programme proposal)	• Tadej Bajd: Osnove robotike, Fakulteta za elektrotehniko, Univerza v Ljubljani, 2000. • Kovačić, Laci, Bogdan, Osnove robotike, Fakultet elektrotehnike i računarstva, Zagreb, 1999.
Quality assurance methods that ensure the acquisition of exit competences	- Keeping records of student attendance. - Annual analysis of course statistics in terms of midterm and finals exams. - Feedback from students via surveys. - Teacher self-evaluation. - Feedback from graduated students (or senior students) on course content relevance. - Periodic institutional evolution of course teachers.
Other (as the proposer wishes to add)	/

<table>
<tr><td>NAME OF THE COURSE</td><td colspan="6">MODELLING AND CONTROL OF VESSELS AND GROUND VEHICLES</td></tr>
<tr><td>Code</td><td>FELG27</td><td>Year of study</td><td colspan="4">1</td></tr>
<tr><td>Course teacher</td><td>Darko Stipaničev,Ph.D., Full Professor (70%)
Damir Krstinić, Ph.D., Associate Professor (30%)</td><td>Credits (ECTS)</td><td colspan="4">5</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2">Damir Krstinić, Ph.D., Associate Professor</td><td rowspan="2">Type of instruction (number of hours)</td><td>L</td><td>S</td><td>AE</td><td>LE</td><td>DE</td></tr>
<tr><td>30</td><td>0</td><td>0</td><td>30</td><td>0</td></tr>
<tr><td>Status of the course</td><td>Elective</td><td>Percentage of application of e-learning</td><td colspan="4">80</td></tr>
<tr><td colspan="7">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="6">The aim of the course is basic knowledge to modeling vessels (ships, floating platforms, underwater vehicles) and ground vehicles with special emphasis on automatic control systems (autopilot).</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="6">Basic knowledge of mathematics and principles of automation.
To follow the College is necessary knowledge of English.</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="6">Students will be able to successfully mastering the subject:
1. Explain systematic approach to automatic control of vehicles divided by means of transport in relation to the media in which they are moving.
2. Apply the mathematical modelling of vehicles: local and global coordinate system, kinematic and dynamic equations, linearization equations of motion, stability.
3. Describe the vessels (ship, platform, underwater vehicles) as an object of control. Manageable and unmanageable freedom of movement of the ship. Setting up a mathematical model of the ship. Hydrodynamic coefficients. Propulsion and steering system. Linearized kinematic and dynamic model of the ship.
4. Describe piloting and automatic piloting. Stabilization of the vessel and automatic stabilization. Navigation and navigation systems in the conduct of the ship (terrestrial, astronomical, radio and satellite (GPS) navigation). Standard and intelligent auto-pilot. Autonomous underwater vehicle (ROV - Remotely Operated Vehicles and AUV - Autonomous Underwater Vehicles) and their control principles.
5. Describe land vehicle as an object of control. Setting up a mathematical model of movement of land vehicles. Drive control structures. Vehicles with three, four or more wheels, excavators. Remotely operated vehicles and autonomous self-propelled vehicles. The application of artificial intelligence in automatic control of vessels and ground vehicles.</td></tr>
<tr><td rowspan="3">Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="4">Course content</td><td>L hours</td><td>LE hours</td></tr>
<tr><td colspan="4">A systematic approach to automatic control of transport vehicles. Division of means of vehicles in relation to the media in which they are moving. Mathematical modeling of the movement of vessels and ground vehicles: local and global coordinate sutavi, kinematic and dynamic equations, linearization equations of motion stability.</td><td>4</td><td>0</td></tr>
<tr><td colspan="4">The vessel (ship, platform, underwater vehicles). Manageable and unmanageable freedom of movement of the vessel. Setting up a mathematical model of the vessel. Hydrodynamic coefficients. Propulsion and steering system linearized model the movement of the ship.</td><td>6</td><td>0</td></tr>
</table>

	Navigation and navigation systems in the conduct of the ship (terrestrial, astronomical, radio and satellite (GPS) navigation). NMEA communication protocols. Piloting and automatic piloting. Standard and intelligent auto-pilot. Design of auto-pilot mode for followed navigation and course keeping. Stabilization of the vessel and automatic stabilization. Autonomous underwater vehicle (ROV - Remotely Operated Vehicles and AUV - Autonomous Underwater Vehicles) and their guiding principles	8	0
	Land vehicle as control objects. Setting up a mathematical model of movement of land vehicle. Vehicles with three, four or more wheels, excavators. Drive drive and Tolinski machines. Management structures and systems of automatic control of land vehicles. CAN communication protocols. Remotely operated vehicles and autonomous self-propelled vehicles. The application of artificial intelligence in automatic management of vessels and vehicles.	8	0
	Mathematical modeling of the vessel to cross the ship simulator in Matlab.	0	0
	The ship as a control object, the bridge, the ship's steering equipment (preferably field work - visit one of the ships)	0	6
	Modern marine simulators (preferably field work - visit one of the maritime colleges)	0	6
	Mathematical Model of the structures driven by springs (Sodaconstructor - http://sodaplay.com)	0	6
	Mathematical modeling of ground vehicles (Racing Car Simulator)	0	6

Format of instruction	☒ ☒ lectures ☐ ☒ seminars and workshops ☒ ☒ exercises ☐ *on line* in entirety ☐ partial e-learning ☐ field work	☐ independent assignments ☒ multimedia ☒ ☒ laboratory ☐ work with mentor ☐ (other)
Student responsibilities	The presence on lectures in the amount of at least 70 % of the times scheduled. Performed all required laboratory exercises.	

Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*						
	Class attendance	1,5	Research		Practical training	
	Experimental work		Report		Individual work	
	Essay		Seminar essay		Laboratory exercises	1,5
	Tests		Oral exam		Preparation for laboratory exercises	
	Written exam	**2**	Project		(Other)	

Grading and evaluating student work in class and at the final exam	The exam consists of a written part and if necessary additional oral exam. During the semester will be two tests. The first colloquium in 8 weeks of classes, the second at 18 weeks. A student can pass the course by these tests. In the two final exams in June and July, students who have not collected inadequate number of points through colloquia take the whole subject covered by the two tests. The condition for taking the final exam is successfully finished practical lab exercises. The exam is comprehensive and includes the theoretical part of the material and tasks with auditory exercises. The condition for positive assessment is that the student has a total of at least 50% on the exam or when it must have a minimum 25% passing the theoretical part of the material and 25% of the deposited duties. If a student has less than 25% of the points on the tasks and / or less than 25% points from the theoretical part of the material again taken the entire exam. Students who did not pass the exam after two final exams can pass the exam in

<table>
<tr><td></td><td colspan="3">autumn periods. All test questions students will be known before the exam.

These rules apply equally to students who are enrolled this course for the first time and to those students who enter college for the second time.

The final grade is determined as follows:
percentage Rating
50% to 61% is sufficient (2)
62% to 74% good (3)
75% to 87% of very good (4)
88% 100% Excellent (5)

The first colloquium will take the material to the teaching units to the seventh week inclusive, and on the other the rest of the teaching weeks. Examinations are held in terms of the anticipated calendar of classes.

Under Article 65 of the Statute of the Faculty, the student is required to participate in all forms of teaching and attend: lectures at least 70% of classes. If she or he do not meet these requirements, the student will not be able to take the exam and get a signature.</td></tr>
<tr><td rowspan="6">Required literature (available in the library and via other media)</td><td>Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td>• D.Stipaničev, D.Krstinić, Modelling and control of vessels and vehicles, lecturing notes and internal textbook</td><td></td><td>e-learning portal</td></tr>
<tr><td>• Jecić, S.: Mehanika II - kinematika i dinamika, Tehnička knjiga Zagreb, 1989.</td><td></td><td></td></tr>
<tr><td>• Babić, E.; Karmelić, A.: Numeričko modeliranje složenih gibanja, Školska knjiga Zagreb, 1988.</td><td></td><td></td></tr>
<tr><td>• Fossen, T.I.: Guidance and Control of Ocean Wehicles, J.Wiley, Chicester, 1994</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">AUV Page http://www.transit-port.net/Lists/AUVs.Org.html
The ROV World Gateway http://www.rovworld.com/
ROV Links http://members.chello.nl/rengelsman/
Robotics http://www.nosc.mil/robots/index.html</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">- Evaluation of results in accordance with the above learning outcomes
- Feedback from students via surveys
- Self-evaluation of teachers
- Institutional and non-institutional evaluations</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="3"></td></tr>
</table>

NAME OF THE COURSE	MODERN PHYSICS							
Code	FEMG01	Year of study	1.					
Course teacher	Nikola Godinović, Ph.D., Associate Professor	Credits (ECTS)	4					
Associate teachers	Dunja Polić, Darko Zarić, Toni Vrdoljak	Type of instruction (number of hours)	L	S	AE	LE	DE	
			30	0		30	0	
Status of the course	Obligatory	Percentage of application of e-learning	0					

COURSE DESCRIPTION

Course objectives	Understanding the basic laws and concepts of quantum physics and their application in modern engineering techniques, technology and information. The acquired knowledge serves as a basis for the adoption of further expertise through specialized courses, as well as preparing for the adoption of professional knowledge throughout his career.
Course enrolment requirements and entry competences required for the course	
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Developing ability of abstract thinking and understanding the concepts of quantum physics on which modern technologies are based Understanding of the electric and magnetic properties of the materials starting from their atomis structure Understanding the fenomenology of superconductors. Basic understanding of nuclear physics and their aplication for energy generation as well as basic understanding of radioactivity and dosimetry. Become familiar with modern diagnostic methods and treatments in medicne: nuclear magnetic resonance (NMR), positron emission tomography (PET), Hadron therapy, ...

Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	LE hours
	Special theory of relativity	2	
	General theory of relativity	2	
	Particle properties of waves	2	
	Wave properties of particle	2	
	Introduction to wave mechanics - Schrodinger equation	2	
	Application of Schrodinger equation	2	
	Schrodinger equation for hydrogen atom	2	
	Electrical properties of material	2	
	Semiconductors	2	
	Magnetic properties of material	2	
	Phenomenology of superconductor	2	
	Atomic nuclei	2	
	Application of nuclear physics	2	

	List of laboratory or design exercises	LE hours
	Basics statistics of data analysis	4
	Light interference	2
	Measurement of the ratio of electron charge and mass	2
	Photoelectric effect	2
	Spectral line of gasses	2
	Solar cell characterisation	2
	Hall effect	2
	Semiconductor photo detectors	4
	Demonstrations of magnetism	2
	Demonstration of the phenomenology of superconductor	2
	Dosimetry	2
	Measurement of the gamma-rays spectrum	4

Format of instruction	☒ **lectures** ☐ seminars and workshops ☒ **exercises** ☐ *on line* in entirety ☐ partial e-learning ☐ field work	☐ independent assignments ☐ multimedia ☒ **laboratory** ☐ work with mentor ☐ (other)
Student responsibilities	The presence on lectures in the amount of at least 70 % of the times scheduled.	

Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*						
	Class attendance	1,0	Research		Practical training	
	Experimental work		Report		Individual work	2,6
	Essay		Seminar essay		(Other)	
	Tests	0,2	Oral exam		(Other)	
	Written exam	0,2	Project		(Other)	

Grading and evaluating student work in class and at the final exam	There are two midterm exams, two final exams and one make-up exam. The first midterm exam is after 7 weeks of lectures and the second one is after the next 6 weeks. Each midterm test lasts for 90 minutes and consists of the following 4 questions: The requirement for passing grade at the midterm exams is to have at least 50% from each of 4 questions. Students that do not pass one of the midterm exams can retake it during the final exams. Final exams lasts 135 minutes each and consist out of the following 6 questions: The requirement for passing grade at the final exam is to have at 50% from each of 6 questions. Final grade is determined using the relative grading system based on the arithmetic mean of the per cents of each of the additional questions. Students that have passed both midterm exams or final exams are grouped in four categories: 15% of the students with the highest arithmetic means are assigned grade A (excellent), 35% of the students with the next best arithmetic means are assigned grade B (very good), 35% of the students with the next to next best arithmetic means are assigned grade C (good), and 15% of the students with the lowest passing arithmetic means are assigned grade D (satisfactory). Students who fail to pass the course through midterms and/or final exams have one make-up exam at the beginning of fall. This exam features the same format as the final exam. Exam schedule is predetermined through the academic calendar.

	Title	Number of copies in the library	Availability via other media
Required literature (available in the library and via other media)	• Knapp, V.; Colić, P.: Uvod u električna i magnetska svojstva materijala, Školska knjiga, Zagreb, 1997		
	• I. Supek, M. Furić: Počela fizike, Školska knjiga, Zagreb, 1994.		
	• A. Beiser: Concepts of Modern Physics, sixth edition, McGraw-Hill 2003		
Optional literature (at the time of submission of study programme proposal)	• E.V. Wichmann: Kvantna Fizika, udžbenik fizike Sveučilišta u Berkeley, svezak 4., Tehnička knjiga, Zagreb, 1988. • D. Halliday, R. Resnick, J. Walker: Fundamentals of Physics 10th edition, John Wiley & Sons, Inc., 2013. • Vladimir Šips, Uvod u fiziku čvrstog stanja, Školska knjiga 2000.		
Quality assurance methods that ensure the acquisition of exit competences	- Student evaluation surveys Teacher self-evaluation - Institutional and non-institutional evaluations		
Other (as the proposer wishes to add)			

NAME OF THE COURSE	MULTIVARIABLE CONTROL						
Code	FELG26	Year of study	2.				
Course teacher	Jadranka Marasović, Ph.D., Full Professor	Credits (ECTS)	5				
Associate teachers		Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	30	0
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students to: Enable students to understand the possibilities of automated systems, and that in everyday life almost there are no simple systems and to understand that the independent work of complex systems should be the result of thoughtful and physically allowable control. Enable students to acquire knowledge about the basic concepts of multivariabel control and how to connect a number of different subsystems for which the whole, joint work is necessary compromise of all interactions.		
Course enrolment requirements and entry competences required for the course	None.		
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: 1. describe the importance of automated multivariable systems and to define the problems of complex interactions, 2. apply mathematical models of multivarible systems and to understand their problems for the automated processes design, 3. apply a simulation on a digital computer to support the control theory, 4. calculate the fundamental characteristics of the system by means of appropriate methods of analysis (time and frequency domain), 5. choose the appropriate methods for the synthesis and taking account of the tasks and possibilities of physical performance, 6. solve independently complex tasks of system automation.		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	Introduction: automation tasks, issues and areas of application. System theory. Control. theory Control loop. Systems modeling.	2	0
	Single input-single output (SISO) system toward multi input-multi output (MIMO) system.	2	0
	Mathematical models of multivarable systems, state space model and Laplace transform presentation.	2	0
	Dynamic systems simulation.	2	0
	ITransfer matrix. Multivariable system response in time.	2	0
	The complex systems analysis. The parts of the systems response in time domain: transient part and steady state part.	2	0
	Multivariable system and matrix of interaction. Operating window.	2	0
	Multivariable system stability analysis.	2	0
	Basic concepts of matrix algebra that are necessary for a full analysis. Multivariable system controllability and observability.	2	0
	Decoupling control.	2	0
	Feedforward control and disturbance rejection.	2	0
	Multivariable control and optimal controllers placement.	2	0

	Multivariable control concepts used in the cae of single input-single output tasks. Observers. Kalman filter.	2	0
	List of laboratory or design exercises		LE hours
	Dynamic multivariable systems simulation.		2
	Testing by means of simulation presentation of mathematical conversions. Transition from state space to the transfer matrix.		2
	The analysis of the impact of changes in one of several inputs to any of several outputs. A simulation presentation of existing interactions.		2
	The analysis of the multivariable first and the second order systems. The parts of the systems response in time domain: transient part and steady state part.		2
	Multivariabel systems stability.		2
	Controllability and observability used for the simple controller synthesis,		2
	Decoupling control and the choice of controller placement.		2
	The choice of controller synthesis in the case of feedforward control and the disturbance rejection.		2
	Optimal control.		2
	Kalman filter and simulation presentation of its work.		2
	Seminar essay.		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 ☒ seminar essay (other)
Student responsibilities	Minimum of 70 percent lecture attendance. Completing all the required laboratory exercises.	

Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*						
	Class attendance	1.5	Research		Practical training	
	Experimental work		Report		Individual work	0.5
	Essay		Seminar essay	1	Laboratory exercises	1
	Tests	0.5	Oral exam		(Other)	
	Written exam	0.5	Project		(Other)	

Grading and evaluating student work in class and at the final exam

During semester, there will be two mid-term exams – according to the class schedule. The requirement for the positive grade is the attendance and commitment at the laboratory exercises, minimum of 40 percent correct answers at one mid-term and a final grade is determined with minimum of 50 percent total correct answers.

The final grade is determined based on the total number of points earned, which is calculated as follows:

Grade [%] = 0.5 * M1 + 0.5*M2

Percentage	Grade
50% to 61%	sufficient (2)
62% to 74%	good (3)
75% to 87%	very good (4)
88% to 100%	excellent (5)

The final exam encompasses the entire course load or selected parts of it that students' did not pass at either of mid-term exams. The correction exam encompasses the entire course load. The requirement for passing the exam is minimum of 50 percent correct answers. The exams are held according to the class schedule.

	Title	Number of copies in the library	Availability via other media
Required literature (available in the library and via other media)	• J. Marasović; "Basics Steps of Automatic Control“ (in Croatian: Temeljni postupci u automatici), FESB, Authorized lectures		e-learning portal
	• J Božičević J.: "Basics of Automatic Control 1“ • (in Croatian: Temelji automatike 1), Školska knjiga, Zagreb, 1990		
	• G. Nikolić : "Automatic Control“ (in Croatian: Upravljanje), Školske novine, Zagreb 1996.		
Optional literature (at the time of submission of study programme proposal)	• T. Šurina: " (in Croatian: Automatska regulacija), Školska knjiga, Zagreb 1987. • B. Novaković: " Methods of Technical Systems Control“ (in Croatian: Metode vođenja tehničkih sistema), Školska knjiga, Zagreb. 1990.		
Quality assurance methods that ensure the acquisition of exit competences	- Keeping records on class attendance - Annual analysis of exam results - Student survey on teaching performance - Teacher self-evaluation - Feedback information from graduates regarding course content relevancy		
Other (as the proposer wishes to add)			

NAME OF THE COURSE	NONLINEAR CONTROL SYSTEMS							
Code	FELG11	Year of study	1					
Course teacher	Mojmil Cecić, Ph.D., Full Professor	Credits (ECTS)	5					
Associate teachers	Ana Kuzmanić Skelin, Ph.D., Assistant Professor	Type of instruction (number of hours)	L	S	AE	LE	DE	
			30	0	30	0	0	
Status of the course	Obligatory	Percentage of application of e-learning	0					

COURSE DESCRIPTION

Course objectives	Training students for: - understanding and application of basic principles and laws of automatic control to analyse nonlinear control systems, - analysis of the nonlinear control systems in the time domain, - analysis of the nonlinear control systems in the phase plane, - permanent adoption and deepening of knowledge in the field of the nonlinear control systems.
Course enrolment requirements and entry competences required for the course	None
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - define the fundamental principles of the time domain analyse of the nonlinear control systems, - present various nonlinearities, - analyse of the nonlinear control systems in the time domain, - describe different nonlinearities with describing function, - analyse the stability of the nonlinear control systems, - analyse the nonlinear control systems in the phase plane.

Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	Fundamentals of nonlinear control theory	2	2
	Typical nonlinearities,Relay systems	2	4
	Transient processes in relay systems	4	4
	Linearization of nonlinear systems	2	2
	Method of harmonic linearization, Describing function	4	2
	Stability of relay systems	4	4
	Phase portraits	4	4
	Phase plane analysis	4	4

Format of instruction		
	☒ lectures ☐ seminars and workshops ☒ exercises ☐ *on line* in entirety ☐ partial e-learning ☐ field work	☒ independent assignments ☐ multimedia ☐ laboratory ☐ work with mentor ☐ (other)
Student responsibilities	The presence on lectures in the amount of at least 70 % of the times scheduled.	

<table>
<tr><td rowspan="5">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>2,0</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Individual work</td><td>2,5</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>0,2</td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td>0,2</td><td>Oral exam</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>0,1</td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">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.

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)
where M1 and M2 are the results of the midterm exams in percentage.

Each midterm test consists of 10 theoretical questions and numerical problems and final test also consists of 10 theoretical questions and numerical problems divided into two groups (the first and the second part). The requirement for passing grade is 50% of the total number of questions. The students who did not pass the midterm exams take part in the final exam. The midterm and final exams are carried out as written tests. Finally grade is determined as follows:
from 50% to 62.5% - dovoljan (2)
from 62.5% to 75% - dobar (3)
from 75% to 87.5% - vrlodobar (4)
from 87.5% to 100% - izvrstan (5)

Midterm and final exams are held in the terms provided by the time table.</td></tr>
<tr><td rowspan="4">Required literature (available in the library and via other media)</td><td colspan="3">Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td colspan="3">• Horacio J. Marquezz, Nonlinear Control Systems : Analysis and Design , WileyInterscience 2003</td><td>1</td><td></td></tr>
<tr><td colspan="3">• Jean-Jacques Slotinee, Weiping Li, Applied Nonlinear Control, Pearson Education, 1990.</td><td>1</td><td></td></tr>
<tr><td colspan="3">• Mojmil Cecić, Nelinearni regulacijski sustavi, authorized lectures, FESB Split, 2007.</td><td></td><td>e-learning portal</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6">• Henk Nijmeijer, Arjan Van Der Schaft, Nonlinear Dynamical Control Systems, Springer Verlag, 1990</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="6">- Evaluation of results in accordance with the above learning outcomes
- Feedback from students via surveys
- Self-evaluation of teachers
- Institutional and non-institutional evaluations</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="6"></td></tr>
</table>

NAME OF THE COURSE	NUMERICAL ANALYSIS						
Code	FEMK01	Year of study	1				
Course teacher	Ivan Slapničar, Ph.D., Full Professor	Credits (ECTS)	5				
Associate teachers	Lana Periša Anita Carević	Type of instruction (number of hours)	L	S	AE	LE	DE
			30		30		
Status of the course	Elective	Percentage of application of e-learning	20				

COURSE DESCRIPTION

Course objectives	Training students for: - understanding concepts and skills of numerical analysis: error analysis of computer aruthmetics, solving systems of linear equations, polynomial interpolation, splines, least squares method, numerical integration, solving nonlinear equations, solving digfferential equations, - applications of the above concepts to natural sciences and engineering.
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: - perform analysis of numerical algorithms and estimate backward and forward stability, - estimate duration of the algorithm, - explain main ideas behibnd numerical methods, - derive basic numerical mathods and illustrate their properties by examples, - write simple computer programs for numerical methods in some of higler-level languages (Matlab or Julia), - find and use computer programs for numerical mathods available on Internet and critically estimate their properties, - choose appropriate numerical methods and apply own or third party computer programs for solving engineering problems.

Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	1. Computer arithmetic and error analysis.	2	2
	2. Stable and unstable computations – condition number.	2	2
	3. Solving systems of linear equations- Gaussian elimination and iterative methods.	2	2
	4. Evaluating functions – Horner's method.	2	2
	5. Approximating functions – interpolation polynomials.	2	2
	6. Splines.	2	2
	7. Least squares method and minimax method.	2	2
	8. Solving nonlinear equations – bisection, Newton's method and secant method.	2	2
	9. Fixed-point theorem and functional iteration.	2	2
	10. Numerical integration – trapezoidal rule, Simpson's formula and error estimates.	2	2
	11. Gaussian quadrature, Romberg's algorithm and adaptive integration.	2	2
	12. Numerical solution of ordinary differential equations – single-step methods.	2	2
	13. Multi-step methods and Runge-Kutta methods.	2	2

	List of laboratory or design exercises	LE or DE hours

Format of instruction	x lectures ☐ seminars and workshops x exercises ☐ *on line* in entirety ☐ partial e-learning ☐ field work	x independent assignments ☐ multimedia ☐ laboratory ☐ work with mentor ☐ (other)
Student responsibilities	Regular attendence to and active participation in lectures and excercises.	

Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*						
	Class attendance	2	Research		Practical training	
	Experimental work		Report		Self study	2
	Essay		Seminar essay		(Other)	
	Tests	0.5	Oral exam		(Other)	
	Written exam	0.5	Project		(Other)	

Grading and evaluating student work in class and at the final exam	During semester two mid-term exams are held. The first exam is scheduled after 7 weeks of lectures, and the second in the week following the lectures. At each mid-term exam students can get 40 points, while the remaining 20 points are attained through assignements during lectures and excercises. The condition for passing the course is minimum 20 points on each mid-term exams and a total of at least 50 points. After semester, two final exams and two correction exams are held. Students which did not pass one mid-term exam, can take only this part of the exam during final exams. Students which did not pass any mid-term exam, take the final exam with comprehensive course content. In that case, masimum numbers of available points is 80. The condition for passing the course is minimum 40 points in the final exam and a total of at least 50 points. The grade is formed as follows: 85 and more points - excellent (5), 75-84 points - very good (4), 60-74 points - good (3), and 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 maximal 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 are held according to the exam schedule.

<table>
<tr><td rowspan="8">Required literature (available in the library and via other media)</td><td>Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td>R. Scitovski, Numerička matematika, drugo izdanje, Sveučilište J. J. Strossmayera, Odjel za matematiku, Osijek, 2004.</td><td rowspan="3"></td><td rowspan="3">http://www.mathos.hr/~scitowsk/NM/Num.PDF</td></tr>
<tr><td>I.</td></tr>
<tr><td></td></tr>
<tr><td>Lecture materials on FESB e-learning portal.</td><td></td><td>https://elearning.fesb.hr</td></tr>
<tr><td>FESBMat</td><td></td><td>https://github.com/ivanslapnicar/FESBMat</td></tr>
<tr><td>Netlib</td><td></td><td>http://www.netlib.org</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">- D. Goldberg, What every computer scientist should know about floating-point arithmetic, http://docs.sun.com/source/806-3568/ncg_goldberg.html
- D. Kincaid, W. Cheney, Numerical Analysis-Mathematics of Scientific Computing, Brooks/Cole Publishing Company, 2002.
- G. W. Stewart, Afternotes on Numerical Analysis, SIAM, Philadelphia, 1996.
- S. Singer, Numerička matematika, Predavanja, Sveučilište u Zagrebu, FSB, Zagreb, 2009.
- S. Singer, Numerička matematika, Vježbe, Sveučilište u Zagrebu, FSB, Zagreb, 2009</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">– homework
– short tests
– quizzes
– mid-term exams
– final exam
– student questionnaires</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="3"></td></tr>
</table>

<table>
<tr><td>NAME OF THE COURSE</td><td colspan="6">OPERATIONS RESEARCH</td></tr>
<tr><td>Code</td><td>FELG14</td><td>Year of study</td><td colspan="4">1.</td></tr>
<tr><td>Course teacher</td><td>Jadranka Marasović, Ph.D., Full Professor</td><td>Credits (ECTS)</td><td colspan="4">5</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2">Martina Bašić, mag.img.</td><td rowspan="2">Type of instruction (number of hours)</td><td>L</td><td>S</td><td>AE</td><td>LE</td><td>DE</td></tr>
<tr><td>30</td><td>0</td><td>0</td><td>30</td><td>0</td></tr>
<tr><td>Status of the course</td><td>Elective</td><td>Percentage of application of e-learning</td><td colspan="4">0</td></tr>
<tr><td colspan="7">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="6">Training students for:
To enable students using examples to understand the importance of optimimal solutions for engineering practice and research. By gaining knowledge through basic concepts of optimization, the necessary theoretical knowledge about different approaches can be achieved, about mathematical and heuristic methods, about the fastest and organized search for optimal solutions, too. To enable students to acquire practical knowledge, user-oriented, on the need for software solutions and precision interface in order to work independently to obtain optimal solutions. Examples from everyday life are used.</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="6">None</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="6">Students will be able to:
1. iimplement models of different systems, quantitative (math) and qualitative (graphs, tables, text) models,
2. apply mathematical conversion to the original models and to understand the purpose of these conversions in the application of known methods of optimization, if the solutions and methods for the original model do not exist,
3. describe the difference between defined mathematical optimization methods and search methods and describe the impossibility of finding a universal method of solving,
4. pick and sort out the proper method of optimization based on model,
5. apply the results optimum analysis on the appropriate practices,
6. calculate the strategic optimum,
7. solve independently complex tasks of optimizing where it is necessary to combine several methods.</td></tr>
<tr><td rowspan="4">Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="4">Course content</td><td>L hours</td><td>AE hours</td></tr>
<tr><td colspan="4">Introduction: Systems approach and purpose and power of modeling (in the analysis and understanding of systems acting and in the problems with the synthesis of the "living" systems). The model is an approximation of the system. Modeling is an iterative process during which resolves a compromise between complex models and quality of approximation.</td><td>2</td><td>0</td></tr>
<tr><td colspan="4">Quantitative models and diffferences of the systems characteristics: deterministic, stochastic, static, dynamic, continuous, discrete, linear and nonlinear. The selection of input and output variables and their impact on the complexity of the model. Physical, economic and other laws as a basis for building models. Qualitative models.</td><td>2</td><td>0</td></tr>
<tr><td colspan="4">The impact of constraints on the behavior of the system and how to add them to the original model - space of solutions. Objective function as an indicator of optimality.
Optimal is not perfect - depends on objective function,on</td><td>2</td><td>0</td></tr>
</table>

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

	Problem solving traveling salesman, optimal touring several cities in Croatia.	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 ☒ seminar essay (other)
Student responsibilities	Minimum of 70 percent lecture attendance. Completing all the required laboratory exercises.	

Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*						
	Class attendance	1.5	Research		Practical training	
	Experimental work		Report		Individual work	0.5
	Essay		Seminar essay	1	Laboratory exercises	1
	Tests	0.5	Oral exam		(Other)	
	Written exam	0.5	Project		(Other)	

Grading and evaluating student work in class and at the final exam	During the semester there will be two mid-term exams (tests). The first mid-term will be held during class (according to the calendar), and the other colloquium after the end of classes. Individual colloquium will be considered passed if it achieved 40% correct answers, or total points achieved that give a positive evaluation must be at least 50% correct. It is necessary during the semester to resolve homework and seminars to be recognized (enrolled) score achieved by tests and exams. The final grade is determined based on the total number of points earned, which is calculated as follows (Including laboratory exercises points, M3) Grade [%] = 0.45 * M1 + 0.45*M2 + 0,1*M3 Percentage Grade 50% to 61% sufficient (2) 62% to 74% good (3) 75% to 87% very good (4) 88% to 100% excellent (5) The final exam encompasses the entire course load or selected parts of it that students' did not pass at either of mid-term exams. The correction exam encompasses the entire course load. The requirement for passing the exam is minimum of 50 percent correct answers. The exams are held according to the class schedule.

Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	J.Marasović: “Introduction in Operations Research“ (in Croatian: Uvod u operacijska istraživanja, Authorized lectures, FESB, 2000.		e-learning portal

Optional literature (at the time of submission of study programme proposal)	- T.B. Boffey: “Graph Theory in Operations Research”, McMillan Press, Hong Kong, 1982. - R. Bronson, G. Naadimuthu: “Operations Research”, Schaum’s Outline of Operations Research, McGraw Hill, 1998. - H.A. Taha: “Operations Research: An Introduction”, Prentice Hall, 1997
Quality assurance methods that ensure the acquisition of exit competences	- Keeping records on class attendance - Annual analysis of exam results - Student survey on teaching performance - Teacher self-evaluation - Feedback information from graduates regarding course content relevancy
Other (as the proposer wishes to add)	

NAME OF THE COURSE	OPTIMIZATION AND OPTIMAL SYSTEMS						
Code	FELG23	Year of study	2.				
Course teacher	Mirjana Bonković, Ph.D., Full Professor	Credits (ECTS)	5				
Associate teachers		Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	30	0
Status of the course	Obligatory	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for adoption and understanding of the basic knowledge of: optimization procedures for solving problems in the fields of engineering, such as robot control, production planning and / or analysis (understanding) the image content.	
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: - Apply optimization methods to engineering problems, including developing a model, defining an optimization problem, applying optimization methods, exploring the solution and interpreting results. - Understand and apply unconstrained optimization theory for continuous problems, including the necessary and sufficient conditions and steepest descent, Newton's method, conjugate gradient and quasi-Newton methods. Understand basic theorems of quasi-Newton methods. - Understand and apply discrete algorithms, including branch and bound, exhaustive search and simulated annealing. - Understand and apply the simplex algorithm for solving linear problems with constraints. - Have some familiarity with optimization software.	
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours AE hours
	Introduction. Models of engineering optimization.	2
	Mathematical modeling. Objective function.	2
	Performance of feedback control system.	4
	Optimization without constraints. Gradient method. Newton's method.	4
	Discrete optimization. Simulated annealing. Genetic algorithms.	4
	Optimization with constraints. Linear programming. Simplex algorithm.	4
	Non-linear optimization with constraints.	4
	The calculus of variations.	2
	Case studies: Application of nonlinear optimization methods for visual servoing.	2
	Analysis and processing of medical images .	6
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		

<table>
<tr><td rowspan="5">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>2</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Individual work</td><td>1</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>Laboratory exercises</td><td>0</td></tr>
<tr><td>Tests</td><td>0,3</td><td>Oral exam</td><td></td><td>Preparation for laboratory exercises</td><td>0</td></tr>
<tr><td>Written exam</td><td>0,3</td><td>Project</td><td>1,4</td><td>(Other)</td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">During the semester, students receive smaller project tasks that have to be addressed. In addition, there are two midterm exams. The first midterm exam is after 7 weeks of lectures and the second one is after 13 weeks of lectures (in a form of presentation and defense of the project assignment). Each midterm test (as well as the final test) is carried out in a written format with duration of 90 minutes. The requirement for passing grade is the positive assessment of project tasks and 50 % points on average midterm exam ((M1 + M2)/2) or the final exam. Students are allowed to have at least 45% of total points on each midterm exams, as long as the final midterm average is at least 50% of total points.
Grade (in percentage) is formed according to the formula:

Grade(%) = 0,5M1 + 0,5M2

where:
• M1, M2 – midterm test results.
It is possible to be relieved of the midterm exams in case of making extensive smaller project tasks.
According to Article 65. of Faculty’s Bylaw, student is required to participate in all teaching activities attending at least 70% of lectures, and 100% of laboratory exercises. If student does not meet these criteria, she or he won’t be able to take part in the final exam, and will be required to enroll in the course the next year.</td></tr>
<tr><td rowspan="5">Required literature (available in the library and via other media)</td><td colspan="3">Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td colspan="3">D. Pierre, Optimization Theory With Applications, John Willey & Sons, New York, 1969.</td><td></td><td>e-learning</td></tr>
<tr><td colspan="3">M. Bonković: Autorizirana predavanja, FESB</td><td></td><td>e-learning</td></tr>
<tr><td colspan="3">http://apmonitor.com/me575/index.php/Main/BookChapters (10.03.2017.)</td><td></td><td></td></tr>
<tr><td colspan="3">V. Zanchi, Optimizacija, Sveučilište u Splitu, 1983.</td><td></td><td>e-learning</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6">- Kamran Iqubal: Fundamental Engineering Optimization Methods, bookboon.com (19.03.2017.)
- Numerical Recipes in C (or C++) : The Art of Scientific Computing, by William H. Press, Brian P. Flannery, Saul A. Teukolsky, William T. Vetterling.
- Convex Optimization, Stephen Boyd & Lieven Vandenberghe, 2004
- Stephen Boyd on Convex Optimizations pdfs video lectures</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="6">- Keeping records of student attendance.
- Annual analysis of course statistics in terms of midterm and finals exams.
- Feedback from students via surveys.
- Teacher self-evaluation.
- Feedback from graduated students (or senior students) on course content relevance.
- Periodic institutional evolution of course teachers.</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="6"></td></tr>
</table>

NAME OF THE COURSE	OPTOELECTRONIC MEASUREMENT METHODS						
Code	FELG33	Year of study	1				
Course teacher	Ivo Stančić, Ph.D., Assistant Professor	Credits (ECTS)	5				
Associate teachers		Type of instruction (number of hours)	L	S	AE	LE	DE
			30			30	
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - Understand the basic principles of camera and optical lens elements - Operate with linear, IR / night and heat cameras - Apply camera to control industrial process or use it as a sensor - Operate and analyze data from laser range finders and LIDAR
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: – Have detail knowledge of camera and camera optical elements – Apply algorithms for 3D reconstruction of motion – Apply algorithm for surface reconstruction – Analyze data from laser range finders and create map of area

Course content broken down in detail by weekly class schedule (syllabus)

Course content	L hours	AE hours
Introduction to optoelectronics	2	
Machine visiona and computer vision	2	
Mathematical description of cameras and geometry of a space	4	
Lense optical system and distorsions	2	
Color system and photosensitive chips	2	
Inudstrial cameras, linear cameras, motion capture systems	2	
IR cameras and applications	2	
Stereovision systems	2	
3D scanners	2	
Laser range finders and LIDAR	2	
Night vision cameras and image intensifiers	2	
Future of optoelectronics	2	
Introduction to optoelectronics	2	

List of laboratory or design exercises	LE hours
Introduction to Matlab: image loading, capture and editing	2
Introduction to Matlab: video loading, capture and editing	2
Camera calibration and distortion removal	2
Movement reconstruction from single camera in single plane	2
Movement reconstruction with stereovision system in space	2
Laser and IR rangefinders	2
3D scanners and surface reconstruction	2
Lidar and applications in robotics	2
Cameras in visible and IR spectrum. Presentation of night optics	2

	IR thermal camera and temperature calculation	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		

Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*						
	Class attendance	1	Research		Practical training	
	Experimental work		Report		Impended research	1,7
	Essay		Seminar essay	1	Laboratory exercises	1
	Tests	0,2	Oral exam		(Other)	
	Written exam	**0,1**	Project		(Other)	

Grading and evaluating student work in class and at the final exam

During the semester there are two midterm exams according to teaching calendar or project assignments will be handed out depending on student preferences.

The requirement for passing grade is the positive assessment of laboratory exercises and 50 % points on average midterm exam ((M1 + M2)/2) or the final exam. Students are allowed to have at least 45% of total points on each midterm exams, as long as the final midterm average is at least 50% of total points.

Midterm consists of both theoretical questions and numerical problems. The midterms consist of 4 questions while final exam test consists of 6 questions divided into two groups.

In determining the final grade (in percentages) each midterm contributes with 30% (or project assignment with 60%), while laboratory exercises contribute with 40%.

Final grade (based on percentages) is formed as follows:

Percentage	Grade
50% do 62%	sufficient (2)
63% do 74%	good (3)
75% do 86%	very good (4)
87% do 100%	excellent (5)

In case student does not complete midterms or project exams he/she needs to take the final exam in which case it contributes with 60% toward final grade, and laboratory exercises again with 40%.

Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	• Hartley, R., Zisserman, A.: 'Multiple view geometry in computer vision' (Cambridge University Press, 2003)		
	• Shapiro, G., Stockman, G.C.: 'Computer vision' (Prentice-Hall, 2001)		

Optional literature (at the time of submission of study programme proposal)	
Quality assurance methods that ensure the acquisition of	- Keeping records of student attendance. - Annual analysis of course statistics in terms of midterm and finals exams. - Feedback from students via surveys.

exit competences	- Teacher self-evaluation. - Feedback from graduated students (or senior students) on course content relevance.
Other (as the proposer wishes to add)	/

NAME OF THE COURSE	PRACTICUM OF AUTOMATIC CONTROL						
Code	FELG12	Year of study	1.				
Course teacher	Tamara Grujić, Ph.D., Full Professor	Credits (ECTS)	4				
Associate teachers	-	Type of instruction (number of hours)	L	S	AE	LE	DE
			15	0	0	45	0
Status of the course	Obligatory	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - Testing the performance of the continuous-time control system by measuring it's time and frequency response - Design and construction of the controller for automatic control - Design, construction and testing of printed circuit boards - System Identification - Analysis of discrete control systems		
Course enrolment requirements and entry competences required for the course	- Completed course ''System Theory'' at the Undergraduate study - Completed course 'Linear Control Systems'' at the Graduate study		
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - Design the electronic circuit of time-continuous automatic control system - Design and construct a printed circuit board (PCB) and conductive paths on the board by using Ki-Cad software - Test the functionality of PCB by measuring the time and frequency response - Implement the laboratory model of control system with PID controller (based on developed PC boards) - Perform the system identification based on the measured time and frequency response - Analyse time response and stability of discrete control systems		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	LE hours
	Introduction: Designing of continuous-time control systems	1	3
	Continuous-time control systems for positioning and speed control	1	3
	Designing of multi-functional electronic circuit (with functions of PID controller and first order system), derivative of transfer functions of the circuit, modeling and simulation of the circuit in Multisim software	1	3
	Design of printed circuit board of the defined circuit in the software package Ki-Cad: The first part	1	3
	Design of printed circuit board of the defined circuit in the software package Ki-Cad: The second part	1	3
	Production of PCB by photo-process, drilling holes in the board and soldering of electronic elements	1	3
	Testing the function of PCB: Measuring the time and frequency response of the circuit and comparison of the measured responses with the responses simulated in the Simulink	1	3
	First midterm exam		
	The implementation of produced PCB-s, Part 1: By using two PCB-s, make the model of control system for motor speed	1	3

	control. Measurement of time and frequency response of the system. Selection of PID controller parameters for improving the time response of the system. Comparison of measured and simulated results in Matlab.		
	The implementation of produced PCB-s, Part 2: By using three PCB-s, make the model of control system for motor positioning. Measurement of time and frequency response of the system. Selection of PID controller parameters for improving the time response of the system. Comparison of measured and simulated results in Matlab.	1	3
	Identification of the parameters of DC motor based on the measured time response and frequency characteristics.	1	3
	Determination and analysis of transient state, the accuracy and sensitivity of discrete systems described by discrete transfer function (Vissim, Simulink)	1	3
	Determination of the stability limits of discrete control systems described by discrete transfer function (Vissim, Simulink)	1	3
	Modified Z-transformation, discrete state space, discrete controllers - discretization of continuous controllers (Vissim)	1	3
	Second midterm exam		

Format of instruction	☒ lectures ☐ seminars and workshops ☐ exercises ☐ *on line* in entirety ☐ partial e-learning ☐ field work	☒ independent assignments ☒ multimedia ☒ laboratory ☐ work with mentor ☐ (other)
Student responsibilities	The presence on lectures in the amount of at least 70 % of the times scheduled. Performed and positively assessed all required laboratory exercises.	

Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*						
	Class attendance	0.5	Research		Practical training	
	Experimental work		Report		Individual work	0.5
	Essay		Seminar essay		Laboratory exercises	2
	Tests	0.25	Oral exam		Preparation for laboratory exercises	0.5
	Written exam	0.25	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 5 theoretical questions and numerical problems and final tests consist of 6 theoretical questions and numerical problems. In the final exams students that did not pass the midterm exams take part. The midterm and final exams are carried out as written tests. The requirement for passing grade is the positive assessment of all laboratory exercises and 50 % points on each midterm exam or the final exam. Grade (in percentage) is formed according to the formula:

$$\text{Grade}(\%) = 0{,}4\ LV + 0{,}3\ (M1 + M2)$$

the activities in percentage:

- LV – laboratory assessment,
- M1, M2 – test results.

The final grade is determined as follows:

Percentage:	Grade:
50% do 61,9%	2
62% do 74,9%	3

<table>
<tr><td></td><td colspan="3"><table><tr><td>75% do 89,9%</td><td>4</td></tr><tr><td>90% do 100%</td><td>5</td></tr></table></td></tr>
<tr><td rowspan="4">Required literature (available in the library and via other media)</td><td colspan="2">Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td colspan="2">• Tamara Grujić: "Razvoj, izrada i testiranje tiskane pločice", interna skripta, FESB</td><td></td><td>e-learning portal</td></tr>
<tr><td colspan="2">• Tamara Grujić: "Upute za laboratorijsku vježbu: Identifikacija sustava", FESB</td><td></td><td>e-learning portal</td></tr>
<tr><td colspan="2">• Tamara Grujić: "Upute za laboratorijske vježbe: Diskretni sustavi", FESB</td><td></td><td>e-learning portal</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="4">• R.C. Dorf, R. H. Bishop: Modern Control Systems, Addison-Wesley Publishing Company, 1995.
• D. Stipaničev, J. Marasović: Digitalno vođenje on-line, Web udžbenik, FESB, link: http://laris.fesb.hr/digitalno_vodjenje</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="4">- Evaluation of results in accordance with the above learning outcomes
- Feedback from students via surveys
- Self-evaluation of teachers
- Institutional and non-institutional evaluations
- Keeping records of lectures attendance
- Keeping records of the presence of the laboratory exercises and a review and assessment of submitted reports</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="4"></td></tr>
</table>

<table>
<tr><td>NAME OF THE COURSE</td><td colspan="5">PROCESS CONTROL</td></tr>
<tr><td>Code</td><td>FELG21</td><td>Year of study</td><td colspan="3">2</td></tr>
<tr><td>Course teacher</td><td>Darko Stipaničev, Ph.D., Full Professor (90%)
Ljiljana Šerić, Ph.D., Assistant Professor (10%)</td><td>Credits (ECTS)</td><td colspan="3">6</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2">Darko Stipaničev, Ph.D., Full Professor (100%)</td><td rowspan="2">Type of instruction (number of hours)</td><td>L</td><td>S</td><td>AE</td><td>LE</td><td>DE</td></tr>
<tr><td>45</td><td>0</td><td>30</td><td>0</td><td>0</td></tr>
<tr><td>Status of the course</td><td>Obligatory</td><td>Percentage of application of e-learning</td><td colspan="3">80</td></tr>
<tr><td colspan="6">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="5">The aim of the course is basic knowledge to processes modelling and control.</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="5">Completed basic courses of automatic control (Linear control systems, Nonlinear control systems, Identification and Digital control)</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="5">Students will be able to successfully mastering the subject:
1. Describe the process through systematic presentation, idea management, mathematical model, automatic control.
2. Enumerate and describe the fundamental processes and their models: transfer processes, processes of transition, transformation process.
3. Build process models based on the equation of balance of matter and energy.
4. manage to models fluidic processes, thermal processes, the mixing process, complex processes (chemical reactor, distillation).
5. Describe the process measurement sensors, converters and actuatorsfor measurement and control of temperature, flow, pressure, level and density.
6. Describe and implement different ways of process control, from the basic scheme of control (ON-OFF, P, PI, PD, PID control, program guidance) to the advanced control schemes (time - optimal, ratio, cascade, feedforward, optimal, adaptive and intelligent control).
7. Describe the principles of distributed process control. SCADA (Scan Control, Alarm, Data Acquisitions).
8. Describe and perform basic procedures for maintaining flow, pressure, level and temperature.
9. Describe examples of managing complex processes.
10. Describe the process industry: production optimization, control and maintenance.</td></tr>
<tr><td rowspan="5">Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="3">Course content</td><td>L or S hours</td><td>AE hours</td></tr>
<tr><td colspan="3">Introduction. The processes and objects. A systematic approach to process control. Feedbeck control, feedforward control, open-loop control. The input - output variables.</td><td>3</td><td>0</td></tr>
<tr><td colspan="3">The processes and process equipment. Operations and technology operations. The division of technological operations: Operations of transfer, transition and transformation.</td><td>3</td><td>0</td></tr>
<tr><td colspan="3">Fluidic systems - basic laws of fluid mechanics, basic fluidic components, modeling fluidic system.
Thermal systems - the basic laws of thermodynamics, basic thermal components, modeling of thermal systems.
Complex processes and process equipment - mixing, distillation, kemijki reactor</td><td>9</td><td>12</td></tr>
<tr><td colspan="3">Sensors (sensors) and the actuator (actuators) - input, output and transfer characteristics. Measuring temperature,</td><td>9</td><td>2</td></tr>
</table>

	flow, level, pressure and other process variables. Actuator (actuators) - valves, pumps, heaters and fans		
	Basic control schemas: four-stage static diagrams, on-off and P control.	3	4
	Basic control schemas: PD, PI and PID control	3	4
	Advanced control schemas: selector control, ratio control, cascade control, feedforward control.	3	2
	The most advanced control schemas: optimal control, adaptive control, and intelligent control.	3	2
	Process industry and automatic control.	3	0

Format of instruction	☒ ☒ lectures ☐ ☒ seminars and workshops ☒ ☒ exercises ☐ *on line* in entirety ☐ partial e-learning ☐ field work	☐ independent assignments ☒ multimedia ☒ laboratory ☐ work with mentor ☐ (other)
Student responsibilities	The presence on lectures in the amount of at least 70 % of the times scheduled. Performed all required laboratory exercises.	

Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*	Class attendance	2,5	Research		Practical training	
	Experimental work		Report		Individual work	
	Essay		Seminar essay	1,5	Laboratory exercises	
	Tests		Oral exam		Preparation for laboratory exercises	
	Written exam	**2**	Project		(Other)	

Grading and evaluating student work in class and at the final exam	The exam consists of a written part and if necessary additional oral exam. During the semester will be two tests. The first colloquium in 8 weeks of classes, the second at 18 weeks. A student can pass the course by these tests. In the two final exams in June and July, students who have not collected inadequate number of points through colloquia take the whole subject covered by the two tests. The condition for taking the final exam is successfully finished practical lab exercises. The exam is comprehensive and includes the theoretical part of the material and tasks with auditory exercises. The condition for positive assessment is that the student has a total of at least 50% on the exam or when it must have a minimum 25% passing the theoretical part of the material and 25% of the deposited duties. If a student has less than 25% of the points on the tasks and / or less than 25% points from the theoretical part of the material again taken the entire exam. Students who did not pass the exam after two final exams can pass the exam in autumn periods. All test questions students will be known before the exam. These rules apply equally to students who are enrolled this course for the first time and to those students who enter college for the second time. The final grade is determined as follows: percentage Rating 50% to 61% is sufficient (2) 62% to 74% good (3) 75% to 87% of very good (4) 88% 100% Excellent (5) The first colloquium will take the material to the teaching units to the seventh week inclusive, and on the other the rest of the teaching weeks. Examinations are held in terms of the anticipated calendar of classes. Under Article 65 of the Statute of the Faculty, the student is required to participate

<table>
<tr><td></td><td colspan="3">in all forms of teaching and attend: lectures at least 70% of classes. If she or he do not meet these requirements, the student will not be able to take the exam and get a signature.</td></tr>
<tr><td rowspan="6">Required literature (available in the library and via other media)</td><td>Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td>D.Stipaničev, Process control, lecturing notes and internal textbook</td><td></td><td>e-learning portal</td></tr>
<tr><td>D.Stipaničev, J.Marasović, Digitalno vođenje on-line, on-line (Web) udžbenik, MZT – Informatički projekt, 2004. http://laris.fesb.hr/digitalno_vodjenje.</td><td></td><td>e-learning portal</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">- Marlin, T.E.: Process Control, McGraw Hill, New York, 1995.
- Patranabis, D.: Principles of Process Control, McGraw Hill, New Delchi, 1981.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">- Evaluation of results in accordance with the above learning outcomes
- Feedback from students via surveys
- Self-evaluation of teachers
- Institutional and non-institutional evaluations</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="3"></td></tr>
</table>

NAME OF THE COURSE	PROCESS CONTROL LABORATORY						
Code	FELG22	Year of study	2.				
Course teacher	Jadranka Marasović, Ph.D., Full Professor	Credits (ECTS)	4				
Associate teachers	Ivo Stančić, Ph.D:, Assistant Professor	Type of instruction (number of hours)	L	S	AE	LE	DE
			15	0	0	30	0
Status of the course	Obligatory	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: Enable students to understand the importance of automated systems, to comprehend how danger can be potentially poorly designed control systems. Enable students to understand that the system automation is very difficult task but the same developed theory can be used for different fields (technical systems, chemical processes, in economy, medicine etc.). Enable students to acquire basic knowledge on the use of computers as a support for the process control.		
Course enrolment requirements and entry competences required for the course	Subscribed and coursees completed: Linear control systems, System identification, Nonlinear control systems and Digital control.		
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: 1. describe the importance of automated systems and to identify potentially poorly designed systems, especially where process control is included, 2. recognize that it is necessary to connect the elements of process control physically and that it is important to introduce the compromise of several different subsystems. 3. apply a simulation on a digital computer to support the control theory, taking into account its impact on the results, 4. to decide how and when to apply mathematical approximations for controlled systems design, 5. choose the appropriate methods for systems synthesis depending on the tasks, and introducing different optimization, 6. solve independently complex tasks of process control.		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L or S hours	AE hours
	The impact of "neglected" elements of the mathematical model of the process (nonlinearity) on the quality of the controlled systems. Why we must ignore the elements of the model?	2	0
	How to design controllers (P, Dahlin, etc.) in the case of non-linear systems (second order)?	2	0
	The advantages, but also the mistakes that brings digital computer built as a unit for process control (time discretization introduced to real-time systems).	2	0
	The nonlinear process models (fluidic, thermal, complex) and the effects of linearization. Phase curve. Static curves. – repetition	2	0
	The sensitivity of the system dealing with the possible parameters change. The impact of these analyzes to the decision where to instal the regulator in control loop.	2	0
	Linear static models. Parameters optimization using Simplex algorithm. Preparing for the use already created program for linear programming. Dual Simplex.	2	0

	How to simulate the logical control laws using special softwares, visually oriented?	2	0
	List of laboratory or design exercises		LE or DE hours
	Simulation tests of controlled systems in real conditions (impact of "neglected" elements of the mathematical model on the quality of controlled systems behaviour).		2
	Simulation tests of digital control cystems in real conditions (time discretization impact on the quality of systems behaviour). An example of the necessary application of such control with case of DDC (Direct Digital Control) algorithms.		2
	Comparison of simulation results (when the impact of neglected nonlinearities on systems with digital control quality was tested) with measurements on real systems in the laboratory.		2
	Modeling and simulation of interactive and non-interactive tanks with liquid. Modelling with non-linear models and with the effects of linearization.		2
	Modeling and simulation of thermal systems. Modelling with non-linear models and with the effects of linearization.		2
	Simulation verification of controlled process in stable conditions (stability limit). How to decide where to instal the regulator, in direct or in feedback branch?		2
	Linear static models - linear programming.		2
	Optimal conditions for processes in steady state - linear programming.		2
	Optimal control with P-controller - minimum integral square error (min ISE).		2
	Simulation test of multivariable systems control: self-regulated process.		2
	Simulation test of process controlled with logical laws (ON-OFF)..		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 ☒ seminar essay (other)
Student responsibilities	Minimum of 70 percent lecture attendance. Completing all the required laboratory exercises.	

Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*	Class attendance	1	Research		Practical training	
	Experimental work		Report		Individual work	0.5
	Essay		Seminar essay	0.5	Laboratory exercises	1
	Tests	0.5	Oral exam		(Other)	
	Written exam	0.5	Project		(Other)	

Grading and evaluating student work in class and at the final exam	During semester, there will be two mid-term exams – according to the class schedule. The requirement for the positive grade is the attendance and commitment at the laboratory exercises, minimum of 40 percent correct answers at one mid-term and a final grade is determined with minimum of 50 percent total correct answers. It is necessary during the semester to resolve seminars to be recognized (enrolled) score achieved by tests and exams. The final grade is determined based on the total number of points earned, which is calculated as follows (Including laboratory exercises points, M3):

<table>
<tr><td></td><td colspan="3">Grade [%] = 0.25 * M1 + 0.25*M2+ 0.5*M3

Percentage Grade
50% to 61% sufficient (2)
62% to 74% good (3)
75% to 87% very good (4)
88% to 100% excellent (5)

The final exam encompasses the entire course load or selected parts of it that students' did not pass at either of mid-term exams. The correction exam encompasses the entire course load. The requirement for passing the exam is minimum of 50 percent correct answers. The exams are held according to the class schedule.</td></tr>
<tr><td rowspan="4">Required literature (available in the library and via other media)</td><td>Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td>J. Marasović: "Process Control Laboratory“ (in Croatian: Praktikum iz vođenja procesa), FESB, Authorized lectures</td><td></td><td>e-learning portal</td></tr>
<tr><td>D. Stipaničev, J. Marasović.: "Digital Control“ laris.fesb.hr/digitalno_vodjenje, on-line udžbenik "Digitalno vođenje", 2004</td><td></td><td>e-learning portal</td></tr>
<tr><td>V. Papić "System Theory“ (in Croatian: Teorija sustava), FESB, Authorized lectures,</td><td></td><td>e-learning portal</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">- B. Novaković: Metode vođenja tehničkih sistema, Školska knjiga, Zagreb, 1990.
- Patranabis, D.: Principles of Process Control, McGraw-Hill Pub. New Delhi 1981.
- Wolowich, W.A.: Linear Multivariable Systems, Spriner-Verlag, New York-Heidelberg- Berlin, 1984.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">- Keeping records on class attendance
- Annual analysis of exam results
- Student survey on teaching performance
- Teacher self-evaluation
- Feedback information from graduates regarding course content relevancy</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="3"></td></tr>
</table>

NAME OF THE COURSE	PRODUCTION MANAGEMENT						
Code	FETL23	Year of study	2.				
Course teacher	Ivica Veža, Ph.D., Full Professor	Credits (ECTS)	5				
Associate teachers	Marko Mladineo, Ph.D.	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	30	0	0
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students to: • production planning and management • making/drafting technological oriented investment projects • be able to simulate the materials flow
Course enrolment requirements and entry competences required for the course	Competences and skills learning outcomes of undergraduate study in industrial engineering, naval architecture or mechanical engineering.
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: 1. Analyze the business model of supply chain management. 2. Analyze the concept of production planning and control. 3. Evaluate management models of production data. 4. Model and simulate the operation of a flexible/intelligent manufacturing system. 5. Recommend software solutions for integrated planning and production management. 6. Apply simulation programs on production problems. 7. Apply acquired knowledge and skills from previous courses on solving the specific task. 8. Prepare technology oriented investment project.

Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours
	Production function. Production management. Production management strategies.	2
	Product designs. New product developing process.	2
	Supply chain (Supply chain management).	2
	Production planning and control.	2
	Materials planning and inventory control.	2
	Concepts for production planning and control: network techniques planning, methods of optimal capacity utilization.	2
	Procedure Just in time – JIT.	2
	Method for manufacturing resource planning (MRP, MRP II, ERP),	2
	Optimized production technology, OPT, management progressive numbers. Improvements. Methods and improvement techniques.	2
	Production systems simulation.	2
	Globalization. Social responsibility. Environment responsibility.	2
	Concept of planning business based on technology. Revive of technology and innovation in technology.	2
	Preparing Technology oriented Investment Project (TIP). Evaluation and demonstration TIP. TIP budgeting. Risks and risks reduction TIP.	2

						AE hours
	Single production. Project management.					2
	Introduction to the Network planning technique.					2
	Time analysis.					2
	CPM method.					2
	PERT method.					2
	PRECEDENCE method.					2
	Cost analysis.					2
	Resource analysis.					2
	Introduction to inventory management.					2
	EOQ and ROP methods.					2
	Probability methods and safety supplies.					2
	JIT method.					2
	Introduction to MRP, MRP-II i ERP.					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	Presence on lectures and exercises at least 70% of the teaching hours. Settled ALL provided laboratory exercises and preparation of terms references.					
Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*	Class attendance	1,0	Research		Practical training	
	Experimental work		Report		Independent work	1,5
	Essay		Seminar essay		Laboratory exercises	0,5
	Tests	0	Oral exam		Preparation for laboratory exercises	
	Written exam		Project	2,0	(Other)	
Grading and evaluating student work in class and at the final exam	During the semester there will be two mid-term exams (tests). The first is the pre-exam after 7 weeks of classes, the second after the next 6 weeks. On final exam students take the test with parts of matter they did not pass in med terms. Every midterm is a written exam that students write for 45 minutes, and has 5 questions. To have a passing grade students have to gain at least 40% of every midterm. On the other hand, students have a colloquium on the Technique of network planning (LE) through first written colloquium at the end of first semester. • LE – grade for laboratory exercises • M1, M2 – points on mid-term exams The final score (in percentage) is formed according to the formula: Grade(%) = 0,30 LE + 0,7 (M1 + M2)					

	Title	Number of copies in the library	Availability via other media
Required literature (available in the library and via other media)	• Dulčić, Ž., Pavić, I., Rovan, M., Veža, I., "Proizvodni management", Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture – Faculty of Economics, Split, 1996.	5	
	• Schroeder, R. G., "Upravljanje proizvodnjom", MATE, Zagreb, 1999.	5	
	• Veža, I., Bilić, B., Gjeldum, N., Mladineo, M., "Upravljanje projektima", Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture, Split, 2011.		e-learning
Optional literature (at the time of submission of study programme proposal)	• Slack, N., Chambers, S., Johnston, R., "Operations Management", Prentice Hall, Harlow, 2004. Wild, R., "Operations Management" Continuum, 2002.		
Quality assurance methods that ensure the acquisition of exit competences	• Tracking the presence on classes • Academic year analyses-grades and exams success • Student survey contain teacher evaluation • Teacher self-evaluation • Graduated student feedback about the relevance of syllabus content		
Other (as the proposer wishes to add)			

NAME OF THE COURSE	PROFESSIONAL TRAINING									
Code	FEXX06		Year of study	2						
Course teacher	Head of the professional training from the Faculty		Credits (ECTS)	5						
Associate teachers	Head of the professional training from the private institution		Type of instruction (number of hours)	L	S	AE	LE	DE		
Status of the course	Elective		Percentage of application of e-learning							
COURSE DESCRIPTION										
Course objectives	Training students for: - consolidating theoretical knowledge and practical skills in solving highly complex engineering problems - acquaintance with the organization, work and business of the receiving institution, - solving practical problems, - inclusion in the labour market, - writing technical reports									
Course enrolment requirements and entry competences required for the course	Acquired 120 ECTS credits									
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - consolidate theoretical knowledge and practical skills in solving problems - use literature, databases and other sources of information - select appropriate methods and procedures for solving practical problems - apply technical knowledge and skills to effectively solve engineering problems - prepare a written report on the work results									
Course content broken down in detail by weekly class schedule (syllabus)	Professional training is the independent work of the student performed in the receiving institution in accordance with the plan and programme agreed between the head of the professional training from the receiving institution and the head of professional training from the Faculty.									
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	Independent work									
Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*	Class attendance		Research		Practical training	4				
	Experimental work		Report		Independent work					
	Essay		Seminar essay		Report writing	1				
	Tests		Oral exam		(Other)					
	Written exam		Project		(Other)					

<table>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="3">Professional training is not evaluated. Students are obliged to complete professional training in accordance with the Regulation on professional training and to write a Professional training report. Professional training report is validated by the head of professional training from the receiving institution and the head of professional training from the Faculty.</td></tr>
<tr><td rowspan="2">Required literature (available in the library and via other media)</td><td>Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3"></td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">- Questionnaire on professional training
- Self-evaluation of the head of professional training
- Student survey of the whole study programme</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="3"></td></tr>
</table>

NAME OF THE COURSE	PROGRAMMABLE LOGIC CONTROLLERS						
Code	FELG13	Year of study	1				
Course teacher	Mojmil Cecić, Ph.D., Full Professor	Credits (ECTS)	5				
Associate teachers	Tihomir Betti, Ph.D., Assistant Professor	Type of instruction (number of hours)	L	S	AE	LE	DE
			30			30	
Status of the course	Obligatory	Percentage of application of e-learning					

COURSE DESCRIPTION

Course objectives	Training students for: - Understanding operating principles of programmable logic controllers. - Reading relay diagrams and writing equivalent ladder-logic control. - Programming PLC using ladder programming. - Design and implementation of simple control tasks using PLC.
Course enrolment requirements and entry competences required for the course	Linear regulation systems. Students also enrolled in courses Nonlinear regulation systems and Digital control.
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - Explain the operating principle of programmable logic controllers. - Describe the types of input and output devices. - Interpret the functionality of ladder-logic programs. - Program the PLC using adequate software. - Design the control system using PLC for specified process parameters.

Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours
	Introduction. History of PLCs. Definition, basic operating principles and types of PLC.	2
	PLC hardware components.	2
	Number systems and the fundamentals of digital logic.	2
	Field devices used in PLC controlled systems: input devices (relays, switches, starters, contactors, sensors) and output devices.	2
	PLC programming languages by IEC 61131-3 standard. Ladder diagrams. Memory organization. Bit-level logic instructions.	2
	Programming timers.	2
	Programming counters.	2
	Program control instructions.	2
	Data manipulation instructions.	2
	Math instructions.	2
	Sequencer and shift register instructions.	2
	Data communication in PLC systems.	2
	SCADA.	2
	List of laboratory or design exercises	LE hours
	Introduction to laboratory equipment.	2
	Introduction to control and PLC programming software. Bit-level instructions, seal-in circuits.	4
	Timers. Data compare instructions. Traffic lights control using sequencer.	4
	Counters. Realization of conveyor model.	4
	Temperature regulation.	4
	Working with analog values.	4
	PID control.	4
	HMI.	4

<table>
<tr><td>Format of instruction</td><td colspan="6">☒ lectures
☐ seminars and workshops
☐ exercises
☐ on line in entirety
☐ partial e-learning
☐ field work</td><td colspan="6">☒ independent assignments
☒ multimedia
☒ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="12">At least 70% of lectures attendance. Completed all laboratory assignments and the presentation of two projects.</td></tr>
<tr><td rowspan="6">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td colspan="2">Class attendance</td><td>1</td><td colspan="2">Research</td><td></td><td colspan="2">Practical training</td><td></td></tr>
<tr><td colspan="2">Experimental work</td><td></td><td colspan="2">Report</td><td></td><td colspan="2">Individual work</td><td>2</td></tr>
<tr><td colspan="2">Essay</td><td></td><td colspan="2">Seminar essay</td><td></td><td colspan="2">Laboratory exercises</td><td>1</td></tr>
<tr><td colspan="2">Tests</td><td>0.05</td><td colspan="2">Oral exam</td><td></td><td colspan="2">Preparation for laboratory exercises</td><td>0.3</td></tr>
<tr><td colspan="2">Written exam</td><td>0.05</td><td colspan="2">Project</td><td>0.6</td><td colspan="2">(Other)</td><td></td></tr>
<tr><td colspan="10"></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="12">There are two midterm exams (the first after 7 weeks of classes, the second after the following 6 weeks of classes) and final exams. Students that do not pass both midterm exams take part in the final exam. Midterm and final exams are written and last for 90 minutes. The requirement for passing the course is to complete all laboratory work, as well as final project. The final grade (in percentage) is formed using following formula:
Grade(%)=0.4M1+0.2M2+0.4P,
where:
• M1, M2 – grade from midterm exams given in percentage,
• P – grade from project given in percentage.</td></tr>
<tr><td rowspan="6">Required literature (available in the library and via other media)</td><td colspan="8">Title</td><td colspan="2">Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td colspan="8">T. Betti: Programabilni logički regulatori, predavanja (prezentacije)</td><td colspan="2"></td><td>E-learning portal</td></tr>
<tr><td colspan="8">F. D. Petruzella: Programmable logic controllers, 5th edition, McGraw-Hill, 2016.</td><td colspan="2"></td><td></td></tr>
<tr><td colspan="8">SIMATIC S7-1200 Programmable controller, Siemens, 2015.</td><td colspan="2"></td><td></td></tr>
<tr><td colspan="8">SIMATIC STEP 7 Basic V13 SP1, Siemens, 2014.</td><td colspan="2"></td><td></td></tr>
<tr><td colspan="8">K. Kamel, E. Kamel: Programmable Logic Controllers – Industrial Control, McGraw-Hill, 2014.</td><td colspan="2"></td><td></td></tr>
<tr><td colspan="11"></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="12">- W. Bolton: Programmable logic controllers, 6th edition, Elsevier, 2015.
- E.A. Parr, Programmable Controllers – An engineer's guide, Newnes, 2003.
- G.K. McMillan, D.M. Considine: Process/industrial instruments and controls handbook, McGraw-Hill, 1999.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="12">- Record of number of students attending the classes
- Evaluation of results in accordance with expected learning outcomes
- Feedback from students via student surveys
- Teachers self-evaluation
- Institutional and non-institutional evaluations</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="12"></td></tr>
</table>

NAME OF THE COURSE	PROGRAMMING AGENTS						
Code	FELG19	Year of study	1				
Course teacher	Maja Štula, Ph.D., Full Professor	Credits (ECTS)	5				
Associate teachers		Type of instruction (number of hours)	L	S	AE	LE	DE
			30			30	
Status of the course	Elective	Percentage of application of e-learning	20%				

COURSE DESCRIPTION

Course objectives	Training students for: - Acquiring knowledge on methodologies and tools for design and development on multi-agent systems - Acquiring deep knowledge on programming frameworks for multi-agent systems development - Acquiring basic knowledge necessary for design, management and deployment of multi-agent systems		
Course enrolment requirements and entry competences required for the course	None		
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - Explain differences between multi-agent systems architecture - Implement multi-agent programming paradigm - Use JADE and NetLogo frameworks - Solve complex user requirements to multi-agent systems - Explain pros of using multi-agent approach in developing applications		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	Agents. Examples of agents, intelligent agents, agents and objects.	2	0
	Using JADE framework	8	0
	Using agent-based models (ABM)	2	0
	Agent types and architectures.	2	0
	Knowledge presentation and formalization, ontologies, content languages.	2	0
	Using NetLogo framework	4	0
	Agent communication language. Communication definition and models. Interaction protocols.	8	0
	Multi-agent systems application area, organisation definition and interaction	2	0
	List of laboratory or design exercises		LE hours
	Simple JADE application		4
	Developing ABM in JADE		4
	Implementing different agent types		4
	Building own ontology		4
	Simple NetLogo application		2
	Design multi-agent system		2
	Define multi-agent system organisation and interaction		2
	Implement designed system in JADE framework		8

<table>
<tr><td>Format of instruction</td><td colspan="6">☒ lectures
☐ seminars and workshops
☒ exercises
☐ on line in entirety
☒ partial e-learning
☐ field work</td><td colspan="2">☒ independent assignments
☐ multimedia
☒ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="8">The presence on lectures in the amount of at least 70 % of the times scheduled. Performed and uploaded on e-learning portal all required laboratory exercises and home works.</td></tr>
<tr><td rowspan="5">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>2</td><td>Research</td><td></td><td>Practical training</td><td>1</td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>1</td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td>0,5</td><td>Oral exam</td><td>0,5</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="8">There are two midterms and final exams duration of 90 minutes. The first midterm exam is after 7 weeks of lecturing and the second one is after the next 6 weeks. In the final exams students that did not pass the midterm exams take part. 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(%) = (M1 + M2)/2
the activities in percentage:
• M1, M2 – test results.</td></tr>
<tr><td rowspan="6">Required literature (available in the library and via other media)</td><td colspan="5">Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td colspan="5">Ferber J., Multi-agent Systems, An Introduction to Distributed Artificial Intelligence, Addison-Wesley, England, 1999.</td><td>1</td><td></td></tr>
<tr><td colspan="5">Wooldridge M., Jennings N., Intelligent Agents: Theory and Practice, Knowledge Engineering Review, Vol. 10, No. 2, Cambridge University Press, 1995</td><td></td><td></td></tr>
<tr><td colspan="5"></td><td></td><td></td></tr>
<tr><td colspan="5"></td><td></td><td></td></tr>
<tr><td colspan="5"></td><td></td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="8"></td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="8">- Students’ surveys for teacher evaluation
- Students attendance track
- Annual statistic on passed exam</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="8">Feedback from potential employers on students employability</td></tr>
</table>

NAME OF THE COURSE	PROJECT MANAGEMENT							
Code	FETG01	Year of study	2.					
Course teacher	Ivica Veža, Ph.D., Full Professor	Credits (ECTS)	5					
Associate teachers	Marko Mladineo, Ph.D.	Type of instruction (number of hours)	L	S	AE	LE	DE	
			30	0	30			
Status of the course	Elective	Percentage of application of e-learning	0					

COURSE DESCRIPTION

Course objectives	Training students for: - planning and managing projects - calculating profitability of the project and return of investment (ROI)
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: - analyze customer requirements (VOC) - formulate the main goals of the project and rank them - develop the main project activities and the structure of distribution of work – (Work Breakdown Structure) - plan the time (to determine the critical path) - plan capacity (determine bottlenecks and balance activities) - plan costs and risks - apply adopted knowledge and skills from contents of completed course to solve a specific task - combine and apply adopted knowledge and skills in teamwork

Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	Introduction and basic concepts	2	2
	The concept and definition of project and project management	2	2
	Projects - vision, strategy, goals (examples - automotive and shipbuilding industries)	2	2
	The strategy and project management. Multi-project management.	2	2
	Basics of organization. The project organizational structure.	2	2
	The phases of the project (initiation of project, project selection, project planning, project management and end of project)	2	2
	Methods for project planning.	2	2
	Quality management (planning of improvement and quality control)	2	2
	Cost management. Continuous Improvement - Kaizen.	2	2
	Risk management.	2	2
	Psychological and social component of project management. Project manager.	2	2
	Teamwork.	2	2
	Communication and motivation in the team. Methods for stimulating creativity.	2	2

<table>
<tr><td>Format of instruction</td><td colspan="6">☒ lectures
☒ seminars and workshops
☒ exercises
☐ on line in entirety
☐ partial e-learning
☐ field work</td><td colspan="2">☒ independent assignments
☐ multimedia
☒ laboratory
☒ work with mentor
☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="8">The presence on lectures in the amount of at least 70 % of the times scheduled. Performed all required laboratory exercises.</td></tr>
<tr><td rowspan="5">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>2,0</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Individual work</td><td>1,0</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>laboratory exercises</td><td>0,5</td></tr>
<tr><td>Tests</td><td>0</td><td>Oral exam</td><td></td><td>Preparation for laboratory exercises</td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td>1,5</td><td>(Other)</td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="8">During the semester the stages of project management are introduced to students, parallel they attend lectures and laboratory exercises to develop their project. There is project work team and the minimum number of students is two, maximum number is three. During the course they determine the content of their project and main targets. Students develop the main activities of project and the structure of distribution of work (WBS). They plan the time for each activity and determine the critical path. Students also plan capacities and determine bottlenecks and balance capacities. At the end they determine the costs, calculate project profitability (ROI) and analyze risks. On test students present their work which is evaluated (grade M).

On the other side students have one test in the field of Network planning techniques (LV) at the end of the semester.
• LV - grade of laboratory exercises,
• M - points achieved from the project.

The final grade (in percentage) is formed according to the formula:
Grade (%) = 0,30 LV + 0,70 M</td></tr>
<tr><td rowspan="6">Required literature (available in the library and via other media)</td><td colspan="5">Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td colspan="5">• Veža, I., Bilić, B., Gjeldum, N., Mladineo, M., “Upravljanje projektima”, Fakultet elektrotehnike, strojarstva i brodogradnje, Split, 2011.</td><td></td><td>e-learning portal</td></tr>
<tr><td colspan="5">• Majstorović, V. Projektni menadžment, Sveučilište u Mostaru, Mostar, 2010.</td><td>5</td><td></td></tr>
<tr><td colspan="5">• Omazić, M.A. Projektni menadžment, Sinergija, Zagreb, 2005.</td><td>5</td><td></td></tr>
<tr><td colspan="5"></td><td></td><td></td></tr>
<tr><td colspan="5"></td><td></td><td></td></tr>
</table>

Optional literature (at the time of submission of study programme proposal)	• "A Guide to the Project Management Body of Knowledge, PMBOK Guide", Project Management Institute, Newtown Square, 2004. • Wysocki, R. K., McGary, R., "Effective Project Management: Traditional, Adaptive, Extreme", John Wiley & Sons, 2003.
Quality assurance methods that ensure the acquisition of exit competences	• Evidence about class attendance • The annual analysis of performance of the examinations • Student survey in order to evaluate teachers • Self-evaluation of teachers • Feedback from students who have already graduated about the relevance of the course content
Other (as the proposer wishes to add)	

NAME OF THE COURSE	SOLAR CELLS						
Code	FELH35	Year of study	1				
Course teacher	Tihomir Betti, Ph.D., Assistant Professor Ivan Marasović, Ph.D., Assistant Professor	Credits (ECTS)	5				
Associate teachers		Type of instruction (number of hours)	L	S	AE	LE	DE
			30			30	
Status of the course	Elective	Percentage of application of e-learning					

COURSE DESCRIPTION

Course objectives	Training students for: - Understanding fundamental operating principles of solar cells. - Modeling solar cells using equivalent electrical circuits. - Calculating solar radiation on the plane of arbitrary tilt and orientation. - Understanding different PV technologies and comparison between them. - Designing simple stand-alone and grid-connected PV systems. - Calculating the electricity production of a photovoltaic system.	
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: - Calculate the components of solar radiation on the plane of arbitrary tilt and orientation. - Explain the physical operating principles of a solar cell. - Compare different solar cell technologies. - Design simple grid-connected and stand-alone photovoltaic system. - Calculate the electricity production of a photovoltaic system.	
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours
	Introduction. Solar radiation: irradiance and irradiation. Basic solar geometry parameters.	2
	Solar radiation components. Measurement of solar radiation. Calculating the beam, diffuse and reflected solar radiation.	2
	Physical principles of solar cell operation. Current-voltage characteristic and basic solar cell parameters. Series and shunt resistance.	2
	Solar cell models. Dependence of solar cell parameters on irradiance and temperature.	2
	Amorphous silicon solar cells.	2
	Crystalline silicon solar cells.	2
	High-efficiency III-V multijunction solar cells. Other semiconductor materials for solar cells.	2
	Organic solar cells.	2
	Third generation solar cells: concepts and perspective. Nanostructure-based solar cells.	2
	Photovoltaic systems: stand-alone and grid-connected. Photovoltaic system components: inverters, charge regulators, batteries, mounting structures, cables.	2
	Design of grid-connected and stand-alone photovoltaic system. Shading and mismatch losses. Hot spot heating.	2
	Estimation of electricity production of a photovoltaic system.	2
	PV cell, module and system testing. Environmental impact of a	2

<table>
<tr><td></td><td colspan="6">photovoltaic system. Photovoltaics in the smart grid.</td><td></td></tr>
<tr><td></td><td colspan="6">List of laboratory or design exercises</td><td>LE hours</td></tr>
<tr><td></td><td colspan="6">Solar radiation. Measurement of solar radiation.</td><td>3</td></tr>
<tr><td></td><td colspan="6">Calculating global horizontal radiation from sunshine duration</td><td>3</td></tr>
<tr><td></td><td colspan="6">Estimation of solar radiation on surface of arbitrary tilt and orientation.</td><td>6</td></tr>
<tr><td></td><td colspan="6">Shade measurement and solar site assessment.</td><td>3</td></tr>
<tr><td></td><td colspan="6">Design of grid-connected photovoltaic system.</td><td>6</td></tr>
<tr><td></td><td colspan="6">Estimating electricity production of a photovoltaic system.</td><td>3</td></tr>
<tr><td></td><td colspan="6">Visiting photovoltaic system on the roof of the faculty building.</td><td>3</td></tr>
<tr><td></td><td colspan="6">Testing photovoltaic modules and systems. Photovoltaic system in the smart energy systems (smart home and smart grid).</td><td>3</td></tr>
<tr><td>Format of instruction</td><td colspan="3">☒ lectures
☐ seminars and workshops
☒ exercises
☐ on line in entirety
☐ partial e-learning
☒ field work</td><td colspan="4">☒ independent assignments
☒ multimedia
☒ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="7">At least 70% of lectures attendance. Completed all laboratory assignments and the presentation of two projects.</td></tr>
<tr><td rowspan="5">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>1</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Individual work</td><td>2</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>Laboratory exercises</td><td>1</td></tr>
<tr><td>Tests</td><td>0.15</td><td>Oral exam</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>0.1</td><td>Project</td><td>0.75</td><td>(Other)</td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="7">Students work in groups of two on two projects: the first project involves calculation of global solar radiation from sunshine duration, the evaluation of the model used and calculation of solar energy on slope of arbitrary tilt and orientation. The first project is presented during the first midterm exam (after 7 weeks of classes). The second project is design of a photovoltaic system and students must complete it and present the results during the second midterm exam (after the following 6 weeks of classes). Apart from presentation of student projects, there will be two midterm quizzes. The requirement for passing the course is to score at least 40% at each quiz, complete all laboratory work and successfully present the projects.. The final grade (in percentage) is formed using following formula:
Grade(%)=0.3(M1+M2)+0.4P,
where:
• M1, M2 – grade from midterm exams given in percentage,
• P – grade from projects given in percentage.
Students not passing the midterm exams take part in the final exams. For passing the final exam, students must score at least 50% as well as have a positive assesment of the laboratory exercises. The grade on final exams is determined by the formula:
Grade(%) = 0.65F+0.35P,
where:
• P – grade from projects given in percentage.</td></tr>
</table>

	Title	Number of copies in the library	Availability via other media
Required literature (available in the library and via other media)	• T. Betti, I. Marasović: Sunčane ćelije – autorizirana predavanja (prezentacije), FESB		E-learning portal
	• P. Kulišić, J. Vuletin, I. Zulim: Sunčane ćelije, Školska knjiga, Zagreb, 1994.		
	• Planning and Installing Photovoltaic Systems, 2nd edition, Earthscan, 2010.		
Optional literature (at the time of submission of study programme proposal)	- T. Markvart, L. Castañer: Practical Handbook of Photovoltaics: Fundamentals and Applications, Elsevier, 2003. - M.A. Green: Solar cells: operating principles, technology, and system applications, Prentice-Hall, 1982. - A. Luque, S. Hegedus: Handbook of Photovoltaic Science and Engineering, Wiley, 2003. - S.M. Sze, K.K. Ng: Physics of Semiconductor Devices, Wiley, 2006. - M.A. Green: Third Generation Photovoltaics, Springer, 2006.		
Quality assurance methods that ensure the acquisition of exit competences	- Record of number of students attending the classes - Evaluation of results in accordance with expected learning outcomes - Feedback from students via student surveys - Teachers self-evaluation - Institutional and non-institutional evaluations		
Other (as the proposer wishes to add)			

NAME OF THE COURSE	SYSTEM IDENTIFICATION						
Code	FELG03	Year of study	1.				
Course teacher	Jadranka Marasović, Ph.D., Full Professor	Credits (ECTS)	5				
Associate teachers	Tea Marasović, Ph.D., Assistant Professor	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	30	0
Status of the course	Obligatory	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: To enable students through practical examples to understand the significance of the system parameter identification for engineering practice and research. To understand that there are no universal identification procedures and for system parameters identification is necessary to implement theoretical knowledge and appropriate mathematical models. To enable students acquire knowledge about the different methods, in particular to explain the differences between the methods that take place outside the working process (off-line) and those that take place during working process (on-line). To provide an understanding of the key impacts of the measuring equipment on the quality of results.		
Course enrolment requirements and entry competences required for the course	The basis of knowledge of Mathematics.		
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: 1. describe the importance of system parameters identification for automated systems and to recognize the danger of potentially bad selected procedures, 2. decide when is need to apply the procedures for the parameters identification during the working process (off-line), and when to apply the procedures simultaneously with the process work (on-line), 3. recognize that the parameters identification is always an approximation procedure and this should be taken into account in applications, 4. apply the simulation on a digital computer to support the theory, taking into account its impact on the results, 5. decide how and when to apply one or more possible methods, depending on the tasks and the available equipment, 6. recognize the exceptional importance of measuring equipment on the quality of the results, 7. solve independent tasks based on actual measurements in the laboratory.		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	Introduction: Systems approach and purpose of modeling (in the analysis and understanding of systems acting and in the problems with the synthesis of the "living" systems acting). The model is an approximation of the system – repetition.	2	0
	Quantitative models, difference of the systems characteristics: deterministic, stochastic, static, dynamic, continuous, discrete, linear and nonlinear mathematical models. The selection of input and output variables and their impact on the complexity of the model.	2	0
	The meaning and the need for system oarameters identification. Introduction to different methods of parameters identification of deterministic systems	2	0
	The impact of disturbances on the quality of identification results. The impact of the unknown (and sometimes	2	0

	unexpected) nonlinearities on the quality of identification results.		
	Parameters Identification of the controlled system whose response is recognized as the response of the first order system with one input and one output.	2	0
	Parameters Identification of the controlled system whose response is recognized as the response of the second order system with one input and one output.	2	0
	Parameters Identification of the controlled system closed in control loop with one input and one output	2	0
	Application of parametric identification results of the existing system in the processes of designing the new complex system.	2	0
	Parameters identification of the controlled multivariable systems.	2	0
	Parameters identification process where the equivalent discrete model was introduced.	2	0
	Parameters identification process where the linear regression method was introduced.	2	0
	The need for identification systems in tasks of forecasting and the tasks of adaptive and intelligent control.	2	0
	Required measuring equipment and the impact of their quality to the quality of the identified parameters. Preparation for laboratory work. parameter identification of the actual system using the existing measuring equipment.	2	0
	List of laboratory or design exercises		LE hours
	Modeling system (transfer function, differential equations: linear or non-linear, state space) – repetition		2
	Analysis based on the system model, the separation of the characteristics useful for the parameters identification– repetition.		2
	Parameters identification of the controlled first order system and the synthesis of new complex systems		2
	Parameters identification of the controlled secong order system.		2
	Application of the results from exercises 1. and 2 in the tasks when is needed to introduce identified systems in an entirely new working conditions		2
	Parameters Identification of the second oredre controlled system closed in control loop.		2
	Synthesis of the closed loop controller applied to the system used in 4. exercise.		2
	Parameters identification of the controlled multivariable systems.		2
	Parameters identification process where the equivalent discrete model was introduced.		2
	Parameters identification process where the linear regression method was introduced.		2
	System identification using measurements in the laboratory.		2
	Seminar essay.		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 ☒ seminar essay (other)	
Student responsibilities	Minimum of 70 percent lecture attendance. Completing all the required laboratory exercises.		

Screening student	Class attendance	1.5	Research		Practical training	

<table>
<tr><td rowspan="4">work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Experimental work</td><td></td><td>Report</td><td></td><td>Individual work</td><td>0.5</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>1</td><td>Laboratory exercises</td><td>1</td></tr>
<tr><td>Tests</td><td>0.5</td><td>Oral exam</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>0.5</td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">During the semester there will be two mid-term exams (tests). The first mid-term will be held during class (according to the calendar), and the other colloquium after the end of classes. Individual colloquium will be considered passed if it achieved 40% correct answers, or total points achieved that give a positive evaluation must be at least 50% correct.
It is necessary during the semester to resolve homework and seminars to be recognized (enrolled) score achieved by tests and exams.
The final grade is determined based on the total number of points earned, which is calculated as follows (Including laboratory exercises points, M3)
Grade [%] = 0.45 * M1 + 0.45*M2 + 0,1*M3
Percentage Grade
50% to 61% sufficient (2)
62% to 74% good (3)
75% to 87% very good (4)
88% to 100% excellent (5)
The final exam encompasses the entire course load or selected parts of it that students' did not pass at either of mid-term exams. The correction exam encompasses the entire course load. The requirement for passing the exam is minimum of 50 percent correct answers. The exams are held according to the class schedule.</td></tr>
<tr><td rowspan="3">Required literature (available in the library and via other media)</td><td colspan="3">Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td colspan="3">J. Marasović: "System Identification“ (in Croatian: Identifikacija sustava), FESB, Authorized lectures</td><td></td><td>e-learning portal</td></tr>
<tr><td colspan="3">D. Stipaničev, J. Marasović.: "Digital Control“ laris.fesb.hr/digitalno_vodjenje, on-line udžbenik "Digitalno vođenje", 2004.</td><td></td><td>e-learning portal</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6">- L. Ljung: System Identification - Theory for the User, Prentice Hall, 1998.
- J. Nan-Yuang: Applied System Identification, Prentice Hall, 1993.
- O. Nelles: Nonlinear System Identification: From Classical Approaches to Neural Networks and Fuzzy Models, Springer –Verlag, 2000.
- R. Pintelon, J. Schoukens: System Identification: A Frequency Domain Approach, IEEE Press, 2001.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="6">- Keeping records on class attendance
- Annual analysis of exam results
- Student survey on teaching performance
- Teacher self-evaluation
- Feedback information from graduates regarding course content relevancy</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="6"></td></tr>
</table>

NAME OF THE COURSE	TELEMEDICINE AND BIOCYBERNETICS						
Code	FELG32	Year of study	1.				
Course teacher	Mojmil Cecić, Ph.D., Full Professor Josip Musić, Ph.D., Assistant Professor	Credits (ECTS)	5				
Associate teachers	Tea Marasović, Ph.D., Assistant Professor	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	30	0
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION		
Course objectives	Training students for: - understanding basic principles and techniques in the area of telemedicine and biocybernetics.	
Course enrolment requirements and entry competences required for the course	None	
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - explain computer and telecommunication basis for telemedicine. - evaluate properties of algorithms for image processing in telemedicine. - rate clinical application of telemedicine. - choose sources of medical information in light of distant learning paradigm. - evaluate systems for biomechanical human analysis. - analyze joint forces and moments in correlation with muscle activity. - experiment with measurement systems in biocybernetics based on EMG sensors, inertial sensors and optoelectronic sensors. - evaluate measurement results in light of possible future application and system limitations.	
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours
	Introduction to telemedicine. Historical development of telemedicine.	2
	Computer and telecommunication basis for telemedicine.	2
	Equipment and services in telemedicine.	2
	Distant learning, searching through sources of medical information.	2
	Image processing in telemedicine.	2
	Ethics and telemedicine.	2
	Clinical application.	2
	Introduction to biocybernetics; overview of technical systems for measurement of human biomechanical parameters; measurement methods in biomechanics.	2
	Human anthropometric parameter identification; gait analysis: terminology and measurements.	2
	Gait parameter measurements; Kinematics and kinetics; Body position and balance during gate; measuring ground reaction forces during gait.	2
	Electromyography, measuring muscle activity during human movement.	2
	Inverse kinematics for muscle force identification.	2
	Machine vision in biocybernetics.	2

	List of laboratory or design exercises	LE hours
	Introductory lecture on laboratory safety procedures, laboratory	2

	measurement systems, and measurement procedures.	
	Measuring human anthropometric parameters using finite element method.	3
	Measuring kinematic parameters during gait using fast cameras.	4
	Measuring ground reaction forces during gait using force plate.	3
	Measuring EMG muscle signals during gait.	4
	Calculation of muscle forces and moments during gait based on measured kinematical parameters and floor reaction forces. Comparison with recorded EMG signals.	4
	Measuring cervical spine range of motion using inertial motion sensors.	3
	Application of machine vision in classification and automatic translation of Croatian signed alphabet.	4
	Algorithms for image processing in telemedicine.	3

Format of instruction	☒ lectures ☒ seminars and workshops ☐ exercises ☐ *on line* in entirety ☐ partial e-learning ☐ field work	☐ independent assignments ☒ multimedia ☒ laboratory ☐ work with mentor ☐ (other)
Student responsibilities	The presence on lectures in the amount of at least 70 % of the times scheduled. Performed all required laboratory exercises.	

Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*						
	Class attendance	1	Research		Practical training	
	Experimental work		Report		Individual work	2
	Essay		Seminar essay		Laboratory exercises	1,5
	Tests	0,1	Oral exam		Preparation for laboratory exercises	0,3
	Written exam	0,1	Project		(Other)	

Grading and evaluating student work in class and at the final exam	During the semester there are two midterm exams. The first midterm exam is after 7 weeks of lectures (in the area of biocybernetics) and the second one is after 13 weeks of lectures (in the area of telemedicine in a form of a project assignment). Each midterm test (as well as the final test) is carried out in a written format with duration of 90 minutes. It consists of both theoretical questions and numerical problems. In the final exams students that did not pass the midterm exams take part. The final exam test consists of 8 theoretical questions and numerical problems. The requirement for passing grade is the positive assessment of laboratory exercises and 50 % points on average midterm exam ((M1 + M2)/2) or the final exam. Students are allowed to have at least 45% of total points on each midterm exams, as long as the final midterm average is at least 50% of total points. Grade (in percentage) is formed according to the formula: Grade(%) = 0,25L + 0,25M1 + 0,5M2 where: • L – laboratory assessment, • M1, M2 – midterm test results. Final grade (based on percantages) is formed as follows: Percentage Grade 50% do 62% sufficient (2) 63% do 74% good (3) 75% do 86% very good (4) 87% do 100% excellent (5) According to Article 65. of Faculty's Bylaw, student is required to participate in all

<table>
<tr><td></td><td colspan="3">teaching activities attending at least 70% of lectures, and 100% of laboratory exercises. In accordance with that student is required to solve and turn over for grading 100% of all laboratory exercises. If student does not meet these criteria, she or he won't be able to take part in the final exam, and will be required to enroll in the course the next year.</td></tr>
<tr><td rowspan="5">Required literature (available in the library and via other media)</td><td>Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td>• I. Klapan, I. Čikeš:; Telemedicina u Hrvatskoj, Medika, Zagreb, 2001.</td><td>3</td><td>teacher</td></tr>
<tr><td>• R. J. Jagacinski, J. M. Flach: Control Theory for Humans: Quantitative Approaches to Modeling Performance, Lawrence Erlbaum Associates Inc., 2003</td><td></td><td>teacher</td></tr>
<tr><td>• T. Marasović, Guidelines for laboratory exercises, FESB</td><td></td><td>e-learning portal</td></tr>
<tr><td>• M. Cecić, J. Musić: Authorized lecture notes, FESB</td><td></td><td>e-learning portal</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">1. Winter D.A.: The Biomechanics and Motor Control of Human Gait, University of Waterloo Press, Waterloo, 1991.
2. Zanchi V., Cecić M., Grujić T., Kuzmanić A., Papić V. : Laboratory for Identification of Human Movement with LaBACS Software Support, International Congress on Computational Bioengineering, ICCB'03, 24-26 September 2003., Zaragoza, Spain, p.p. 155-161
3.I. Kaplan, I Čikeš (editors): "Telemedicine", Telemedicine Association, Zagreb, 2005.
4. V. Štambuk: "Kibernetika s informatikom", 1989.
5. V. R. Milačić : "Tehnička kibernetika", 1981.
6. N. Wiener: "Kibernetika ili upravljanje i komunikacija kod živih bića i mašina", 1972.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">- Keeping records of student attendance
- Annual analysis of course statistics in terms of midterm and finals exams
- Feedback from students via surveys
- teacher self evaluation
- Feedback from graduated students (or senior students) on course content relevance
- Periodic institutional evolution of course teachers</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="3">/</td></tr>
</table>

<table>
<tr><td>NAME OF THE COURSE</td><td colspan="9">DIPLOMA THESIS</td></tr>
<tr><td>Code</td><td>FEXX02</td><td colspan="2">Year of study</td><td colspan="6">2</td></tr>
<tr><td>Course teacher</td><td></td><td colspan="2">Credits (ECTS)</td><td colspan="6">30</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2"></td><td colspan="2" rowspan="2">Type of instruction (number of hours)</td><td>L</td><td>S</td><td>AE</td><td>LE</td><td>DE</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Status of the course</td><td>Mandatory</td><td colspan="2">Percentage of application of e-learning</td><td colspan="5"></td></tr>
<tr><td colspan="10">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="9">Training students for:
- consolidating theoretical knowledge and practical skills in solving highly complex engineering problems,
- being independent in solving problems under the given conditions,
- applying scientific-research and ethical principles,
- writing and presenting the project results.</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="9">Acquired 60 ECTS credits</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="9">Students will be able to:
- To consolidate theoretical knowledge and practical skills in solving highly complex engineering problems
- To use literature, databases and other sources of information
- To select appropriate methods and procedures for solving the most complex engineering problems
- To apply scientific and technical knowledge and skills to effectively solve engineering problems
- To apply scientific research methodology and ethical principles in the science
- To give oral public presentation, to prepare written report and present project results</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="9">Diploma thesis is the independent work of the student produced according to the task and instructions given by the supervisor, and according to the scientific research methodology and ethical principles.</td></tr>
<tr><td>Format of instruction</td><td colspan="4">☐ lectures
☐ seminars and workshops
☐ exercises
☐ on line in entirety
☐ partial e-learning
☐ field work</td><td colspan="5">☐ independent assignments
☐ multimedia
☐ laboratory
☒ work with mentor
☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="9">Independent work</td></tr>
<tr><td rowspan="6">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td></td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Individual work</td><td>30</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td></td><td>Oral exam</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
</table>

<table>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="3">Producing of the diploma thesis is evaluated by the supervisor based on the student's achievements during the process of preparing the diploma thesis. Commission for defence of the diploma thesis gives an assessment, representing an average grade for the preparation and defence of the thesis.</td></tr>
<tr><td rowspan="2">Required literature (available in the library and via other media)</td><td>Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td>1. Etički kodeks Fakulteta elektrotehnike, strojarstva i brodogradnje u Splitu
2. Zelenika, Ratko: Metodologija i tehnologija izrade znanstvenog i stručnog djela, Pisana djela na stručnim i sveučilišnim studijima, knjiga peta, Ekonomski fakultet u Rijeci, Rijeka, 2011.
3. Žugaj, Miroslav; Dumičić, Ksenija; Dušak, Vesna: Temelji znanstvenoistraživačkog rada, Metodologija i metodika, Fakultet organizacije iinformatike, Varaždin, 2006.

Literature depends on the given problem. The literature list may be given by the supervisor or the student should find the appropriate literature to help solve the problem.</td><td></td><td>Web site of the Faculty</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3"></td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">- Self-evaluation of teachers
- Student survey of the whole study programme</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="3"></td></tr>
</table>

STUDY PERFORMANCE CONDITIONS

2.14. Places of the study performance

Buildings of the constituent part (name existing, under construction and planned buildings)	
Identification of building	
Location of building	
Year of completion	
Total square area in m^2	
Identification of building	
Location of building	
Year of completion	
Total square area in m^2	

2.15. List of teachers and associate teachers

CODE	Course	Teachers and associate teachers
	List the courses in alphabetical order	
FENG02	Adaptive control	Ozren Bego, Ph.D., Associate Professor Danijel Jelovski, Ph.D., Assistant Professor
FELH11	Artificial intelligence	Darko Stipaničev, Ph.D., Full Professor Ljiljana Šerić, Ph.D., Assistant Professor Toni Jakovčević, Ph.D., Assistant Professor
FELG17	Bioelectrical systems and equipment	Mirjana Bonković, Ph.D., Full Professor Zoran Valić, Ph.D., Full Professor
FELG15	CAD in automatic control	Mojmil Cecić,. Ph.D., Full Professor Ana Kuzmanić Skelin, Ph.D., Assistant Professor
FELG18	Computational intelligence (neuro-fuzzy-genetic systems)	Darko Stipaničev, Ph.D., Full Professor Toni Jakovčević, Ph.D., Assistant Professor Marin Bugarić, Ph.D. Dunja Gotovac, Teaching Assistant
FELG29	Computer aided process control	Betti Tihomir, Ph.D., Assistant Professor Ivan Marasović, Ph.D., Assistant Professor
FELK04	Computer graphics	Vladan Papić, Ph.D., Full Professor Denis Štajduhar, Teaching Assistant
FELG20	Computer methods in bioengineering	Vladan Papić, Ph.D., Full Professor Josip Musić, Ph.D., Assistant Professor
FELG02	Computer systems	Maja Štula, Ph.D., Full Professor Toni Jakovčević, Ph.D., Assistant Professor
FELG10	Digital control	Darko Stipaničev, Ph.D., Full Professor Josip Musić, Ph.D., Assitant Professor
FELG09	Digital image processing and analysis	Damir Krstinić, Ph.D., Associate Professor Darko Stipaničev, Ph.D., Full Professor Maja Braović, Ph.D.
FELG16	Digital instrumentation 2	Tihomir Betti, Ph.D., Assistant Professor Ivan Marasović, Ph.D., Assistant Professor

FELH07	Digital systems projecting - Projektiranje digitalnih sustava	Julije Ožegović, Ph.D., Full Professor Vesna Pekić, Ph.D. Ante Kristić, Ph.D.
FENG03	Electric servo drives	Božo Terzić, Ph.D., Full Professor Goran Majić, Ph.D.
FELG07	Electronic and virtual instrumentation	Ivo Mateljan, Ph.D., Full Professor
FELH13	Electronic circuits	Ivan Marinović, Ph.D., Full Professor Duje Čoko, Ph.D., Assistant Professor
FENG04	Energy storage systems	Ozren Bego, Ph.D., Associate Professor Danijel Jolevski, Ph.D., Assistant Professor
FENG01	Engineering economy	Ranko Goić, Ph.D., Associate Professor Damir Jakus, Ph.D., Assistant Professor Josip Vasilj, Ph.D. Stipe Vodopija, Teaching Assistant
FEOG01	English language for academic purposes	Daniela Matić, Ph.D., Assistant Professor
FETG02	Hydraulic and pneumatic systems	Jani Barle, Ph.D., Full Professor Alen Kovač, Teaching Assistant
FELG05	Industrial robotics	Mojmil Cecić, Ph.D., Full Professor Stanko Kružić, Teaching Assistant
FELG30	Introduction to machine learning	Tamara Grujić, Ph.D., Full Professor Ivo Stančić, Ph.D., Assistant Professor
FELG01	Linear control systems	Tamara Grujić, Ph.D., Full Professor
FENI03	Measurements and signal processing	Goran Petrović, Ph.D., Associate Professor Juraj Alojzije Bosnić, Teaching Assistant
FELG24	Microcontrollers and network embedded systems	Mirjana Bonković, Ph.D., Full Professor Ivo Stančić, Ph.D., Assistant Professor
FELG25	Mobile robotics	Mirjana Bonković, Ph.D., Full Professor Miroslav Dujmović, Teaching Assistant
FELG27	Modelling and control of vessels and ground vehicles	Darko Stipaničev,Ph.D., Full Professor Damir Krstinić, Ph.D., Associate Professor
FEMG01	Modern physics	Nikola Godinović, Ph.D., Associate Professor Dunja Polić, Darko Zarić, Toni Vrdoljak
FELG26	Multivariable control	Jadranka Marasović, Ph.D., Full Professor
FELG11	Nonlinear control systems	Mojmil Cecić. Ph.D., Full Professor Ana Kuzmanić Skelin, Ph.D., Assistant Professor
FEMK01	Numerical analysis	Ivan Slapničar, Ph.D., Full Professor Lana Periša, Anita Carević
FELG14	Operations research	Jadranka Marasović, Ph.D., Full Professor Martina Bašić, Teaching Assistant
FELG23	Optimization and optimal systems	Mirjana Bonković, Ph.D., Full Professor
FELG33	Optoelectronic measurement methods	Ivo Stančić, Ph.D., Assistant Professor
FELG12	Practicum of automatic control	Tamara Grujić, Ph.D., Full Professor
FELG21	Process control	Darko Stipaničev, Ph.D., Full Professor Ljiljana Šerić, Ph.D., Assistant Professor
FELG22	Process control laboratory	Jadranka Marasović, Ph.D., Full Professor Ivo Stančić, Ph.D:, Assistant Professor
FETL23	Production management	Ivica Veža, Ph.D., Full Professor Marko Mladineo, Ph.D.
FEXX06	Professional Training	
FELG13	Programmable logic controllers	Mojmil Cecić, Ph.D., Full Professor Tihomir Betti, Ph.D., Assistant Professor
FELG19	Programming agents	Maja Štula, Ph.D., Full Professor
FETG01	Project management	Ivica Veža, Ph.D., Full Professor Marko Mladineo, Ph.D.
FELH35	Solar cells	Tihomir Betti, Ph.D., Assistant Professor

		Ivan Marasović, Ph.D., Assistant Professor
FELG03	System Identification	Jadranka Marasović, Ph.D., Full Professor Tea Marasović, Ph.D., Assistant Professor
FELG32	Telemedicine and biocybernetics	Mojmil Cecić, Ph.D., Full Professor Josip Musić, Ph.D., Assistant Professor Tea Marasović, Ph.D., Assistant Professor
FEXX02	Diploma thesis	

3.4. Curriculum vitae of the course teacher

First and last name and title of teacher	**Jani Barle, Ph.D., Full Professor**
The course he/she teaches in the proposed study programme	Hydraulic and pneumatic systems
GENERAL INFORMATION ON COURSE TEACHER	
Address	Žnjanska 4, 21000 Split, HR a
Telephone number	+385 (21) 305930
E-mail address	Jani.Barle@fesb.hr
Personal web page	https://nastava.fesb.hr/nastava/nastavnici/detalji/barle
Year of birth	1964
Scientist ID	186172
Research or art rank, and date of last rank appointment	Scientific Adviser, May 2011.
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Senior Full Professor, September 2016.
Area and field of election into research or art rank	Mechanical engineering, mechanical construction engineering
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	University of Split, Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Date of employment	July 1991.
Name of position (professor, researcher, associate teacher, etc.)	Professor
Field of research	Process Automation, System Maintenance Management
Function	Education and research
INFORMATION ON EDUCATION – Highest degree earned	
Degree	Ph.D.
Institution	University of Zagreb, Faculty of Mechanical Engineering and Naval Architecture
Place	HR - Zagreb
Date	January 1998.
INFORMATION ON ADDITIONAL TRAINING	
Year	1996.
Place	IT - Padua
Institution	Dipartimento di Ingegneria Meccanica
Field of training	Research on experimental methods
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English - 5
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	German - 3
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	Italian - 3

COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	On Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture <u>Undergraduate study:</u> - Industrial process control (FETC06) <u>Master's degree study:</u> - Hydraulics and pneumatics(FETL17) - Maintenance management (FETL04) - Product life management (FETM06) <u>Doctorate degree study:</u> - Experimental methods (FETU24) - Reliability engineering (FETU14)
Authorship of university/faculty textbooks in the field of the course	Barle, J.: Hydraulics and pneumatics, (student handbook and workbook in Croatian: *Hidraulika i pneumatika*), FESB, Split, 2010.
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1. Barle, Jani; Đukić, Predrag; Ban, Dario. Verification of Number of Cycles for Fatique Life Estimation of Wind-Sensitive Structures // 7th ICCSM / Croatian Society of Mechanics, 2012. 233-234. 2. Barle, Jani; Wolf, Hinko; Đukić, Predrag. Experimental verification of the dynamic model for a wind turbine tower // 30th Danubia-Adria: Symposium on Advances in Experimental Mechanics / Croatian Society of Mechanics, 2013. 219-220 3. Grubišić, Vatroslav; Barle, Jani. Procedure for the Service Strength Approval of the Drillship Derricks. // Rad Hrvatske akademije znanosti i umjetnosti. Tehničke znanosti. 521 (2015), 17; 51-62. 4. Đukić, Predrag; Wolf, Hinko; Jani, Barle. Simple dynamic model of wind turbine tower with experimental verification. // International journal for engineering modelling. 28 (2015) , 1-4; 49-59
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	1. Barle, Jani; Franulović, Marina; Jurčević Lulić, Tanja; Kladarić, Ivica; Markučič, Damir; Radica, Gojmir. *Izrada kataloga znanja, vještina i kompetencija za studije strojarstva u Republici Hrvatsko*j // Zbornik radova međunarodne stručne konferencije ME4CataLOgue / Kozak, D., Barle, J., Markučič, D., Pavletić, D., Matičević, G, Vranešević M. N., Rosandić, Ž, Damjanović, D. (ur.)., Sl.Brod 2015. 2. "*Hrvatski katalog znanja, vještina i kompetencija za studije strojarstva zasnovan na ishodima učenja (za preddiplomski, diplomski i doktorski studij)*", Strojarski fakultet u Slavonskom Brodu Sveučilišta J. J. Strossmayera u Osijeku, 2015., Kozak, D., Barle, J., Boras, I., Franulović,, M., Jurčević-Lulić, T., Kladarić, I., Lelas, D., Markučić, D., Matičević, G., Pavletić, D., Vranešević-Marinić, N.(ur.), ISBN 978-953-6048-78-6
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences	IPA IV project ME4CataLOgue “Further development and implementation of the Croatian Qualifications Framework (CQF)”, 2013-2015.

PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	

First and last name and title of teacher	**Ozren Bego, Ph.D., Associate Professor**
The course he/she teaches in the proposed study programme	Adaptive control Energy Storage Systems
GENERAL INFORMATION ON COURSE TEACHER	
Address	Trondheimska 4C, 21000 Split, Croatia
Telephone number	+385 21 305605
E-mail address	obego@fesb.hr
Personal web page	
Year of birth	1966.
Scientist ID	186161
Research or art rank, and date of last rank appointment	Research Scientist, November 2017.
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Associate Professor, December 2017.
Area and field of election into research or art rank	Technical Sciences, Field Automation and Robotics
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Date of employment	1991.
Name of position (professor, researcher, associate teacher, etc.)	Associate Professor
Field of research	Automation, Digital Control Systems
Function	
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Faculty of Electrical Engineering and Computing
Place	Zagreb
Date	24. 2. 2005.
INFORMATION ON ADDITIONAL TRAINING	
Year	
Place	
Institution	
Field of training	
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English (4)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	
COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	Elements of industrial automation, Undergraduate study: Electrical Engineering and Information Technology.
Authorship of university/faculty textbooks in the field of the course	
Professional, scholarly and artistic articles published in the last five	Jolevski, Danijel; Bego, Ozren; Sarajcev, Petar: **Control structure design and dynamics modelling of the organic**

years in the field of the course (5 works at most)	**Rankine cycle system** // *Energy (Oxford)*. **121** (2017) ; 193-204. Jolevski, Danijel; Bego, Ozren. **Model predictive control of gantry/bridge crane with anti-sway algorithm**. // *Journal of mechanical science and technology*. **29** (2015) , 2; 827-834 Jolevski, Danijel; Bego, Ozren; Grgat, Frano. **GA Optimized AVR Controller with Higher Degree of Freedom of Tuning of Wanted Response**. // *International Review of Automatic Control (IREACO)*. **8** (2015) , 1; 72-79
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	Nacional research project: Safer and more efficient cogeneration / trigeneration plants, 2015. -2016., project financed from the EU fond. Development project: Control system for small hydro power plants, project leader, 2010.-2017., project realized for Sintaksa d.o.o.
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?-pedagoške kompetencije?	
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	

First and last name and title of teacher	**Tihomir Betti, Ph.D., Assistant Professor**
The course he/she teaches in the proposed study programme	Computer aided process control Digital instrumentation 2 Programmable logic controllers Solar cells
GENERAL INFORMATION ON COURSE TEACHER	
Address	Kaštelanska 2, HR-21000, Split
Telephone number	091 4305 889
E-mail address	betti@fesb.hr
Personal web page	
Year of birth	1977
Scientist ID	248722
Research or art rank, and date of last rank appointment	Assistant research fellow, 22.11.2012.
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Assistant professor, 18.09.2013.
Area and field of election into research or art rank	Technical sciences, electrical engineering
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Date of employment	08.06.2001.
Name of position (professor, researcher, associate teacher, etc.)	Assistant professor
Field of research	Electronics, Nanoelectronics, Photovoltaics
Function	
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Place	Split
Date	04.12.2009.
INFORMATION ON ADDITIONAL TRAINING	
Year	2013. (7 weeks)
Place	Freiburg, Germany
Institution	Fraunhofer ISE
Field of training	Photovoltaics
Year	2011. (3 weeks)
Place	Ljubljana, Slovenia
Institution	Institute „Jožef Stefan“
Field of training	Hybrid polymer solar cells
Year	2007-2009. (several visits, 4 weeks in total)
Place	Munich, Germany
Institution	Walter Schottky Institute
Field of training	Application of semiconductor nanostructures in third generation photovoltaics
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English, 5
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	Italian, 2

COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	Programmable logic controllers, Graduate study of Control Engineering and Automation, Optoelectronics, Graduate study of Electronic and Computer Engineering Solar cells, Graduate study of Electronic and Computer Engineering and Control Engineering and Automation
Authorship of university/faculty textbooks in the field of the course	
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1. I. Marasović, Ž. Milanović, T. Betti, "Resistance Fluctuations in GaAs Nanowire Grids", Journal of Nanomaterials, (2014), 428390 2. I. Marasović, T. Garma, T. Betti, "Modelling a nanowire grid for light-sensing applications", Journal of Physics D: Applied Physics 45 (2012)
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?	
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	

First and last name and title of teacher	**Mirjana Bonković, Ph.D., Full Professor**
The course he/she teaches in the proposed study programme	Bioelectrical systems and equipment Microcontrollers and network embedded systems Mobile robotics Optimization and optimal systems
GENERAL INFORMATION ON COURSE TEACHER	
Address	R. Boškovića 32, 21 000 Split, HR
Telephone number	+385 91 4 305 641
E-mail address	mirjana.bonkovic@fesb.hr
Personal web page	
Year of birth	
Scientist ID	190481
Research or art rank, and date of last rank appointment	
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Full professor, 2016.
Area and field of election into research or art rank	Technical Sciences, Field Electrical engineering
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Date of employment	01/7/1991
Name of position (professor, researcher, associate teacher, etc.)	Full professor, 2016.
Field of research	3D modelling, robotics, computer vision, optimization
Function	
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Place	Split
Date	10/3/2000.
INFORMATION ON ADDITIONAL TRAINING	
Year	1995
Place	Oxford, UK
Institution	Robotics Research Group
Field of training	Robot production lines optimization
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English (5)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	German (2)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	
COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	Computers and Programming, Undergraduate study program Programming, Undergraduate professional study program
Authorship of university/faculty	

textbooks in the field of the course	Zbirka riješenih zadataka iz programiranja u Cu, upute za laboratorijske vježbe, Interna skripta, FESB Split Mikroregulatori i ugradbeni mrežni sustavi, Interna skripta, FESB Split, 2014
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1. Kuzmanić Skelin, Ana; Grujić, Tamara; Bonković, Mirjana, Visual Peoplemeter: A Vision-based Television Audience Measurement System. // Advances in Electrical and Computer Engineering. 14 (2014) , 4; 73-80 2. Mazić Igor, Bonković Mirjana, Džaja Barbara. Two-Level Coarse-to-Fine Classification Algorithm for Asthma Wheezing Recognition in Children's Respiratory Sounds. //Biomedical Signal Processing and Control. 5 (2015) ; 105-118 (članak, znanstveni). 3. Džaja, Barbara; Bonković, Mirjana; Malešević, Ljubomir. Solving a two-colour problem by applying probabilistic approach to a full-colour multi- frame image super-resolution. // Signal processing. Image communication. 28 (2013) , 5; 509-521 (članak, znanstveni). 4. Čić, Maja; Šoda, Joško; Bonković, Mirjana. Automatic classification of infant sleep based on instantaneous frequencies in a single-channel EEG signal. // Computers in biology and medicine. 43 (2013) , 12; 2110-2117 (članak, znanstveni). 5. Musić, Josip; Bonković, Mirjana; Cecić, Mojmil. Comparison of uncalibrated model-free visual servoing methods for small amplitude movement: a simulation study. //International journal of advanced robotic systems. 11 (2014) , 108; 1-16 (članak, znanstveni).
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	Provjera inovativnog koncepta, Alarm astmatičnog napada, projekt HAMAG-BICRO, agencija za malo gospodarstvo, inovacije i investicije., 2014. /2015. "Virtual CulTourist - Razvoj korisničkog sučelja za virtualno predstavljanje kulturne baštine kroz integraciju inovativnih 3D tehnologija", 2016-2017. Programa tehnološkog razvoja, istraživanja i primjene inovacija (2014.-2017.), SDŽ "Napredne metode 3D virtualizacije – na putu prema virtualnom turizmu i digitalizaciji splitske kulturne baštine", 2015-2016. Programa tehnološkog razvoja, istraživanja i primjene inovacija (2014.-2017.), SDŽ
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences	
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on	

grading scale and course evaluated)	

First and last name and title of teacher	**Mojmil Cecić, Ph.D., Full Professor**
The course he/she teaches in the proposed study programme	CAD in automatic control Industrial Robotics Nonlinear Control Systems Telemedicine and Biocybernetics
GENERAL INFORMATION ON COURSE TEACHER	
Address	Slavonska 6, Split
Telephone number	091 4 305 828
E-mail address	mcecic@fesb.hr
Personal web page	-
Year of birth	1960.
Scientist ID	122922
Research or art rank, and date of last rank appointment	Scientific Adviser, 20th November, 2007.
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Full professor; 20th March, 2014.
Area and field of election into research or art rank	Technical Science, Electrotehnics
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Date of employment	15th January, 1985.
Name of position (professor, researcher, associate teacher, etc.)	Professor
Field of research	Control Systems, Robotics
Function	Head of the Department of Electronics and Computer Science
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD.
Institution	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Place	Split
Date	25th June, 1999.
INFORMATION ON ADDITIONAL TRAINING	
Year	1988.
Place	Budapest, Hungary
Institution	Budepest University of Technology and Economics
Field of training	Industrial robotics
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English (4)
COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	1. Nonlinear Control Systems (Graduate Study Programme) 2. Industrial robotics (Graduate Study Programme) 3. Programmable logic controllers (PLC), (Graduate Study Programme)
Authorship of university/faculty textbooks in the field of the course	1. V. Zanchi, M. Bonković, M. Cecić, Programska podrška linearnoj teoriji automatskog upravljanja, FESB, Split.

Professional, scholarly and artistic articles published in the last five	1. Stančić, Ivo; Cecić, Mojmil; Ljubičić, Ante; Identification of UAV Engine Parameters. // WSEAS TRANSACTIONS ON

years in the field of the course (5 works at most)	SYSTEMS AND CONTROL. 10 (2015) ; 179-185 (članak, znanstveni). 2. Musić, Josip; Bonković, Mirjana; Cecić, Mojmil; Comparison of uncalibrated model-free visual servoing methods for small amplitude movement: a simulation study. // International journal of advanced robotic systems. 11 (2014) , 108; 1-16 (članak, znanstveni) 3. Cecić, Mojmil; Papić, Vladan; Bonković, Mirjana; Grujić, Tamara; Musić, Josip; Kuzmanić Skelin, Ana; Stančić, Ivo; Marasović, Tea; Čić, Maja; Pleština, Vladimir; Science and Technology in Biomedical Engineering: LaBACS Case Example. // Physical Medicine and Rehabilitation - International. 1 (2014) , 2; 1-11 (članak, znanstveni). 4. Stančić, Ivo; Musić, Josip; Cecić, Mojmil; A Novel Low-Cost Adaptive Scanner Concept for Mobile Robots. // Ingeniería e Investigación. 34 (2014) , 3; 37-43 (članak, znanstveni). 5. Cecić, Mojmil; Krajči, Vesna; Bonković, Mirjana; Optimization of Model-Reference Variable-Structure Controller Parameters for Direct-Current Motor. // Journal of Computations and Modelling. 2 (2012.) , 3; 67-88 (članak, znanstveni).
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	1. Stančić, Ivo; Cecić, Mojmil; Ljubičić, Ante; Identification of UAV Engine Parameters. // WSEAS TRANSACTIONS ON SYSTEMS AND CONT ROL. 10 (2015) ; 179-185 (članak, znanstveni). 2. Musić, Josip; Bonković, Mirjana; Cecić, Mojmil; Comparison of uncalibrated model-free visual servoing methods for small amplitude movement: a simulation study. // International journal of advanced robotic systems. 11 (2014) , 108; 1-16 (članak, znanstveni) 3. Cecić, Mojmil; Papić, Vladan; Bonković, Mirjana; Grujić, Tamara; Musić, Josip; Kuzmanić Skelin, Ana; Stančić, Ivo; Marasović, Tea; Čić, Maja; Pleština, Vladimir; Science and Technology in Biomedical Engineering: LaBACS Case Example. // Physical Medicine and Rehabilitation - International. 1 (2014) , 2; 1-11 (članak, znanstveni). 4. Stančić, Ivo; Musić, Josip; Cecić, Mojmil; A Novel Low-Cost Adaptive Scanner Concept for Mobile Robots. // Ingeniería e Investigación. 34 (2014) , 3; 37-43 (članak, znanstveni). 5. Cecić, Mojmil; Krajči, Vesna; Bonković, Mirjana; Optimization of Model-Reference Variable-Structure Controller Parameters for Direct-Current Motor. // Journal of Computations and Modelling. 2 (2012.) , 3; 67-88 (članak, znanstveni).
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	1. Projekt 0023022: Biomechanics of Human Walking, Control and Rehabilitation, MZT RH, 2008.-2013. 2. Computer Intelligence in Recognition and Support of Human Activities (RIPrePAkt), project FESB.
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?	

PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	
Results of student evaluation taken in the last five years for the course that is	

comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	

First and last name and title of teacher	**Nikola Godinović, Ph.D., Associate Professor**
The course he/she teaches in the proposed study programme	Modern Physics
GENERAL INFORMATION ON COURSE TEACHER	
Address	Omiška 20, 21000 Split
Telephone number	0915195314
E-mail address	nikola.godinovic@fesb.hr
Personal web page	
Year of birth	1959
Scientist ID	129696
Research or art rank, and date of last rank appointment	
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Associate Professor, 11.3.2016.
Area and field of election into research or art rank	Area of natural sciences, field of physics
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	University of Split *Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture* R. Boškovića 32 21000 Split Croatia
Date of employment	1.1.1985.
Name of position (professor, researcher, associate teacher, etc.)	professor
Field of research	Physics
Function	Head of the Department of Mathematichs and Physics
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	University of Zagreb
Place	Croatia, Zagreb
Date	30.11.2003.
INFORMATION ON ADDITIONAL TRAINING	
Year	1995. – 2017. god.
Place	Geneva
Institution	CERN
Field of training	Experimenatal Elementary Particle Physics
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English 5
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	Italian 4
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	German 2
COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	Nuclear physcis, Experimtnal Methods of Moderan Physics, graduate program, University of Split, Fcaulty of Scince.

Authorship of university/faculty textbooks in the field of the course	Faculty text book*:* *Instructions for laboratory exercises in Physics 1* *Instructions for laboratory exercises in Physics 1*
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1. *Teraelectronvolt pulsed emission from the Crab Pulsar detected by MAGIC,* MAGIC Collaboration, Ansoldi, S.; et al., . (Authors: MAGIC collaboration), Astronomy and Astrophysics 585, Article Number: A133 (2016) IF: 4.479. 2. *The major upgrade of the MAGIC telescopes, Part I: The hardware improvements and the commissioning of the system*, (Authors: MAGIC Collaboration,) Astroparticle Physics 72, pages: 61-75 (2016) IF: 3.584. 3. *The major upgrade of the MAGIC telescopes, Part II: A performance study using observations of the Crab Nebula*, (Authors: MAGIC Collaboration), Astroparticle Physics 72, pages: 76-94 (2016) IF: 3.584. 4. *Measurement of the properties of a Higgs boson in the four-lepton final state*, By: Chatrchyan, S.; Khachatryan, V.; Sirunyan, A. M.; et al., Group Author(s): CMS Collaboration, Physical Review D 89, Issue: 9, Article Number: 092007 (2014) IF: 4.506 5. *Study of the Mass and Spin-Parity of the Higgs Boson Candidate via Its Decays to Z Boson Pairs*, S. Chatrchyan et al. (CMS Collaboration), Physical Review Letters 110, 081803 – Published 21 February 2013; Erratum Phys. Rev. Lett. 110, 189901 (2013). IF: 7.512.
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	None
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	***HRZZ Research Projects* (IP-11-2013)**, Croatian Sicnece Foundation zaklada za znanost (1.10.2014. god. – 30.9.2018. god.). ***HRZZ Research Projects* (Very high energy gamma ray astronomy with the MAGIC telescopes)**, Croatian Sic nece Foundation zaklada za znanost (1.7.2012. god. – 31.12.2016.).
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?	
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	Slobodna Dalmacija ”Science Award”
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	

First and last name and title of teacher	**Ranko Goić, Ph.D., Full Professor**
The course he/she teaches in the	Engineering Economy

proposed study programme	
GENERAL INFORMATION ON COURSE TEACHER	
Address	Put Žnjana 14G, 21000 Split, HR
Telephone number	+385 21 305604
E-mail address	rgoic@fesb.hr
Personal web page	www.fesb.hr/~rgoic
Year of birth	1969.
Scientist ID	207263
Research or art rank, and date of last rank appointment	Senior scientific associate, 2011
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Associate Professor, 2011
Area and field of election into research or art rank	Technical Sciences, Field Electrical engineering
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Date of employment	1993
Name of position (professor, researcher, associate teacher, etc.)	Professor
Field of research	Transmission and distribution networks, Power system analysis, Energy economics
Function	Head of Chair of Electrical Networks and Substations
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Place	Split
Date	11/July/2002
INFORMATION ON ADDITIONAL TRAINING	
Year	2002
Place	Tokyo, Japan
Institution	JICA
Field of training	Energy efficiency
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English (4)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	
COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	Electrical networks (undergraduate), Distribution networks (undergraduate), Fundamentals of power engineering (undergraduate)
Authorship of university/faculty textbooks in the field of the course	
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1. Sarajčev, Petar; Goić, Ranko: Assessment of the backflashover occurrence rate on HV transmission line towers, European transactions on electrical power (2011) 2. Vasilj, Josip; Sarajcev, Petar; Goic, Ranko: Modeling of

	current-limiting air-core series reactor for transient recovery voltage studies, Electric power systems research, 117 (2014) 3. Jakus, Damir; Goić, Ranko; Krstulović Opara, Jakov: The impact of wind power plants on slow voltage variations in distribution networks, Electric power systems research 81 (2011), 2 4. Parida, B.; Iniyan, S.; Goić, Ranko: A review of solar photovoltaic technologies, Renewable & sustainable energy reviews 15 (2011), 3 5. Goić, Ranko; Krstulović-Opara, Jakov; Jakus, Damir: Simulation of aggregate wind farm short-term production variations, Renewable energy 35 (2010), 11
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	1. Development of mid-voltage distribution grid for next 20 years for Zadar county, 2014 2. Engineering studies (short circuit, load flow, overvoltage protection, earthing system). – basis for design of new submarine cable 110 kV Dugi rat – Postire and reconstruction of substation Dugi rat", 2014 3. Energy-economic analysis of construction of small HPP Peruća, 2013 4. Engineering studies (short circuit, load flow, overvoltage protection, earthing system) – basis for design of refurbishment of HPP Ozalj 1, 2013 5. Optimal technical solution for grid connection of refurbished HPP Zakučac 4x140 MW, 2013
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?-pedagoške kompetencije?	
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	4,6/5

First and last name and title of teacher	**Tamara Grujić, Ph.D., Full Professor**
The course he/she teaches in the proposed study programme	Introduction to machine learning Linear Control Systems Practicum of Automatic Control
GENERAL INFORMATION ON COURSE TEACHER	
Address	Dinka Šimunovića 5, 21000, Split
Telephone number	++38591-4305-642
E-mail address	tamara.grujic@fesb.hr
Personal web page	
Year of birth	1973.
Scientist ID	248770
Research or art rank, and date of last rank appointment	Scientific Adviser, 06. June, 2013.
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Full Professor, 23. Februar, 2017.
Area and field of election into research or art rank	Technical Sciences, Field Electrical engineering
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture – FESB, University of Split
Date of employment	01. September, 2000.
Name of position (professor, researcher, associate teacher, etc.)	Professor
Field of research	Electrical Engineering, Biomedical Engineering
Function	Head of Chair of Automatic Control and Systems
INFORMATION ON EDUCATION – Highest degree earned	
Degree	Dr. sc. (Ph.D.)
Institution	Faculty of Electrical Engineering, University of Ljubljana, Slovenia
Place	Ljubljana, Slovenia
Date	24. November, 2006.
INFORMATION ON ADDITIONAL TRAINING	
Year	Additional trainings (Visiting stays in total of 5 months, during the time period since 2003. to 2006.)
Place	Ljubljana, Slovenia
Institution	Faculty of Electrical Engineering, University of Ljubljana, Slovenia
Field of training	Electrical Engineering, Biomedical Engineering
Year	2003.g. (three months stay)
Place	Reading, UK
Institution	University of Reading, Department of Cybernetics, School of Systems Engineering
Field of training	Biomedical Engineering
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English language (5)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	Italian language (3)

COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	• Signals and Systems, Undergraduate study programme, • Multimedia Systems, Graduate study programme, • Signals and Systems in Biomedical Engineering, Postgraduate (PhD) study programme
Authorship of university/faculty textbooks in the field of the course	• Faculty textbook for Linear Control Systems course: Tamara Grujić: "Linearni regulacijski sustavi – Predavanja sa zadacima", Interna skripta, FESB, Split, 2011. • Faculty textbook for Practicum of Automatic Control course: Tamara Grujić: "Razvoj, izrada i testiranje tiskane pločice", Interna skripta, FESB, Split, 2008.
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	Scientific papers published in international journals cited by CC or SCI-Expanded: 1. Grujić Tamara; Kuzmanić Skelin, Ana; Čić, Maja. Design, Development and Testing of a Low-Cost sEMG System and Its Use in Recording Muscle Activity in Human Gait. // *Sensors*. 14 (2014) , 5; 8235-8258 2. Kuzmanić Skelin, Ana; Grujić, Tamara; Bonković, Mirjana. Visual Peoplemeter: A Vision-based Television Audience Measurement System. // *Advances in Electrical and Computer Engineering*. 14 (2014) , 4; 73-80 3. Stančić, Ivo; Grujić, Tamara; Panjkota Ante. Design, Development, and Evaluation of Optical Motion-Tracking System Based on Active White Light Markers. // *IET science measurement & technology*. 7 (2013) , 4; 206-214 4. Stančić, Ivo; Grujić, Tamara; Bonković, Mirjana. New Kinematic Parameters for Quantifying Irregularities in the Human and Humanoid Robot Gait. // *International Journal of Advanced Robotic Systems*. 9 (2012) ; 215-1-215-8 5. Grujić Šupuk, Tamara; Bajd, Tadej; Kurillo, Gregorij. Assessment of Reach-to-Grasp Trajectories Toward Stationary Objects. // *Clinical biomechanics*. 26 (2011) , 8; 811-818
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	1. Project: "Advanced Methods of 3D Visualization - Towards Virtual Tourism and Cultural Heritage Digitalization of Town of Split", 2015-2016. Tamara Grujić is project researcher. 2. Project: Biomechanics of Human Movements, Control and Rehabilitation", 2007-2014. Tamara Grujić was project researcher. 3. Program: Biomechanics of Human Movements – BioPok, 2007-2014. Tamara Grujić was project researcher.
The name of the programme and	Tamara Grujić, from the time of employment at the FESB

the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?	(the year 2000) continuously lead a range of courses at The Undergraduate Study in Electrical Engineering and Information Technology, Undergraduate Study in Computer Science, Graduate Study in Automation and Systems, and Postgraduate (Ph.D.) Study in Electrical Engineering and Information Technology. Also, she is giving lectures as a visiting professor, at The Undergraduate Study of Physiotherapy, at the Department of Health Studies, University of Split, Croatia, and at The Faculty of Mechanical Engineering and Computer Science, University of Mostar, Bosnia and Herzegovina. Total so far she held more than 5,000 hours of lectures, auditory and laboratory exercises, as an research assistant (2000-2007), and as professor (2007 -)
PRIZES AND AWARDS	
Prizes and awards for teaching and scholarly/artistic work	
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	Results of student evaluation taken in the last five years for the course "Linear Control Systems": 4.76 / 5 Results of student evaluation taken in the last five years for the course "Practicum of Automatic Control": 4.72 / 5 Evaluation organizer: University of Split

First and last name and title of teacher	**Toni Jakovčević, Ph.D., Assistant Professor**
The course he/she teaches in the proposed study programme	Computer systems
GENERAL INFORMATION ON COURSE TEACHER	
Address	Getaldićeva 25, Split
Telephone number	0914305832
E-mail address	toni.jakovcevic@fesb.hr
Personal web page	http://laris.fesb.hr/toni.htm
Year of birth	1982
Scientist ID	292313
Research or art rank, and date of last rank appointment	Scientific associate, March 2014.
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Assistant professor, May 2014.
Area and field of election into research or art rank	Technical sciences, Field: Computer science
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Date of employment	2007.
Name of position (professor, researcher, associate teacher, etc.)	Professor
Field of research	Computer science, Artificial intelligence
Function	
INFORMATION ON EDUCATION – Highest degree earned	
Degree	Ph.D.
Institution	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Place	Split, Croatia
Date	10.1.2011.
INFORMATION ON ADDITIONAL TRAINING	
Year	
Place	
Institution	
Field of training	
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English 5
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	

COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	
Authorship of university/faculty textbooks in the field of the course	
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1. Bugarić, Marin; Jakovčević, Toni; Stipaničev, Darko. Adaptive Estimation of Visual Smoke Detection Parameters Based on Spatial Data and Fire Risk Index. // Computer vision and image understanding. 118 (2014) ; 184-196 2. Jakovčević, Toni; Stipaničev, Darko; Krstinić, Damir. Visual spatial-context based wildfire smoke sensor. // Machine vision and applications. 24 (2013) , 4; 707-719 3. Bugarić, Marin; Jakovčević, Toni; Stipaničev, Darko. Computer Vision Based Measurement of Wildfire Smoke Dynamics. // Advances in Electrical and Computer Engineering. 15 (2015) , 1; 55-62 4. Stipaničev, Darko; Bugarić, Marin; Krstinić, Damir; Šerić, Ljiljana; Jakovčević, Toni; Braović, Maja; Štula, Maja. New generation of automatic ground based wildfire surveillance systems // Advances in forest fire research. Coimbra, Portugal : Imprensa da Universidade de Coimbra, 2014. 1455-1466 5. Stipaničev, Darko; Šerić, Ljiljana; Braović, Maja; Krstinić, Damir; Jakovčević, Toni; Štula, Maja; Bugarić, Marin; Maras, Josip. Vision Based Wildfire and Natural Risk Observers // Proc. of 3rd International Conference on Image Processing Theory, Tools and Applications, OS1: Special session on Image Processing for Natural Risks (IPNR) / Khalifa Djemal (France), Mohamed Deriche (KSA), Istanbul, 2012. P271
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	AgISEco – Agent-oriented intelligent systems for environmental survaillance and protection
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?	
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	

First and last name and title of teacher	**Damir Krstinić, Ph.D., Associate Professor**
The course he/she teaches in the proposed study programme	Digital image processing and analysis Modelling and control of vessels and ground vehicles
GENERAL INFORMATION ON COURSE TEACHER	
Address	Slobode 43, Split 21000
Telephone number	+385 (0) 21 305 895
E-mail address	damir.krstinic@fesb.hr
Personal web page	http://www.fesb.hr/~dkrst
Year of birth	1975
Scientist ID	248812
Research or art rank, and date of last rank appointment	senior research associate, 2011.
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Associate professor, 25. 01. 2017.
Area and field of election into research or art rank	Computer science, Information systems
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	FESB, University of Split
Date of employment	01. 02. 2000.
Name of position (professor, researcher, associate teacher, etc.)	Associate professor
Field of research	Computer science
Function	Associate professor
INFORMATION ON EDUCATION – Highest degree earned	
Degree	dr. sc.
Institution	FESB, University of Split
Place	Split
Date	2008.
INFORMATION ON ADDITIONAL TRAINING	
Year	
Place	
Institution	
Field of training	
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English 4
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	Italian 2
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	
COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	
Authorship of university/faculty textbooks in the field of the course	

Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1. Krstinić, Damir; Kuzmanić Skelin, Ana; Milatić, Ivan, Laser Spot Tracking Based on Modified Circular Hough Transform and Motion Pattern Analysis, Sensors, Vol. 14, no. 11, 2014., pp. 20112-20133 2. Jakovčević, Toni; Stipaničev, Darko; Krstinić, Damir, "Visual spatial-context based wildfire smoke sensor", Machine vision and applications (ISSN 1387-8092), Vol. 24(2013), No. 4, pp. 707-719, 2013. 3. Šerić, Ljiljana; Krstinić, Damir; Braović, Maja; Milatić, Ivan; Mirčevski, Aljoša; Stipaničev, Darko, "Holonic Multi Agent System for Data Fusion in Vehicle Classification", in Proc. Of 10th KES International Conference, KES-AMSTA 2016.; pp-151-161; Puerto de la Cruz, Tenerife, Spain, June 15. - 17. 2016. 4. Stipaničev, Darko; Šerić, Ljiljana; Krstinić, Damir; Bugarić, Marin, "Wildfire video observers network with phyisical an d virtual sensors", 10th EARSel Forest Special Interest Group Workshop – Sensors, Multi-Sensor Integration, Large Volumes: New Oportunities and Chalenges in Forest Fire Research, Limassol, Cyprus, November 2. - 5. 2015. 5. Štula, Maja; Krstinić, Damir; Šerić, Ljiljana, "Intelligent forest fire monitoring system", Information System Frontiers (ISSN 1387-3326), Vol. 14(2012), No. 3; pp- 725-739, 2012.
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?	
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	Digital image processing and analysis: • 2015/2016 – overall average 4.7 • 2014/2016 – overall average 4.6 • 2013/2014 – overall average 4.6 • 2012/2013 – overall average 4.7 • 2011/2012 – overall average 4.6

First and last name and title of teacher	**Ana Kuzmanić Skelin, Ph.D., Assistant Professor**
The course he/she teaches in the proposed study programme	CAD in Automatic Control
GENERAL INFORMATION ON COURSE TEACHER	
Address	R. Boškovića 32, 21 000 Split, HR
Telephone number	+385-91-4305-652
E-mail address	akuzmani@fesb.hr
Personal web page	
Year of birth	
Scientist ID	254392
Research or art rank, and date of last rank appointment	Research associate (Electrical Engineering), 11/7/2014 Research associate (Computer Science), 6/11/2015
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Assistant professor, 14/6/2016
Area and field of election into research or art rank	Technical Sciences, Field Electrical engineering Technical Sciences, Field Computer Science
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Date of employment	15/6/2002
Name of position (professor, researcher, associate teacher, etc.)	Assistant professor
Field of research	control systems, computer vision, adaptive learning methods
Function	
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Place	Split
Date	4/7/2013
INFORMATION ON ADDITIONAL TRAINING	
Year	2006
Place	Surrey, UK
Institution	Centre for Vision, Speech and Signal Processing
Field of training	Wide-baseline image correspondences
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English (5)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	German (3)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	

COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	Nonlinear Control Systems, Graduate study program Automatic Control, Undergraduate professional study program
Authorship of university/faculty textbooks in the field of the course	Automatika - upute za laboratorijske vježbe, Interna skripta, FESB Split
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1. Grujić Tamara; Kuzmanić Skelin, Ana; Čić, Maja, Design, Development and Testing of a Low-Cost sEMG System and Its Use in Recording Muscle Activity in Human Gait. // Sensors. 14 (2014) , 5; 8235-8258 2. Ante Palac; Ana Kuzmanić Skelin; Mirjana *Bonkovic, Design and Development of a Low-Cost Hen Eggs Incubator//* Proc. of the 1st International Multidisciplinary Conference on Computers and Energy Science, SpliTech, 2016
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	Biomehanika ljudskih pokreta, upravljanje i rehabilitacija, 023-0232006-1655, 2007-2014., MZOŠ
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?	
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	4,8 (grading scale: 1-5); Nonlinear control systems

First and last name and title of teacher	**Ivan Marasović, Ph.D., Assistant Professor**
The course he/she teaches in the proposed study programme	Solar cells Computer aided process control
GENERAL INFORMATION ON COURSE TEACHER	
Address	Jurja Šižgorića 14, 21000 Split
Telephone number	+385 21 305826
E-mail address	Ivan Marasovic@fesb.hr
Personal web page	
Year of birth	1983.
Scientist ID	297561
Research or art rank, and date of last rank appointment	Assistant research fellow, 07.07.2015.
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Assitant professor, 01.10.2015.
Area and field of election into research or art rank	Technical Sciences, Field electrical Engineering, Branch Electronics
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Date of employment	01/09/2007
Name of position (professor, researcher, associate teacher, etc.)	Professor
Field of research	Electronics, Micro and nano electronics, Solar cells and photovoltaics, Embedded systems
Function	
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Place	Split
Date	11/05/2012
INFORMATION ON ADDITIONAL TRAINING	
Year	2011. (1 weeks)
Place	Freiburg, Germany
Institution	Fraunhofer ISE
Field of training	Photovoltaics
Year	2011. (2 weeks)
Place	Ljubaljana, Slovenia
Institution	Fakultet za elektrotehniko
Field of training	Semiconductor nanoelectronics
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English (4)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	

COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	Electronic devices and circuits, Undergraduate study of Electrical Engineering and Information Technology Basic electronics, Undergraduate study in Computing Digital instrumentation 1, Undergraduate study of Control Engineering and Automation, Electronic and Computer Engineering and Communication
Authorship of university/faculty textbooks in the field of the course	
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1. L. Mainetti, I. Marasović, L. Patrono,P. Šolić, M.L. Stefanizzi, R. Vergallo "A Novel IoT-aware Smart Parking System based on the integration of RFID and WSN technologies., (2016), 833257 2. I. Marasović, Ž. Milanović, I. Zulim, "Modelling and detection of failure in medical electrodes", (2015), 789296 3. S. Nižetić, I. Marasović, D. Čoko, "Experimental study on a hybrid energy system with small-and medium-scale applications for mild climates., (2014), 694087 4. I. Marasović, Ž. Milanović, T. Betti, "Resistance Fluctuations in GaAs Nanowire Grids", Journal of Nanomaterials, (2014), 428390 5. I. Marasović, T. Garma, T. Betti, "Modelling a nanowire grid for light-sensing applications", Journal of Physics D: Applied Physics 45 (2012)
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences	
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	4,0

First and last name and title of teacher	**Jadranka Marasović, Ph.D., Full Professor**
The course he/she teaches in the proposed study programme	Multivariable control Operations Research Process Control Laboratory System Identification
GENERAL INFORMATION ON COURSE TEACHER	
Address	Split, Zagrebačka 21
Telephone number	385 021 305 830 (institution)
E-mail address	jmar@fesb.hr
Personal web page	/
Year of birth	1955.
Scientist ID	080633
Research or art rank, and date of last rank appointment	Senior Research Scientist, 09. July 2007.
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Full professor, 01. March 2009.
Area and field of election into research or art rank	Technical science, field of electrical engineering
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Electrical Engineering, Machine Engineering and Naval Architecture, University of Split
Date of employment	04. May 1978.
Name of position (professor, researcher, associate teacher, etc.)	Professor
Field of research	Science and Education
Function	/
INFORMATION ON EDUCATION – Highest degree earned	
Degree	Doctor of science
Institution	Faculty of Electrical Engineering, Machine Engineering and Naval Architecture, University of Split
Place	Split
Date	11. July 1997.
INFORMATION ON ADDITIONAL TRAINING	
Year	/
Place	/
Institution	/
Field of training	/
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English (excellent -5)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	Italian (sufficient-2)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	

COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	**Undergraduate studies:** • Measurements and Process Control • Industrial Process Control **Graduate studies:** • Automatic Control • System Identification • Process Control Laboratory • Optimization Methods • Operations Research • Automation **Postgraduate study:** • Optimization Techniques for Environmental Studies (Wessex Institute of Tecnology, UK i FESB) • Game theory and optimization methods (FESB) • Complex systems modelling and simulation (FESB)
Authorship of university/faculty textbooks in the field of the course	- (autor) Kvantitativno i kvalitativno modeliranje i simuliranje (Quantitative and Qualitative Modelling and Simulation) (ISBN 953-6114-67-4), - (koautor) On-line (web) udžbenik, Informatički projekt MZT-a, http://laris.fesb.hr/digitalno_vodjenje (Digital Control) - (autor) Predavanja iz kolegija Metode optimizacije (Lessons for Optimizaion Methods) (FESB, e-learning). - (autor) Predavanja iz kolegija Modeliranje i simuliranje sustava (Lessons for Modelling and Simulations) (FESB, e-learning).
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	- Marasović, Tea; Papić, Vladan; **Marasović, Jadranka**. *Motion-based Gesture Recognition Algorithms for Robot Manipulation*. // International Journal of Advanced Robotic Systems. 12 (2015), 51; 1-13, doi: 10.5772/60077. - **Marasović, Jadranka**; Marasović, Tea; Đapić, Marija. *Fair Division Methods Approach as the Option of Learning Process Modeling*. // Proceedings of 18th IEEE International Symposium on Computers and Communications (ISCC). 2013; 735-739. - Mance, Davor; **Marasović, Jadranka**. *EMC in Electronic System Developed to Support Measurements in Space Environment*. // Proceedings of 20th International Conference on Software, Telecommunications and Computer Networks (SoftCOM). 2012; 1-5.
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	/
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	Associated member in scientific projects: - Računalna inteligencija za prepoznavanje i potporu ljudskih aktivnosti (RIPrePAkt), - GRS Front End Electronics Characterization for LISA, - Agentski orijentirani inteligentni sustavi za nadzor i zaštitu okoliša (Agents Oriented Intelligent Systems for Environment Control and Protection), - Inteligentni agenti u modeliranju i vođenju kompleksnih sustava (Intelligent Agents used for Complex Systems Modelling and Control),

	- Vođenje složenih sustava inteligentnim metodama (Intelligent Methods for Complex Systems Control).
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?	/
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	/
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	

First and last name and title of teacher	**Ivan Marinović, Ph.D., Full Professor**
The course he/she teaches in the proposed study programme	Electronic circuits
GENERAL INFORMATION ON COURSE TEACHER	
Address	Butor dolac 13, 21405 Milna, o. Brač
Telephone number	098 1835911
E-mail address	imarin@fesb.hr
Personal web page	www.fesb.hr/~imarin
Year of birth	1966.
Scientist ID	200263
Research or art rank, and date of last rank appointment	Scientific Advisor, 20.06.2016.
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Full Professor, 15.07.2016.
Area and field of election into research or art rank	Technical Sciences, Electrical Engineering
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture – Split
Date of employment	21.02.1991.
Name of position (professor, researcher, associate teacher, etc.)	Professor
Field of research	Electronics, Radiocommunications
Function	Head of Cathedra for Radiocommunication Circuits and Systems
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture – Split
Place	Split
Date	12.05.2005.
INFORMATION ON ADDITIONAL TRAINING	
Year	
Place	
Institution	
Field of training	
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English (4)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	Italian (4)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	

COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	Electronic Circuits, Graduate study programme, Electronic Circuits and Measurements, Graduate study programme
Authorship of university/faculty textbooks in the field of the course	Marinović, Ivan; Čoko, Duje, Electronički sklopovi-Upute za laboratorijske vježbe, FESB-Split
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences	
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	4.8

First and last name and title of teacher	**Ivo Mateljan, Ph.D., Full Professor**
The course he/she teaches in the proposed study programme	Electronic and virtual instrumentation
GENERAL INFORMATION ON COURSE TEACHER	
Address	J. Rodina 4, 21215 Kaštel Lukšić
Telephone number	+395 21 305 860
E-mail address	ivo.mateljan@fesb.hr
Personal web page	marjan.fesb.hr/~mateljan/
Year of birth	1953
Scientist ID	76394
Research or art rank, and date of last rank appointment	Scientific Adviser, 2007
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Senior Full Professor, 2011
Area and field of election into research or art rank	Technical Sciences, Electrical engineering
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Date of employment	1/1/1977
Name of position (professor, researcher, associate teacher, etc.)	Professor
Field of research	Programming, Virtual Instrumentation, Electroacoustics
Function	Head of Electroacoustic Laboratory
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PdD
Institution	University of Zagreb, Faculty of Electrical Engineering
Place	Zagreb, Croatia
Date	1992.
INFORMATION ON ADDITIONAL TRAINING	
Year	
Place	
Institution	
Field of training	
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English (4)
COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	Programming, OOP, Electronic circuit
Authorship of university/faculty textbooks in the field of the course	Ivo Mateljan: Programiranje jezikom C, book published by University of Split, 2010. Ivo Mateljan: Electronic and Virtual Instrumentation, FESB, internal script,, 2004

Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1. Sikora, Marjan; Mateljan, Ivo.: A Method for Speeding up Beam-tracing Simulation Using Thread-level Parallelization. // *Engineering with computers*. **30,** 2014. 2. Sikora M., Mateljan I., Bogunovic, N.: *Beam Tracing with Refraction,* Archives of Acoustics Vol.37, 2012. 3. Mateljan I., Sikora M.: *Estimation of loudspeaker drivers parameters*, Proc. of 5th Congress of the Alps Adria Acoustics Association Zadar, 2012. 4. Slamka M., Mateljan I., Howes M.: Virtual Surround for Headphones and Earbuds Headphone Externalization System, US patent 8270616, US class: 381/17; 381/1; 381/309, Assignee: Logitech Europe S.A., Sept. 18,2012.
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	Ivo Mateljan: ARTA software, Artalabs, 2004-2017.
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?-pedagoške kompetencije?	
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	4.6/5

First and last name and title of teacher	**Daniela Matić, Ph.D., Assistant Professor**
The course he/she teaches in the proposed study programme	English Language for Academic Purposes
GENERAL INFORMATION ON COURSE TEACHER	
Address	Matice hrvatske 23, 21000 Split
Telephone number	098/ 1766010
E-mail address	daniela.matic@fesb.hr
Personal web page	/
Year of birth	1967
Scientist ID	332846
Research or art rank, and date of last rank appointment	/
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Assistant professor; January 23, 2013
Area and field of election into research or art rank	Humanities; philology
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Date of employment	November 11, 2005
Name of position (professor, researcher, associate teacher, etc.)	English teacher
Field of research	ESP, pragmatics, discourse analysis, contact linguistcs
Function	/
INFORMATION ON EDUCATION – Highest degree earned	
Degree	Ph.D.
Institution	Faculty of Humanities and Social Sciences, University of Zagreb
Place	Zagreb
Date	December 12, 2011
INFORMATION ON ADDITIONAL TRAINING	
Year	1998
Place	Barnstaple, Velika Britanija
Institution	Services for Open Learning, Barnstaple, Inservice Course in Teacher Training
Field of training	English language teaching methodology
Year	2002.
Place	Gyula, Hungary
Institution	A.S.Hornby International Trust, British Council, "Teaching English through Culture"
Field of training	English language teaching methodology
Year	2003
Place	Krakow, Poland
Institution	A.S.Hornby International Trust, British Council, "Intercultural Studies on the Web: Methodology and Materials"
Field of training	English language teaching methodology
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English; 5
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	French; 5

Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	Italian; 3
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent	German; 2
COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	Course teacher of : - English Language 1, 2 and 3 courses at undergraduate studies of Computer Science, Electrical Engineering and IT and Naval Architecture; - English Language 1 and 2 courses at professional studies of Computer Science, Electrical Engineering and IT and Naval Architecture; - English Language for Academic purposes at graduate studies of Mechanical Engineering.
Authorship of university/faculty textbooks in the field of the course	/
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1. Matić, Daniela. (2012). Zamjenice u hrvatskim političkim govorima. *Filolog: časopis za jezik, književnost i kulturu*. V/2012, Univerzitet u Banjoj Luci, Filološki fakultet, ISSN 1986-5864. 2. Matić, Daniela. (2012). Jezične igre moći u drami Who's Afraid of Virginia Woolf? Edwarda Albeeja. *LINGUA MONTENEGRINA časopis za jezikoslovna, književna i kulturna pitanja,* god. V/2, br. 10. (2012). Podgorica: Institut za crnogorski jezik i književnost. ISSN 1800-7007. 3. Matić, Daniela. (2012). Ideological Discourse Structures in Political Speeches. *Komunikacija i kultura online. Elektronski časopis za jezik, komunikaciju i kulturu*. Godina III. Broj 3. http://www.komunikacijaikultura.org/KK3.html Beograd: FOKUS – Forum za interkulturnu komunikaciju. e-ISSN 2217-4257 (Online) UDC 8:008:316.7 4. Matić, Daniela. (2013). Pronouns in American Political Speeches. *LINGUA MONTENEGRINA časopis za jezikoslovna, književna i kulturna pitanja*, god. VI/1 br. 11. (2013). Podgorica: Institut za crnogorski jezik i književnost. ISSN 1800-7007. 5. Matić, Daniela, Nataša Stojan. (2013). Rodne oznake u oglasima za posao. Kroz jezike i kulture ; Across Languages and Cultures - *Zbornik radova sa Treće međunarodne konferencije Instituta za strane jezike (ICIFL3) i Treće međunarodne konferencije o interkulturnoj komunikaciji* / Lakić, Igor ; Kostić, Nataša (ur.). - Podgorica : Institut za strane jezike / Institute of Foreign Languages, 2013. 59-69 ISBN: 978-86-85263-10-1. 6. Matić, Daniela. (2014). Ideology Hidden in the Form of Croatian and American Political Speeches. *Teme. Časopis za društvene nauke.* Br.3 (2014). Niš: Univerzitet u Nišu. ISSN 0353-7919.

Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	1. Matić, Daniela. (2014). Attitudes of computer science students to the English element in Croatian ICT magazines. *ESP Today. Journal of English for Specific Purposes at Tertiary Leve*l. Volume 2, Issue 2 (2014). http://www.esptodayjournal.org/index.html e-ISSN 2334-9050. 2. Matić, Daniela. (2015). Percepcija hrvatskih studenata računarstva o prihvatljivosti engleskoga elementa u glagolima, glagolskim imenicama i jukstaponiranim leksičkim segmentima u hrvatskim tekstovima iz područja računalnih i komunikacijskih tehnologija. *Od teorije do prakse u jeziku struke - Zbornik radova s 3. stručno-znanstvenog skupa Udruge nastavnika jezika struke na visokoškolskim ustanovama.*/ Cigan, Vesna; Omrčen, Darija (ur.) – Zagreb: Udruga nastavnika jezika struke na visokoškolskim ustanovama, 2015. 65-81.
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	Students' attitudes toward the English element in ICT terminology
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?-pedagoške kompetencije?	Regular four-year studies of the English language and literature and the French language and literature at Zagreb University.
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	/
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	Positive

First and last name and title of teacher	**Josip Musić, Ph.D., Assistant Professor**
The course he/she teaches in the proposed study programme	Telemedicine and Biocybernetics
GENERAL INFORMATION ON COURSE TEACHER	
Address	Ruđera Boškovića 32, Split
Telephone number	+ 385 (0)21 305 829
E-mail address	jmusic@fesb.hr
Personal web page	http://marjan.fesb.hr/~jmusic
Year of birth	1980
Scientist ID	272932
Research or art rank, and date of last rank appointment	Senior research associate (February 2013)
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Assistant professor (July 2014)
Area and field of election into research or art rank	Technical sciences, Electrical engineering
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of electrical engineering, mechanical engineering and naval architecture, University of Split
Date of employment	September 2014
Name of position (professor, researcher, associate teacher, etc.)	Assistant professor
Field of research	Robotics and automatization
Function	/
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Faculty of electrical engineering, mechanical engineering and naval architecture, University of Split
Place	Split
Date	28.04.2010.
INFORMATION ON ADDITIONAL TRAINING	
Year	2012
Place	Glasgow, Scotland, UK
Institution	School of Computing, University of Glasgow
Field of training	human-computer interaction (HCI), signal processing
Year	2008
Place	Glasgow, Scotland, UK
Institution	Department of Computing, University of Glasgow
Field of training	human-computer interaction (HCI), signal processing
Year	2005.
Place	Ljubljana, Slovenia
Institution	Faculty of electrical engineering, University of Ljubljana
Field of training	robotics, biomechanics
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English (5)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	Italian (2)

COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	Automation (412/512), Automatic control 2 (910,11), Digital electronics (110), Digital control (210), Sensors and transducers (512), Biomechanics Practicum (412/512), Programing mobile robots and drones (221/222/242/250), Computer methods in biomechanics (111), Computers and computer methods in biomechanics (310/330), Telemedicine and biocybernetics (210/220/242)m Introduction to system theory (330)
Authorship of university/faculty textbooks in the field of the course	M. Bonković, J. Musić, I. Stančić, Microcontrollers and embedded network systems based on Arduino development environment, faculty script, 2014
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	. Musić, Josip; Bonković, Mirjana; Cecić, Mojmil: "Comparison of uncalibrated model-free visual servoing methods for small amplitude movement: a simulation study", International Journal of Advanced Robotic Systems, 2014 (DOI: dx.doi.org/10.5772/58822) 2. Stančić, Ivo; Musić, Josip; Cecić, Mojmil: "A Novel Low-Cost Adaptive Scanner Concept for Mobile Robots", Ingenieria e Investigacion, 34 (2014), 3; 37-43 3. Stančić, Ivo; Musić, Josip; Zanchi, Vlasta: "Improved structured light 3D scanner with application to anthropometric parameter estimation", Measurement, 46 (2013), 1; 716-726 4. Musić, Josip; Cecić, Mojmil; Zanchi, Vlasta: "Real-time body orientation estimation based on two-layer stochastic filter architecture", Automatika : časopis za automatiku, mjerenje, elektroniku, računarstvo i komunikacije, 51 (2010), 3; 264-274 5. Musić, Josip; Murray-Smith, Roderick: "Virtual Hooping: teaching a phone about hula-hooping for Fitness, Fun and Rehabilitation", Proceedings of Mobile Human Computer Interaction (MobileHCI) 2010. 309-312
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	/
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	1. Compressive sensing and super-resolution in surveillance systems based on optical sensors and UAVs, 2015-2017, Bilateral Croatia-Montenegro cooperation, project lead 2. Supervised and unsupervised learning from imbalanced datasets for assistance in movement of persons with low vision, 2014-2015, Bilateral Croatia-Slovenia cooperation, project lead 3. Prototyping a module for automatization of industrial floor scrubbers, 2014-2016, Split-Dalmatia county and Odabir d.o.o., project lead 4. Computer intelligence for classification and support of human activities, 2014 - , Faculty/University project, researcher 5. Biomechanics of human motion, control and rehabilitation, 2007-2014, Ministry of science, education and sports,

	researcher
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?-pedagoške kompetencije?	/
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	/
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	/

First and last name and title of teacher	**Julije Ožegović, Ph.D., Full Professor**
The course he/she teaches in the proposed study programme	Digital Systems Projecting
GENERAL INFORMATION ON COURSE TEACHER	
Address	Istarska 2, 21000 Split, HR
Telephone number	+385 21 305825
E-mail address	julije.ozegovic@fesb.hr
Personal web page	www.fesb.hr/~julije
Year of birth	1954.
Scientist ID	91795
Research or art rank, and date of last rank appointment	Scientific Advisor, 2008-03-12
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Senior Full Professor, 2013-09-15
Area and field of election into research or art rank	Technical Sciences, Field Electrical engineering
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Date of employment	1979-10-01
Name of position (professor, researcher, associate teacher, etc.)	Professor
Field of research	Digital electronics, Computer networks, Automata theory
Function	Head of Chair of Digital Systems and Computer Network
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Place	Split
Date	1998-02-27
INFORMATION ON ADDITIONAL TRAINING	
Year	
Place	
Institution	
Field of training	
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English (5)
COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	Digital Electronics, Undergraduate study of Electrotechnics, 2006/2007 - today Discrete systems and structures, Undergraduate study of Computing, 2006/2007 - today Computer Networks, Undergraduate study of Electrotechnics, 2006/2007 - today Computer Networks, Undergraduate study of Computing, 2006/2007 - today Digital Electronics, Graduate study of Electrotechnics (pre-Bologna), 1998/1999 -2006/2007

	Discrete systems and structures, Graduate study of Computing (pre-Bologna), 19982000/2001 - 2006/2007 Computer Networks, Graduate study of Electrotechnics (pre-Bologna), 1998/1999 -2007/2008 Computer Networks, Graduate study of Computing (pre-Bologna), 1998/1999 -2007/2008
Authorship of university/faculty textbooks in the field of the course	Julije Ožegović, Digitalna i mikroprocesorska tehnika, ISBN 953-6806-26-6, Split University, 2000, several editions Julije Ožegović, Digital electronics, Discrete systems and structures, elearning.fesb.hr, updated from 1998 Julije Ožegović, Computer Networks, elearning.fesb.hr, updated from 1998
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	Kedžo, Ivan; Ožegović, Julije; Kristić, Ante: Contention Overhead — Adaptive Binary Priority Countdown protocol, SoftCOM 2013, ISBN 978-953-290-043-9 Kristić, Ante; Ožegović, Julije; Kedžo, Ivan: Mathematical model of simplified Constrained Priority Countdown Freezing protocol, The 18th IEEE Symposium on Computers and Communications (ISCC'13), 2013, ISBN 978-1-4673-2711 Kristić, Ante; Ožegović, Julije; Kedžo, Ivan: Improved mathematical model of simplified Constrained Priority Countdown Freezing protocol, SoftCOM 2013, ISBN 978-953-290-043-9 Kristić, Ante; Ožegović, Julije; Kedžo, Ivan: Mathematical model of Constrained Priority Countdown Freezing Protocol, SoftCOM 2014, ISBN 978-9-5329-0052-1 Ines Ramadza, Julije Ozegovic, Vesna Pekic: Class based tunnel exclusion router architecture, SoftCOM 2014, ISBN 978-9-5329-0052-1
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	1. Media access mechanism modelling for wireless local networks (MAMM), FESB Split, od 2014. 2. HGCAL - CERN CMS, from 2015.
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences	Me4CataLOgue – Teaching and administrative personnel training
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	Coauthor of awarded paper - ISCC conference 2013.
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	4

First and last name and title of teacher	**Vladan Papić, Ph.D., Full Professor**
The course he/she teaches in the proposed study programme	Computer graphics Computer methods in bioengineering
GENERAL INFORMATION ON COURSE TEACHER	
Address	Makarska 2, 21000 Split
Telephone number	(021) 305649
E-mail address	vpapic@fesb.hr
Personal web page	www.fesb.hr/~vpapic
Year of birth	1968
Scientist ID	227412
Research or art rank, and date of last rank appointment	Scientific Adviser, 20/4/2010
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Senior Full Professor, 17/12/2015
Area and field of election into research or art rank	Technical Sciences, Field Computer science
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Date of employment	1/7/20097
Name of position (professor, researcher, associate teacher, etc.)	Professor
Field of research	Computer Vision, Expert Systems
Function	Vice-dean for bussines
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Place	Split
Date	12/2/2002
INFORMATION ON ADDITIONAL TRAINING	
Year	
Place	
Institution	
Field of training	
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English (5)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	Italian (2)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	
COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	Computers in technical systems (PMF, Informatika i tehnička kultura, Undergraduate study programme, 2002-2009.) Electronics (PMF, Informatika i tehnička kultura, Undergraduate study programme 2002 – 2009.) Systems theory (FESB, EIT, Undergraduate study programme, 2009-), Computer graphics ((FESB, Computing, Undergraduate study programme, 2003-)
Authorship of university/faculty	V.Papić, Lectures in electronics, University textbook, 2005. (in

textbooks in the field of the course	Croatian) V. Papić, Computer graphics, Faculty textbook, 2013. (in Croatian)
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1. J. Musić, T. Marasović, V. Papić, I. Orović, S. Stanković, Performance of compressive sensing image reconstruction for search and rescue, IEEE Geoscience and Remote Sensing Letters, Volume 13, Issue 11, November 2016, Pages 1739-1743. 2. J. Musić, I. Orović, T. Marasović, V. Papić, S. Stanković, Gradient Compressive Sensing for Image Data Reduction in UAV Based Search and Rescue in the Wild, Mathematical Problems in Engineering, Volume 2016, 2016. 3. I. Orović, V. Papić, C. Ioana, X. Li, S. Stanković, Compressive Sensing in Signal Processing: Algorithms and Transform Domain Formulations, Mathematical Problems in Engineering, Volume 2016, 2016. 4. T. Marasović, V. Papić, V. Zanchi, LMNN metric learning and fuzzy nearest neighbour classifier for hand gesture recognition, Journal on Multimodal User Interfaces, Volume 9, Issue 3, 27 August 2015, Pages 211-221. 5. T. Marasović, V. Papić, J. Marasović, Motion-based gesture recognition algorithms for robot manipulation, International journal of advanced robotic systems. 12 (2015) , 51; 1-13.
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	-
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	1. »Technology transfer infrastructure in the Croatian Adriatic region« - TTAdria (IPA IIIc), 2013-2015. 2. "Computer intelligence for recognition and support of human activities " (RIPrePAkt) (FESB), 2013-. (lead researcher). 3. „Search and rescue system prototype based on image processing " (FESB - Statim d.o.o.), 2014-. (lead researcher) 4. „Advanced methods of 3D virtualization – towards virtual turism and digitalization of cultural heritage“ (FESB – Neir d.o.o.), 2015-. (researcer). 5. International bilateral project Croatia- ”Compressive sensing and superresolution in surveillance systems based on optical sensors and UAVs ", Contract with MZOS RH and MZT Republike Crne Gore, 2015-2016. (researcher)
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?	
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	Mentor of best student (Marko Trninić) in field of social and humanistic scienses (annual award HRZZ, 2010).
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	4.7/5

First and last name and title of teacher	**Goran Petrović, Ph.D., Associate Professor**
The course he/she teaches in the proposed study programme	Measurements and Signal Processing

GENERAL INFORMATION ON COURSE TEACHER	
Address	Split, Ruđera Boškovića 32
Telephone number	+385 21 305 731
E-mail address	petrovic@fesb.hr
Personal web page	
Year of birth	1971
Scientist ID	248882
Research or art rank, and date of last rank appointment	Research scientist 19.12. 2012.
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Associate professor 19.12. 2012.
Area and field of election into research or art rank	Technical sciences, electrical engineering
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	FESB
Date of employment	30. 03. 1998.
Name of position (professor, researcher, associate teacher, etc.)	professor
Field of research	Electrical and process measurement, Signal processing
Function	Head of Department for power engineering
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	FESB
Place	Split
Date	24. 03. 2006.
INFORMATION ON ADDITIONAL TRAINING	
Year	
Place	
Institution	
Field of training	
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English; very good (4)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	
COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	1. Measurement and signal processing, Electrical engineering, graduate 2. Process measurement, Electrical engineering, graduate 3. Instrumentation in electrical engineering, Electrical engineering, undergraduate

Authorship of university/faculty textbooks in the field of the course	
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1. Bosnić, Juraj Alojzije; Petrović, Goran; Malarić, Roman. Estimation of the wall thermal properties through comparison of experimental and simulated heat flux // 21ST IMEKO TC-4 measurement. Budapest, 2016. 2. Mostarac, Petar; Malarić, Roman; Petrović, Goran. Measurement of frequency spectrum with interpolated adaptive chirp-z transformation // XXI IMEKO world congres. Prag,: Czech Technical University in Prague, 2015. 2008-2011. 3. Petrović, Goran; Malarić, Roman; Ivana, Kardum. Matlab based flickermeter // 20th IMEKO TC4 International Symposium and 18th International Workshop on ADC Modelling and Testing. Benevento: University of Sannio, 2014. 31-34. 4. Lorincz, Josip; Matijević, Tončica; Petrović, Goran. On interdependence among transmit and consumed power of macro base station technologies. // Computer communications. 50 (2014) ; 10-28 5. Petrović, Goran; Kilić, Tomislav; Garma, Tonko. Measurement and Estimation of the Extremely Low Frequency Magnetic Field of the Overhead Power Lines. // Elektronika ir elektrotechnika. 19 (2013) , 7; 33-36.
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	1. Smart grid metrology infrastructure, HRZZ Research Projects 2015- 2. Extracting electric energy from human body for supplying autonomous biomedical devices and new PVDF transducer optimization, Bilateral Croatian Italian scientific project 2010-2013.
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?-pedagoške kompetencije?	
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	

First and last name and title of teacher	**Ivan Slapničar, Ph.D., Full Professor**
The course he/she teaches in the proposed study programme	Numerical Analysis
GENERAL INFORMATION ON COURSE TEACHER	
Address	FESB, R. Boškovića 32, B803
Telephone number	021 305893
E-mail address	ivan.slapnicar@fesb.hr
Personal web page	http://www.fesb.hr/~slap
Year of birth	1961
Scientist ID	30650
Research or art rank, and date of last rank appointment	scientific counselor
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Full Professor, permanent position, since 2008
Area and field of election into research or art rank	Area od Natural Sciences, Field of Mathematics
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	FESB, Split
Date of employment	1985
Name of position (professor, researcher, associate teacher, etc.)	Full Professor
Field of research	Mathematics
Function	Head of the Chair of Mathematics
INFORMATION ON EDUCATION – Highest degree earned	
Degree	dr. sc. (dr. rer. Nat.)
Institution	Fernuniversität Hagen
Place	Hagen, Germany
Date	October 1992
INFORMATION ON ADDITIONAL TRAINING	
Year	2014
Place	Cambridge, MA, USA
Institution	Massachusetts Institute of Technology
Field of training	Fulbright-Schuman International Educator/Lecturer Grant
Year	2009/2010
Place	Berlin, Germany
Institution	Technische Universität Berlin
Field of training	FP7 People "Marie Curie" Intra European Fellowship
Year	2001/2002
Place	Logan, UT, SAD
Institution	Utah State University
Field of training	Visiting Professor of Mathematics
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English (5)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	German (5)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	
COMPETENCES FOR THE COURSE	

Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	Lecturer of various courses since 1992.
Authorship of university/faculty textbooks in the field of the course	Ivan Slapničar, Matematika 1, FESB, Split, 2002. (Manualia Universitatis studiorum Spalatensis) Ivan Slapničar, Josipa Barić i Marina Ninčević, Matematika 2 – zbirka zadataka, FESB, Split, 2010. (Manualia Universitatis studiorum Spalatensis)
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1. Jakovčević Stor, Nevena; Slapničar, Ivan; Barlow, Jesse L. **Forward stable eigenvalue decomposition of rank-one modifications of diagonal matrices,** *Linear Algebra and its Applications*. **487** (2015) 301-315. 2. Jakovčević Stor, Nevena; Slapničar, Ivan. **Forward Stable Computation of Roots of Real Polynomials with Real Simple Roots**, *Applied Mathematics and Information Sciences*. **11** (2017) 33-41. 3. Jakovčević Stor, Nevena; Slapničar, Ivan; Barlow, Jesse L. **Accurate eigenvalue decomposition of real symmetric arrowhead matrices and applications,** *Linear algebra and its applications*. **464** (2015) 62-89. 4. Slapničar, Ivan. **Symmetric matrix eigenvalue techniques,** Handbook of Linear Algebra, Hogben, Leslie (ed.). Chapman & Hall / CRC, Boca Raton, 2013, pp. 55-1-55-23. 5. Slapničar, Ivan. **On the spectra of generalized Fibonacci and Fibonacci-like operators**., *Operators and Matrices. **6*** (2012) 49-62.
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	1. Accurate and fast matriox algorithms and applications, project MZOS No. 372783-1289, 2007- 2013, principal investigator. 2. Optimization of parameter dependent mechanical systems, HRZZ research project No. 9540, 2015-2019, collaborator.
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?	
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	Prize of the Fernunivesität Hagenu for the best disseration, 1992. Prize of the Croatian Mathematical Society Nagrada for the young scientist, 1996.
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	Evaluations organized by the Quality Enhancement Centre of the University of Split each semester. Average grade is 4.5 on the 1-5 scale.

First and last name and title of teacher	**Ivo Stančić, Ph.D., Assistant Professor**
The course he/she teaches in the proposed study programme	Optoelectronic measurement methods

GENERAL INFORMATION ON COURSE TEACHER	
Address	R. Boškovića 32
Telephone number	+ 385 (0)21 305 879
E-mail address	istancic@fesb.hr
Personal web page	http://marjan.fesb.hr/~istancic/
Year of birth	1984.
Scientist ID	291143
Research or art rank, and date of last rank appointment	Research associate (October 2013)
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Assistant professor (March 2017)
Area and field of election into research or art rank	Technical sciences, Electrical engineering
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of electrical engineering, mechanical engineering and naval architecture, University of Split
Date of employment	4.5.2007.
Name of position (professor, researcher, associate teacher, etc.)	Assistant professor
Field of research	Electrical engineering / electronics
Function	/
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Faculty of electrical engineering, mechanical engineering and naval architecture, University of Split
Place	Split
Date	30. 11. 2012.
INFORMATION ON ADDITIONAL TRAINING	
Year	
Place	
Institution	
Field of training	
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English (5)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	Italian (2)
COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	

Authorship of university/faculty textbooks in the field of the course	M. Bonković, J. Musić, I. Stančić, Microcontrollers and embedded network systems based on Arduino development environment, faculty script, 2014.
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1. Stančić, Ivo; Grujić, Tamara; Panjkota Ante. Design, Development, and Evaluation of Optical Motion-Tracking System Based on Active White Light Markers. IET science measurement & technology. 7 (2013) , 4; 206-214. 2. Stančić, Ivo; Grujić, Tamara; Bonković, Mirjana. New Kinematic Parameters for Quantifying Irregularities in the Human and Humanoid Robot Gait. // International Journal of Advanced Robotic Systems. 9 (2012) ; 215-1-215-8 3. Stančić, Ivo; Musić, Josip; Zanchi, Vlasta. Improved structured light 3D scanner with application to anthropometric parameter estimation 4. Stančić, Ivo; Musić, Josip; Cecić, Mojmil. A Novel Low-Cost Adaptive Scanner Concept for Mobile Robots. // Ingeniería e Investigación. 34 (2014) , 3; 37-43 5. Stančić, Ivo; Brajović, Miloš; Orović, Irena; Musić, Josip. Compressive sensing for reconstruction of 3D point clouds in smart systems
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	1. Compressive sensing and super-resolution in surveillance systems based on optical sensors and UAVs, 2015-2017, Bilateral Croatia-Montenegro cooperation, researcher. 2. Supervised and unsupervised learning from imbalanced datasets for assistance in movement of persons with low vision, 2014-2015, Bilateral Croatia-Slovenia cooperation, researcher. 3. Prototyping a module for automatization of industrial floor scrubbers, 2014-2016, Split-Dalmatia county and Odabir d.o.o., researcher. 4. Development and implementation of methods for identification of bio-system and environment, 2014 - , Faculty/University project, researcher. 5. Biomechanics of human motion, control and rehabilitation, 2007-2014, Ministry of science, education and sports, researcher.
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences.	

PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	FESTO prize for young scientist and researchers DAAAM Symposium "Intelligent Manufacturing & Automation, Vienna, Austria, 26.11.2011. Best paper award in „Symposium on Smart Environment Technologies“ during SofCOM 2016 conference.
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	

First and last name and title of teacher	**Darko Stipaničev, Ph.D., Full Professor**
The course he/she teaches in the proposed study programme	Artificial intelligence Computational intelligence (neuro-fuzzy-genetic systems) Digital control Digital image processing and analysis Modelling and control of vessels and ground vehicles Process control
GENERAL INFORMATION ON COURSE TEACHER	
Address	Matoševa 26, 21000 Split
Telephone number	+385 91 4305 643
E-mail address	darko.stipanicev@fesb.hr
Personal web page	http://laris.fesb.hr/dstip-e.html
Year of birth	1955
Scientist ID	44861
Research or art rank, and date of last rank appointment	Scientific Adviser in Computer Science, 2006 Scientific Adviser in Electrical Engineering, 1997
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Senior Full Professor, 2002
Area and field of election into research or art rank	Technical Systems, Field Electrical engineering Technical Systems, Fireld Computer sciences
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Date of employment	1981
Name of position (professor, researcher, associate teacher, etc.)	Professor
Field of research	Computer Science – Artificial Intelligence, Electrical Engineering - Automatic Control
Function	Head of Chair of Modelling and Intelligent Systems
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Electrotechnical Faculty University of Zagreb
Place	Zagreb
Date	1987
INFORMATION ON ADDITIONAL TRAINING	
Year	1988-89
Place	London
Institution	Queen Mary College
Field of training	post-doctoral specialisation
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English (5)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	Italian (4)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	

COMPETENCES FOR THE COURSE

Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	Process Modelling and Control (1995 – 2005) Process control (2005 – today) Digital control (2005 – today) Modelling and Control of Maritime and Land Vehicles (1995 – today)
Authorship of university/faculty textbooks in the field of the course	D.Stipaničev, J.Marasović, Digitalno vođenje on-line (Digital control on-line), on-line (Web) book, MZT – Informatički projekt, 2004. http://laris.fesb.hr/digitalno_vodjenje
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1. D.Stipaničev, J.Božičević, Fuzzy Feedforward and Composite Control, **Transaction Inst. Measurement and Control (UK)**, 8(2), 1986, pp. 67-75 2. D.Stipaničev, Vođenje i zaštita vjetroelektrana u autonomnom elektro-energetskom sistemu, **Sunčana energija**, 8(2), 1987, pp.91-96 3. D.Stipaničev, Diskretno vođenje složenih sustava adaptivnim, nelinearnim PID regulatorima, **Elektrotehnika**, 34(3-4), 1991, pp.153-161 4. D.Stipaničev, Fuzzy Relational Models for Intelligent Control, u knizi R. Hanus, P.Kool, S.Tzafestas(ed) **"Mathematical and Intelligent Models in System Simulation"**, J.C.Baltzer AG Scientific Pub.Co., 1991, pp.275-279 5. M.De Neyer, D.Stipaničev, R.Gorez, Intelligent Self-organising Controllers and their Application to the Control of Dynamic Systems, u knjizi R.Hanus, P.Kool, S.Tzafestas(ed) **"Mathematical and Intelligent Models in System Simulation"**, J.C.Baltzer AG Scientific Pub.Co., 1991, pp.287-292
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	1. Project Vision based intelligent observers (ViO) (2012 – 2016) 2. Project 023-0232005-2003 – AgISEco – Agent based intelligent systems for environmental monitoring, Contract with Ministary of Science RH (2006 - 2012)
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?	
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	4,4/5

First and last name and title of teacher	**Ljiljana Šerić, Ph.D., Assistant Professor**
The course he/she teaches in the proposed study programme	Artificial Intelligence
GENERAL INFORMATION ON COURSE TEACHER	
Address	FESB, Ruđera Boškovića 32, 21000 Split
Telephone number	+385 (0)21 305 651
E-mail address	ljiljana.seric@fesb.hr
Personal web page	http://www.fesb.hr/~ljiljana
Year of birth	1979.
Scientist ID	272906
Research or art rank, and date of last rank appointment	Senior Research Associate, 14.02.2013.
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Assistant professor, 02.12.2013.
Area and field of election into research or art rank	Technical sciencies, Computer Science
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	University of Split, Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Date of employment	02.12.2013.
Name of position (professor, researcher, associate teacher, etc.)	Assistant professor
Field of research	Science and education
Function	Assistant professor
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	University of Split, Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Place	Split
Date	06.10.2010.
INFORMATION ON ADDITIONAL TRAINING	
Year	
Place	
Institution	
Field of training	
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English (5)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	German (3)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	
COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	1. Course name: Artificial Intelligence Name of the study programme in which the course is offered: Automation and Systems, Electrical Engineering, Computer Engineering, Telecommunications and Computer Science, Computer Science The level of the study programme: Graduate study 2. Course name: Intelligent Systems

	Name of the study programme in which the subject is taught: Electrical Engineering and Information Technology The level of the study programme: Postgraduate study 3. Course name: Web intelligence and large data sets Name of the study programme in which the subject is taught: Electrical Engineering and Information Technology The level of the study programme: Postgraduate study
Authorship of university/faculty textbooks in the field of the course	1) Stipaničev Darko, Šerić Ljiljana. Artificial intelligence. Split, FESB - Internal script, 2012. 2) Bodrožić Ljiljana. Programming languages of artificial intelligence. Split, FESB - Internal script, 2007.
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1) Doko Alen, Štula Maja, Šerić Ljiljana. Improved sentence retrieval using local context and sentence length. Information processing & management, 49 (2013), 6, 1301-1312. 2) Šerić Ljiljana, Stipaničev Darko, Štula Maja. Engineering of holonic multi agent intelligent forest fire monitoring system. AI communications, 26 (2013), 3; 303-316. 3) Šerić Ljiljana, Krstinić Damir, Braović Maja, Milatić Ivan; Mirčevski Aljoša, Stipaničev Darko. Holonic Multi Agent System for Data Fusion in Vehicle Classification. Proceedings of 10th International KES Conference on Agents and Multi-Agent Systems: Technologies and Applications (KES-AMSTA-16). 2016. 4) Stipaničev Darko, Šerić Ljiljana, Krstinić Damir, Bugarić Marin. Wildfire video observers network with physical and virtual sensors. Proceeding of 10th EARSeL Forest Fire Special Interest Group Workshop - Sensors, Multi-Sensor Integration, large Volumes: New opportunities and Challanges in Forest Fire Research, Themistocleous, Kyriacos ; Hadjimitsis, Diofantos; Gitas, Ioannios ; Boschetti, Luigi (ur.). Limassol, Cyprus, 2015. 5) Ukić Nenad, Maras Josip, Šerić Ljiljana. The influence of cyclomatic complexity distribution on the understandability of xtUML models, Software quality journal, PP (2016)
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	AgiSeco – Agent Oriented Intelligent Systems for Environement Monitoring and Control, MZOS, 2007-2012 HOLISTIC – Adriatic Holistic Forest Fire Protection , IPA, 2014- in progres Wind Risk Prevention Projekt – ECHO, Civil Protection Automatic vehicle classification based on computer vision and data fusion
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences.	
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	20 best junior reasearchers, 2013
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	

First and last name and title of teacher	**Maja Štula, Ph.D., Full Professor**
The course he/she teaches in the proposed study programme	Computer systems Programming agents
GENERAL INFORMATION ON COURSE TEACHER	
Address	R. Boškovića 32, Split
Telephone number	021305852
E-mail address	maja.stula@fesb.hr
Personal web page	http://marjan.fesb.hr/~kiki/moja_stranica.htm
Year of birth	1971
Scientist ID	248946
Research or art rank, and date of last rank appointment	
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Full professor
Area and field of election into research or art rank	Technical Sciences, Computer engineering
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Date of employment	15.06.1998.
Name of position (professor, researcher, associate teacher, etc.)	Professor
Field of research	
Function	
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Place	Split
Date	06.05.2005.
INFORMATION ON ADDITIONAL TRAINING	
Year	
Place	
Institution	
Field of training	
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English, 5
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	Italian, 2
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	
COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	Internet programming, Undergraduate study in Computing Windows programming, Graduate study in Electronics and Computer engineering
Authorship of university/faculty	Programiranje korisničkih sučelja na Windows platformama,

textbooks in the field of the course	FESB, 2010.
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1. Markić, Ivan; Štula, Maja; Maras, Josip.Intelligent Multi Agent Systems for Decision Support in Insurance Industry // / Biljanović, Petar (ur.).Rijeka : Croatian Society for Information and Communication Technology, Electronics and Microelectronics - MIPRO, 2014. 1368-1373 2. Stipaničev, Darko; Bugarić, Marin; Krstinić, Damir; Šerić, Ljiljana; Jakovčević, Toni; Braović, Maja; Štula, Maja.New generation of automatic ground based wildfire surveillance systems // Advances in forest fire research.Coimbra, Portugal : Imprensa da Universidade de Coimbra, 2014. 1455-1466 3. Štula, Maja; Stipaničev, Darko; Maras, Josip. Distributed Computation Multi-agent System. // New generation computing. 31 (2013) , 3; 187-209 4. Štula, Maja; Krstinić, Damir; Šerić, Ljiljana. Intelligent Forest Fire Monitoring System. // Information systems frontiers. 14 (2012) , 3; 725-739
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	1. Golčić, Hrvoje; Skelić, Ivana; Štula, Maja. Razvoj, implementacija i korištenje dodataka za osobe s oštećenjem vida u Moodle sustavu, 2015. (brošura). 2. Golčić, Hrvoje; Skelić, Ivana; Štula, Maja. Accessibility Issues Faced By Blind and Visually Impaired Persons in the Field of Studying and Education // Proceedings of CIET 2014 / Plazibat, Bože ; Kosanović, Silvana (ur.).Split : University of Split, 2014. S-187-S-198
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	IPNAS (Inteligentni Protupožarni NAdzorni Sustav) sustav, stručni DICES – Distributed Component-based Embedded Software Systems, UKF Agentski orijentirani inteligentni sustavi nadzora i zaštite okoliša, MZOŠ
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?-pedagoške kompetencije?	
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	

First and last name and title of teacher	**Božo Terzić, Ph.D., Full professor**
The course he/she teaches in the proposed study programme	Electric Servo Drives
GENERAL INFORMATION ON COURSE TEACHER	
Address	Elemova 5, 21312 Podstrana HR
Telephone number	+385 91 4305609
E-mail address	bterzic@fesb.hr
Personal web page	
Year of birth	1962.
Scientist ID	138865
Research or art rank, and date of last rank appointment	Scientific Adviser, 9/7/2009
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Senior Full Professor, 18/9/2014
Area and field of election into research or art rank	Technical Sciences, Field Electrical engineering
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Date of employment	1986.
Name of position (professor, researcher, associate teacher, etc.)	Professor
Field of research	Electrical Drives, Power Converters
Function	Head of Chair of Electrical Drives and Automation
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Place	Split
Date	25/11/1998
INFORMATION ON ADDITIONAL TRAINING	
Year	
Place	
Institution	
Field of training	
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English (4)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	German (2)
COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	Electrical drives - Professional study programme of Electrical engineering, Testing of Electrical Equipement - Graduate study programme of Power engineering
Authorship of university/faculty textbooks in the field of the course	
Professional, scholarly and artistic articles published in the last five	1. Terzić, Božo; Despalatović, Marin; Slutej, Alojz. *Magnetization Curve Identification of Vector-Controlled*

years in the field of the course (5 works at most)	*Induction Motor at Low-Load Conditions*. // Automatika - Journal for Control, Measurement, Electronics, Computing and Communications, 53 (2012) , 3; 1-8. 2. Jadrić, Martin; Terzić, Božo; Despalatović, Marin; Majić, Goran; Slutej, Alojz; Šimić, Toni. *Identification of Rotor Resistance and Transient Inductance of Induction Motors Using Frequency Selection Criterion* // Proceedings of the 2012 XXth International Conference on Electrical Machines / Nogueiras Meléndez, Andrés A. (ur.). Marseille, Francuska : IEEE IES, 2012. 978-984. 3. Terzić, Božo; Despalatović, Marin; Majić, Goran; Gladina, Željko: *Mjerenja i analiza karakteristika upuštača asinkronih motora u postrojenju mlina cementa 2 u tvornici Cemex – Pogon Sv. Juraj*, Naručitelj: Siemens, 2014. 4. Terzić, Božo; Despalatović, Marin; Majić, Goran; Stergulc, Marjan; Kriletić, Ante; Šormaz, Krste: *Frequency Converter Design for High Speed Permanent Magnet Generator in Cogeneration Plants*,, Technical Journal, Scientific-professional Journal of University North, Vol. 10, No. 3-4, Croatia, 2016.
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	1. Domestic sceintific project: *On-line parameter identification of synchronous generator,* project leader, 2011. – 2013., funding the project: MZOŠ 2. International development project: Development of electric drives for crane systems operating in hard environment, project leader, 2008. – 2013., in cooperation with swedish company *ABB Crane Systems* that fully funded the project. 3. Researche and development project: A safer and more efficient cogeneration / trigeneration plants, project leader, 2014.-2016., project was funded from EU structural funds.
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?	
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	From 4 to 4,8.

First and last name and title of teacher	**Ivica Veža , Ph.D., Full Professor**
The course he/she teaches in the proposed study programme	Production management Project management
GENERAL INFORMATION ON COURSE TEACHER	
Address	Odeska 13, 21000 Split, HR
Telephone number	+385 21 305933
E-mail address	iveza@fesb.hr
Personal web page	
Year of birth	1951.
Scientist ID	095643
Research or art rank, and date of last rank appointment	Scientific Adviser - Mechanical Engineering, 08.03.2001. Scientific Adviser – Fundamental Technical Science 05.07.2006.
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Senior Full Professor, 23.01.1998.
Area and field of election into research or art rank	Technical Sciences, Field Industrial engineering
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Date of employment	1/1/1981
Name of position (professor, researcher, associate teacher, etc.)	Professor
Field of research	Plant Layout, Organization, Production Engineering
Function	Head of Chair of Inudstrial Engineering
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Faculty of Mechanical Engineering and Naval Architecture
Place	Zagreb
Date	9/11/2001
INFORMATION ON ADDITIONAL TRAINING	
Year	1983/84
Place	Stuttgart, Germany
Institution	University of Stuttgart, Fraunhofer – Institut fuer Produktiontechnik und Automatisierung
Field of training	Plant Layout, Simulation
INFORMATION ON ADDITIONAL TRAINING	
Year	1991
Place	Berlin, Germany
Institution	Technical University of Berlin, Fraunhofer IPK
Field of training	Design of Assembly Systems
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English (4)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	Germany (4)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	
COMPETENCES FOR THE COURSE	
Earlier experience as course	Economics and Production Organisation, Undergraduate study

teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	programme
Authorship of university/faculty textbooks in the field of the course	Veža, Ivica: Bilić, Boženko; Gjeldum, Nikola; Mladineo, Marko: "Upravljanje projektima", Fakultet elektrotehnike, strojarstva i brodogradnje, Split, 2011.
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1. Perić, Tunjo; Babić, Zoran; Veža, Ivica: Vendor selection and supply quantities determination in a bakery by AHP and fuzzy multi-criteria programming. International journal of computer integrated manufacturing. 26 (2013) , 9; 816-829 2. Veža, Ivica; Mladineo, Marko: SUSTAINABILITY THROUGH PRODUCTION NETWORKS. Management and Production Engineering Review. 4 (2013), 4; 33-39 3. Gjeldum, Nikola; Bilić, Boženko; Veža, Ivica. Investigation and modelling of process parameters and workpiece dimensions influence on material removal rate in CWEDT process. International journal of computer integrated manufacturing. 28 (2015) , 7; 715-728 4. Takakuwa, Soemon; Veža, Ivica: Technology Transfer and World Competitiveness. Procedia Engineering. 69 (2014); 121-127 5. Banduka, Nikola; Veža, Ivica; Bilić, Boženko: An integrated lean approach to Process Failure Mode and Effect Analysis (PFMEA): A case study from automotive industry. Advances in Production Engineering & Management. 11 (2016) , 4; 355-365
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	1. Gečevska, Valentina; Čuš, Franci; Chiabert, Paolo; Veža, Ivica: LINKING LEAN PRODUCTION WITH PRODUCT LIFECYCLE MANAGEMENT FOR SUSTAINABLE BUSINESS ENVIRONMENT, DEVELOPMENT OF INTELLIGENT AND INNOVATIVE TOOLS FOR PRODUCTION PROCESS ENGINEERING AND SUSTAINABLE MANAGEMENT, Čuš, F.; Gečevska, V. (Ed.). Maribor, Slovenija: Faculty of Mechanical engineering, Maribor, 2013. 19-39. 2. Čelar, Stipe; Turić, Mili; Dragičević, Srdjana; Veža, Ivica. Digital Learning Factory at FESB – University of Split , ZBORNIK RADOVA YU INFO 2016, 2016. 001-006 3. Veža, Ivica; Gjeldum, Nikola; Mladineo, Marko: Logistics Personal Excellence by Continuous Self-Assessment (LOPEC): Pilot Implementation - Case Studies. Conference Proceedings - MTSM 2014, Split, 2014. 39-46 4. Stojkić, Željko; Veža, Ivica; Bošnjak, Igor. CONCEPT OF INFORMATION SYSTEM IMPLEMENTATION (CRM AND ERP) WITHIN INDUSTRY 4.0, Proceedings of the 26th DAAAM International Symposium, Vienna, DAAAM International, 2016. 912-919
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	3. 2008 – 2013 Project TEMPUS-2008-IT-JPCR 144 959, Master Study Program in Product Lifecycle Management with Sustainable Production 4. 2011-2014 LEONARDO DA VINCI Project "LOPEC - Logistics personnel excellence by continuous self-assessment", FESB Split, University of Reutlingen 5. 2013-2016 Network of Innovative Learning Factories NIL, "System - Learning Factory", FESB, Split, University of Reutlingen 6. 2013-2016 Know-how Exchange on the Consequences and Challenges of the Integration of Key Enabling Technologies

	in European Manufacturing for the Danube Region, Fraunhofer Institute for Systems and Innovation Research ISI – Karlsruhe 7. 2014-2018 Innovative Smart Enterprise, INSENT, Croatian Science Foundation, Zagreb
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?	
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	4,9/5

2.16. Optimal number of students

The admission quote for the first year of studies is 50.

2.17. Estimate of costs per student

Annual costs of studies per student amount to HRK 25,000.00

2.18. Plan of procedures of study programme quality assurance

<table>
<tr><td colspan="2">In keeping with the European standards and guidelines for internal quality assurance in higher education institutions (according to “Standards and Guidelines of Quality Assurance in the European Higher Education Area”) on the basis of which the University of Zagreb defines procedures for quality assurance, the proposer of the study programme is obliged to draw up a plan of procedures of study programme quality assurance.</td></tr>
<tr><td colspan="2">Documentation on which the quality assurance system of the constituent part of the University is based:</td></tr>
<tr><td colspan="2">• Regulations on the quality assurance system of the constituent part (enclose if existing)</td></tr>
<tr><td colspan="2">• Handbook on the quality assurance system of the constituent part (enclose if it exists)</td></tr>
<tr><td colspan="2">Description of procedures for evaluation of the quality of study programme implementation:
• Fore each procedure the method needs to be described (most often questionnaires for students or teachers, and self-evaluation questionnaire), name the body conducting evaluation (constituent part, university office), method of processing results and making information available, and timeframe for carrying out evaluation
• If procedure is described in an attached document, name the document and the article.</td></tr>
<tr><td>Evaluation of the work of teachers and part-time teachers</td><td>• Student evaluation of quality of instruction and teaching activities conducted through student survey (printed questionnaires)
• Survey is organised and conducted by the Quality Enhancement Committee of the Faculty (Committee)
• Survey results are processed automatically at the University
• Survey is conducted each semester
• The Committee presents cumulative results of the survey at the sessions of the Faculty Council. The report is published at the Faculty web site.
All procedures are conducted in accordance with the Regulations on organisation and role of the quality assurance system of the University of Split, Regulations on procedure of student evaluation of the quality of teachers and teaching of the University of Split and Regulations on the quality enhancement system of FESB.</td></tr>
<tr><td>Monitoring of grading and harmonization of grading with anticipated learning outcomes</td><td>Committee for study programmes in Graduate university study programme in Automation and Systems is monitoring the harmonisation of grading and learning outcomes.
All the procedures are conducted in accordance with the Rules of procedure of the Faculty Council and the Rules of procedure of the Department, since the Committees for</td></tr>
</table>

	study programmes are bodies of the Faculty Council and are accountable to the Faculty Council.
Evaluation of availability of resources (spatial, human, IT) in the process of learning and instruction	• Student evaluation of work performance of administrative and supporting services, learning infrastructure and student life is conducted through e-survey • Evaluation is conducted using an on-line questionnaire which the students complete in each year of study, except the final year • Survey is organised by the Quality Enhancement Centre of the University of Split, and is implemented by the Quality Enhancement Committee of the Faculty (Committee) • Survey results are processed automatically at the University • Survey is conducted every year • Survey results are presented at the Faculty Council sessions and published at the Faculty web site.
Availability and evaluation of student support (mentorship, tutorship, advising)	• Administrative and supporting services are available to students to provide support in their study activities • Supervisors/ mentors are appointed for students' final papers and diploma thesis
Monitoring of student pass/fail rate by course and study programme as a whole	• Analysis of student pass rate by courses and study programmes is carried out once a year • Analysis of pass rate by study programmes is carried out by the University in cooperation with the Committee • Analysis by courses and study programmes is carried out by the Faculty Management Board • Results of both analyses are presented at the Faculty Council sessions and published at the Faculty web site.
Student satisfaction with the programme as a whole	• Student evaluation of work performance of administrative and supporting services, learning infrastructure and student life is conducted through e-survey • Evaluation is conducted using an on-line questionnaire which the students complete following the completion of studies • Survey is organised by the Quality Enhancement Centre of the University of Split, and is implemented by the Quality Enhancement Committee of the Faculty (Committee) • Survey results are processed automatically at the University • Survey results are presented at the Faculty Council sessions and published at the Faculty web site.
Procedures for obtaining feedback from external parties (alums, employers, labour market and other relevant organizations)	• Once every month, the Faculty Management Board meets with the alumni representatives • Once a year, during the annual FESB anniversary event, round tables and workshops are organised with representatives of employers and other stakeholders
Evaluation of student practical education (where this applies)	Professional training is an elective course of the study programme. Head of the professional training from the receiving institution and the head of professional training from the Faculty are appointed to students who enrol professional training course. During the training student writes Professional training report which describes working tasks covered by the professional training. Students are

	obliged to complete professional training in accordance with the Regulation on professional training. Professional training report is validated by the head of professional training from the receiving institution and the head of professional training from the Faculty. Professional training is not evaluated. In addition to the Professional training report student completes a Questionnaire on professional training that evaluates student's satisfaction with organization and performance of the professional training.
Other evaluation procedures carried out by the proposer	• Internal audit of the quality assurance system is conducted once every year • Self-evaluation is carried out every 5 years All the procedures are conducted in line with the Quality Assurance Handbook of FESB.
Description of procedures for informing external parties on the study programme (students, employers, alums)	• All information are available through the Faculty web site: https://www.fesb.hr • Visits to the faculty are organised for high-school students from Split and the wider region • Participation at University fairs • Public media presentations