UNIVERSITY OF SPLIT

FACULTY OF ELECTRICAL ENGINEERING, MECHANICAL ENGINEERING AND NAVAL ARCHITECTURE

DETAILED PROPOSAL OF THE STUDY PROGRAMME

GRADUATE UNIVERSITY STUDY IN ELECTRICAL ENGINEERING

SPLIT, July 2017

CONTENT

GENERAL INFORMATION OF HIGHER EDUCATION INSTITUTION

Name of higher education institution	FACULTY OF ELECTRICAL ENGINEERING, MECHANICAL ENGINEERING AND NAVAL ARCHITECTURE
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GENERAL INFORMATION OF THE STUDY PROGRAMME

Name of the study programme	ELECTRICAL ENGINEERING		
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 Electrical Engineering; mag. ing. el.		

1. INTRODUCTION

1.1. Reasons for starting the study programme

Electrical engineering is a field of science and engineering that encompasses the research and application of electrical phenomena. Similar to other branches of engineering, electrical engineering serves as a link between mathematics, physics and other natural sciences on one part, and on the other part, their practical applications. Widely diverse forms of practical applications of electrical engineering can be in the general sense divided into two basic groups: applications related to electrical energy and applications related to information.

The area of electrical engineering has become exceptionally wide and interdisciplinary, and there is virtually no human activity in which electrical engineering does not contribute, significantly fostering their development. One of the main features of the field of electrical engineering is its rapid development. The demands of the developed society for electrical energy are continually growing, creating constant demand for development of devices for energy conversion and seeking new and environmentally acceptable systems for distribution of electrical energy. Striking development of the electronic computers technology enabled their application in nearly all areas of human activity. Development of microelectronics and computer technology enabled the development of the area of information and telecommunication technology, which became one of the most promising sectors of economy. Information transfer, i.e. image, voice and data transfer came to represent one of major prerequisites for the development of modern society. State-of-the-art computer technology enables major breakthroughs in the quality of automated control in the processing industry, control of vessels and aircrafts, complex robots and modern medical devices. Continuous and rapid development of this area, driven by new findings and achievements, necessarily requires corresponding educational processes. Well-educated professionals are an essential prerequisite for progress and keeping pace with the developed countries.

The goal of the proposed university study programme in Electrical Engineering is to educate professional staff in the area of electrical engineering, to meet the demands of the industry, governmental and other public institutions.

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

The goal of the proposed university study programme in Electrical Engineering is to educate professional staff in the area of electrical engineering, to meet the demands of the industry, governmental and other public institutions. 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 human resources 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 the Dalmatian region power system was facilitated by the efforts of power engineering professionals trained at FESB. Of special importance is the influence FSB had on development of IT sector in the region. 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 ICT companies in the Split-Dalmatia County and town of Split.

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 study programme in Electrical Engineering, the Faculty is actively pursuing the process of development in higher education on global level, and especially in Europe. When developing the new curriculum, special attention was given to consolidating the curriculum and course contents with other renowned foreign higher education institutions. The educational systems in the field of electrical engineering differ a lot, both worldwide and in Europe, and there are practically no countries with identical educational systems. The former applies to almost all components of education: type and organisation of studies, fields of study, duration of studies, titles and degrees awarded at individual institutions, names of higher education institutions, etc. As a rule, the first stage is acquiring knowledge of mathematics and fundamental natural sciences, followed by core courses in electrical engineering and information technology and specific specialist courses related to particular branches of electrical engineering. In addition, the programme includes a number of non-engineering courses. 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/). Based on the analysis of the study programmes in Electrical Engineering and Information Technology at 87 European universities, a proposal was prepared for organisation of the study programme in Electrical Engineering and the ratio of each of the mentioned components. The organisation of the proposed study programme is comparable with related study programmes at the following European institutions:

- Techniche Univerzität Wien/ Engineering University Vienna, Austria http://www.tuwien.ac.at/informationen_fuer/studierende
- Eidgenössische Technische Hochschule (ETH)/ Swiss Federal Institute of Technology in Zürich, Switzerland https://www.ethz.ch/de/studium.html

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

Graduate university study programme in Electrical Engineering enables vertical and horizontal mobility of students. In terms of vertical mobility, the graduate university study programme in Electrical Engineering 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 programme in Electrical Engineering 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 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 Electrical 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 Electrical Engineering 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 electrical engineering 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 is 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 implemented at the Faculty, providing specialisation in the areas of telecommunications and computer information systems, electronics, power engineering and electromechanical engineering, automation and computing.

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, field of study Electrical Engineering, or completed other related undergraduate study programme with acquired at least 180 ECTS credits, with possible differential exams.

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 *Electrical Engineering*. The learning outcomes are aligned with the Croatian Qualification Framework Act and are listed as common learning outcomes for both fields of study and additional learning outcomes depending on the selected field of study, 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 electrical engineering problems.
2. To apply advanced engineering knowledge and engineering principles in presenting and solving highly complex and original electrical engineering problems.
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 electrical engineering products, processes and methods.

6. By applying scientific principles, to design innovative experiments with the use of state-of-the-art technological solutions in the area of electrical engineering systems.
7. To select optimal economically viable engineering solutions in the design and construction of highly complex electrical engineering systems.
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 electrical engineering problems.
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 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 public presentations, to prepare written reports 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 FOR THE FIELD OF STUDY AUTOMATION AND FACILITIES MANAGEMENT

1. To consolidate theoretical knowledge and practical skills in solving highly complex problems in the area of electric motor drives, power electronics and automation of industrial facilities.

2. To propose new procedures and new solutions for modernisation of electric motor drives and industrial facilities.
3. To develop innovative programming solutions for simulation of components and systems in power electronics, electric motor drives and automation of industrial facilities.
4. To design advanced algorithmic solutions for regulating and controlling of electric motor drives and industrial facilities.
5. To analyse physical phenomena in power electronics devices, electric machines and other electric devices and appliances.
6. To organise and manage the investigation of highly complex electric motor systems and industrial facilities.
7. To design innovative solutions in the development, design, implementation and investigation of elements and devices in power electronics, electric motor drives and automation of industrial facilities.

ADDITIONAL LEARNING OUTCOMES FOR THE FIELD OF STUDY POWER ENGINEERING SYSTEMS

1. To consolidate theoretical knowledge and practical skills in solving highly complex problems in the area of power generation, transmission, and distribution.
2. To propose new procedures and new solutions for modernisation of power generation, transmission, and distribution systems.
3. To develop innovative programming solutions for simulation of power generation, transmission, and distribution systems.
4. To design advanced algorithmic solutions for regulating and controlling of power generation, transmission, and distribution systems.
5. To analyse physical phenomena in switching equipment, power engineering facilities and power generating systems.
6. To organise and manage the investigation of highly complex power engineering facilities and power generating systems.
7. To design innovative solutions in the development, design, implementation and investigation of switching devices and equipment and power engineering facilities for power generation and transmission.

2.3. Employment possibilities

Following the completion of studies, the acquired knowledge enables the students to find employment in the industry, electric power industry, software and ICT companies, education, service industry, etc. There is virtually no working environment in which experts with completed graduate university degree in Electrical Engineering 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 Electrical Engineering acquire the knowledge and skills necessary for work in various areas: power generation, transmission, and distribution, electromechanical engineering, automation and other production and service industries. Following the completion of studies, the students are capable of testing, maintenance, designing, monitoring and controlling the most complex electrical engineering and industrial systems. 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 Electrical Engineering, graduates may continue their studies at the postgraduate study programme in Electrical Engineering and Information Technology 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.

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. The first semester is implemented jointly for both fields of study:

- Automation and facilities management,
- Power engineering systems.

In the second year of study, in addition to required courses, the students select three elective courses. The final component of the study programme is preparing and defending the diploma thesis. 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

Students may choose courses from other study programmes only 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 (name which language)

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 Committee for graduate thesis and the defence is public and held in the presence of the Commission for defence of diploma thesis.	

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	FENI36	Basics of Energy Engineering	30	0	0	15	0	4
	FENI01	Electromagnetics	45	0	30	0	0	8
	FENI02	Numerical Methods and Simulation	30	0	0	30	0	6
	FESI01	Fundamentals of Mechanical Constructions	45	0	15	0	0	6
	FENI03	Measurements and Signal Processing	30	0	0	30	0	6
	Total		**180**	**0**	**45**	**75**	**0**	**30**
	L = lectures, S = seminars, AE = auditory excercise, LE = laboratory excercise, DE = design excercise							
	No elective courses							

Specialisation: Automation and drives - 231

List of courses								
Year of study: 1.								
Semester: II								
STATUS	CODE	COURSE	HOURS IN SEMESTER					ECTS
			L	S	AE	LE	DE	
Mandatory	FENI11	Control of Electrical Machines	30	0	0	30	0	6
	FENI12	Modeling of Electromechanical Systems	30	0	0	30	0	6
	FENI13	Embedded Computer Systems	30	0	0	30	0	6
	FENI14	Semiconductor Power Converters	30	0	0	30	0	6
	FENI19	Measurements of Process Quantities	30	0	0	30	0	6
	Total		150	0	0	150	0	30
	L = lectures, S = seminars, AE = auditory excercise, LE = laboratory excercise, DE = design excercise							
	No elective courses							

List of courses								
Year of study: 2.								
Semester: III.								
STATUS	CODE	COURSE	HOURS IN SEMESTER					ECTS
			L	S	AE	LE	DE	
Mandatory	FENI15	Digital Control Systems	45	0	0	15	0	6
	FENA19	Automation of Industrial Plants	30	0	0	30	0	7
	FENI37	Engineering Economy	30	0	0	30	0	5
Elective		Elective 1.*						
		Elective 2.*						
		Elective 3.*						
	Total mandatory		105	0	0	75	0	18
	L = lectures, S = seminars, AE = auditory excercise, LE = laboratory excercise, DE = design excercise							
	Three elective courses are selected							

List of courses								
Year of study: 2.								
Semester: IV.								
STATUS	CODE	COURSE	HOURS IN SEMESTER					ECTS
			L	S	AE	LE	DE	
Mandatory	FEXX02	Diploma thesis						30
	Total mandatory							
	L = lectures, S = seminars, AE = auditory excercise, LE = laboratory excercise, DE = design excercise							
	No elective courses							

Specialisation: Power systems - 232

List of courses								
Year of study: 1.								
Semester: II								
STATUS	CODE	COURSE	HOURS IN SEMESTER					ECTS
			L	S	AE	LE	DE	
Mandatory	FENI04	Power System Planning	45	0	15	0	0	6
	FENI05	Power System Analysis	45	0	0	15	0	6
	FENI06	High Voltage Engineering	45	0	0	15	0	6
	FENI07	Electrical Power Switchyards and Substations	45	0	0	15	0	6
	FENI08	Power Plants	45	0	0	15	0	6
	Total		**225**	**0**	**15**	**60**	**0**	**30**
	L = lectures, S = seminars, AE = auditory excercise, LE = laboratory excercise, DE = design excercise							
	No elective courses							

List of courses								
Year of study: 2.								
Semester: III.								
STATUS	CODE	COURSE	HOURS IN SEMESTER					ECTS
			L	S	AE	LE	DE	
Mandatory	FENI09	Power System Operation and Control	30	0	15	15	0	6
	FENI10	Protection at Substations	45	0	0	15	0	7
	FENI37	Engineering Economy	30	0	0	30	0	5
Elective		Elective 1.*						
		Elective 2.*						
		Elective 3.*						
	Total mandatory		**105**	**0**	**15**	**60**	**0**	**18**
	L = lectures, S = seminars, AE = auditory excercise, LE = laboratory excercise, DE = design excercise							
	Three elective courses are selected							

List of courses								
Year of study: 2.								
Semester: IV.								
STATUS	CODE	COURSE	HOURS IN SEMESTER					ECTS
			L	S	AE	LE	DE	
Mandatory	FEXX02	Diploma thesis						30
	Total mandatory							
	L = lectures, S = seminars, AE = auditory excercise, LE = laboratory excercise, DE = design excercise							
	No elective courses							

Elective courses								
Year of study: 2.								
Semestar: III.								
STATUS	CODE	COURSE	HOURS IN SEMESTER					ECTS
			L	S	AE	LE	DE	
Elective	FENI18	Power Quality Monitoring	30	0	0	15	0	4
	FENI20	Electric Servo Drives	30	0	0	15	0	4
	FELI01	Fundamentals of Robotics	30	0	0	15	0	4
	FENI21	Transients in Electrical Machines	30	0	0	15	0	4
	FETI01	Hydraulic and Pneumatic Systems	30	0	0	15	0	4
	FENI22	Analysis of Electromagnetic Fields and Circuits	30	0	0	15	0	4
	FENI23	Lightning Protection and Grounding	30	0	0	15	0	4
	FENI27	Control of Electrical Machines Laboratory	30	0	0	15	0	4
	FENI28	Electromagnetic Compatibility	30	0	0	15	0	4
	FENI29	Electrical Installations Testing	30	0	0	15	0	4
	FENI30	Computer Application in Electric Power System	30	0	0	15	0	4
	FENI32	Distribution Networks and Dispersed Generation	30	0	0	15	0	4
	FENI33	Power Cables	30	0	0	15	0	4
	FENI34	Synchronous Machines and Excitation Systems	30	0	0	15	0	4
	FENI35	Flexible Transmission Systems	30	0	0	15	0	4
	FENI16	Automated Electrical Drives	30	0	0	15	0	4

	FENI50	Electric Switching Devices	30	0	0	15	0	4
	FENI38	Design of Electrical Networks and Substations	15	0	0	30	0	4
	FENI39	Power Engineering in Buildings	30	0	0	15	0	4
	FENI40	Distributed Generation	30	0	0	15	0	4
	FENI41	Energy Storage Systems	30	0	0	15	0	4
	FENI42	Design of Magnetic Circuits	30	0	0	15	0	4
	FENI43	Design of Power Converters	30	0	0	15	0	4
	FENI44	Application of Analytical Methods in Electromagnetic Compatibility	30	0	0	15	0	4
	FEXX06	Professional Training						5
	L = lectures, S = seminars, AE = auditory excercise, LE = laboratory excercise, DE = design excercise							

2.13. Course description

NAME OF THE COURSE	ANALYSIS OF ELECTROMAGNETIC FIELDS AND CIRCUITS							
Code	FENI22	Year of study	2.					
Course teacher	Slavko Vujević, Ph.D., Full Professor	Credits (ECTS)	4					
Associate teachers	Dino Lovrić, Ph.D., Research Assistant	Type of instruction (number of hours)	L	S	AE	LE	DE	
			30	0	0	15	0	
Status of the course	Elective	Percentage of application of e-learning	0					

COURSE DESCRIPTION

Course objectives	Training students for understanding and application of specialized knowledge of: - numerical analysis of electromagnetic fields using finite element method, - numerical analysis of DC and AC electric circuits using the finite element technique, - transient analysis of electrical circuits using the finite element technique.
Course enrolment requirements and entry competences required for the course	None
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - describe the basic differential and integral equations of electromagnetic fields, - apply the finite element method (FEM) to solve 1D, 2D and 3D electromagnetic problems, - write a simple MATLAB program for FEM analysis of electromagnetic problems, - use advanced MATLAB tools for solving partial differential equations, - numerically analyze DC and AC electric circuits using the finite element technique, - numerically analyze transients in electrical circuits using the finite element technique, - apply edge finite elements in numerical solving 1D, 2D and 3D electromagnetic problems.

	Course content	L hours
Course content broken down in detail by weekly class schedule (syllabus)	Differential and integral equations of electromagnetic fields.	2
	Numerical models for computation of electromagnetic fields.	2
	Finite Element Method (FEM). 1D finite elements.	2
	Multi-dimensional finite elements.	2
	Finite element discretization.	2
	Forming the systems of linear / non-linear algebraic equations. Local system of equations. The global system of equations.	2
	Setting boundary conditions. Solving systems of equations.	2
	FEM programming in MATLAB.	4
	Pre-processing and post-processing.	2
	Numerical analysis of DC and AC circuits using the finite element technique.	2
	Transient analysis of electrical circuits using the finite element technique.	2

	Edge finite elements.	2
	Two midterm exams	
	List of laboratory exercises	LE hours
	Numerical computation of 1D electromagnetic field	3
	Numerical computation of 2D electromagnetic field	3
	Numerical computation of 3D electromagnetic field	3
	Numerical analysis of AC electric circuits	3
	Transient analysis of electric circuits	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	Attendance 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	1.7
	Essay		Seminar essay		Laboratory exercises	0.4
	Tests	0.2	Oral exam		Preparation for laboratory exercises	0.1
	Written exam	0.1	Project		(Other)	

Grading and evaluating student work in class and at the final exam	There are two midterm exams. After two midterm exams, student can pass the entire exam. In the two final exams students take course parts that they did not pass in the preliminary exams. If in the first final exam student passes one of the two course parts, that course part the student does not have to take in the second final exam. The requirement for a positive evaluation of the course part is that the student has completed at least 50 % points from that course part. The final grade (in percentage) can be calculated using the formula: Grade (%) = 0.1*LV + 0.45*(G1 + G2) where activities in percentage are: LV - laboratory assessment, G1 - points from the first course part, G2 - points from the second course part. Students who did not pass the entire exam after two final exams can pass the exam in two additional exams. In the two additional exams students take the entire course. The requirement for a positive assessment of the additional exams is that the student has completed at least 50 % points from the entire course. The final grade (in percentage) can be calculated using the formula: Grade (%) = 0.1*LV + 0.9*G where activities in percentage are: LV - laboratory assessment, G - points from the entire course. The final grade can be calculated as follows: • 50 % to 61 % - pass (2) • 62 % to 74 % - good (3) • 75 % to 87 % - very good (4) • 88 % to 100 % - excellent (5) Each of the midterm exams consists of ten questions. Two final exams and two additional exams consist of twenty questions.

<table>
<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>Vujević, S.: "Predavanja iz predmeta Proračun elektromagnetskih polja i krugova", Sveučilište u Splitu, FESB, Split, 2010. (lecture notes – electronic version)</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">• Kwon, Y. W. and Bang, H., "The Finite Element Method Using MATLAB - Second Edition", CRC Press, 2000.
• Pratap, R., "Getting Started with MATLAB - A Quick Introduction for Scientists and Engineers", Oxford University Press, New York - Oxford, 2002.
• Jin, J.; "The Finite Element Method in Electromagnetics", John Wiley & Sons, New York, 1993.</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	APPLICATION OF ANALYTICAL METHODS IN ELECTROMAGNETIC COMPATIBILITY						
Code	FENI44	Year of study	2.				
Course teacher	Silvestar Šesnić, Ph.D., Assistant Professor	Credits (ECTS)	4				
Associate teachers	-	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	15	0
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - mathematical modelling in electromagnetic compatibility; - application of analytical methods for the solution of differential, integral and integro-differential equations; - computer application of analytical methods.	
Course enrolment requirements and entry competences required for the course	Completed undergraduate study in the field of electrical engineering and information technology	
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - analyse scientific literature in the field of analytical methods; - prepare and present a student paper regarding the analytical methods in electromagnetic compatibility; - evaluate advantages and disadvantages of existing analytical methods; - mathematically model phenomena in electromagnetic compatibility.	
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours
	Mathematical modelling in electromagnetism.	2
	Mathematical modelling in electromagnetic compatibility.	2
	Overview of methods for the solution of differential equations in electromagnetic compatibility.	2
	Overview of methods for the solution of integral equations in electromagnetic compatibility.	2
	Approximation procedures.	2
	Analytical methods in frequency domain.	4
	Analytical methods in time domain.	4
	Comparison of analytical and numerical methods.	2
	Application of analytical methods to antenna systems.	2
	Application of analytical methods to grounding systems.	2
	Application of analytical methods to transmission lines.	2
	Application of analytical methods in bio-electromagnetism.	2
	Application of analytical methods in magneto-hydrodynamics.	2
	List of laboratory or design exercises	LE hours
	Analytical methods in frequency and time domain.	3
	Comparison of analytical and numerical methods.	2
	Analytical modelling of antenna systems.	2
	Analytical modelling of grounding systems.	2
	Analytical modelling of transmission lines.	2
	Analytical modelling in bio-electromagnetism.	2
	Analytical modelling in magneto-hydrodynamics.	2
Format of instruction	☒ lectures	☒ independent assignments

	☒ seminars and workshops ☒ exercises ☐ *on line* in entirety ☐ partial e-learning ☐ field work	☐ 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	-	Individual work	1,5
	Essay	-	Seminar essay	0,5	Laboratory exercises	0,5
	Tests	-	Oral exam	0,5	(Other)	
	Written exam	-	Project	-	(Other)	

Grading and evaluating student work in class and at the final exam	The final grade is determined as an average of: • grade for the written seminar essay; • grade for its oral presentation; • grade for the laboratory exercises.

	Title	**Number of copies in the library**	**Availability via other media**
Required literature (available in the library and via other media)	J. D. Jackson, *Classical Electrodynamics*. New York, USA: John Wiley & Sons, Inc., 1999.		
	E. J. Rothwell and M. J. Cloud, *Electromagnetics*. Boca Raton, London, New York, Washington, D.C.: CRC Press, 2001.		
	A. Hoorfar and D. C. Chang, "Analytic Determination of the Transient Response of a Thin-Wire Antenna Based upon an SEM Representation," *IEEE Trans. Antennas Propag.*, vol. 30, no. 6, pp. 1145-1152, November 1982.		
	R. W. P. King, "A Review of Analytically Determined Electric Fields and Currents Induced in the Human Body When Exposed to 50–60-Hz Electromagnetic Fields," *IEEE Trans. Antennas Propag.*, vol. 52, no. 5, pp. 1186-1192, May 2004.		

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 learning outcomes; - feedback from students survey; - self-evaluation of the teacher; - institutional and non-institutional evaluations.
Other (as the proposer wishes to add)	-

<table>
<tr><td>NAME OF THE COURSE</td><td colspan="6">AUTOMATED ELECTRICAL DRIVES</td></tr>
<tr><td>Code</td><td>FENI16</td><td>Year of study</td><td colspan="5">2.</td></tr>
<tr><td>Course teacher</td><td>Božo Terzić, Ph.D., Full Professor</td><td>Credits (ECTS)</td><td colspan="5">4</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2">Goran Majić, 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>0</td><td>0</td><td>15</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">0</td></tr>
<tr><td colspan="7">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="6">Training students for:
- understanding the structure and operation principle of modern electric drives
- permanent deepening of knowledge in the field of electric drives</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="6">Entry competences:
- Basic knowledge of the course Electric Drives
- Basic knowledge of the course Power Electronics
- Basic knowledge of the course Elements of Industrial Plant Automation</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:
- select the type, power and speed of the motor for defined working cycle,
- select cross-section and type of power cables based on calculation of short circuit current and voltage drop in plant,
- design and select protection devices of electric drives,
- use specialized software package for design electric drives
- commissioning electrical drives with power converter
- compare and rank drive converter characteristics of different world producers based on data from technical documentation</td></tr>
<tr><td rowspan="9">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">The basic structure and components of the controlled and uncontrolled electrical drives. Classification and features of modern electric drives according to product range of the world's largest manufacturer of electric drives (ABB, SIEMENS). Electrical drives in automation systems.</td><td>2</td><td>0</td></tr>
<tr><td colspan="4">Design electric drives. Legislation. Preliminary, main and detailed project. An example of the main electrical engineering project with automated electric drive.</td><td>2</td><td>0</td></tr>
<tr><td colspan="4">Basic classification and features of working mechanisms in electric drives. Determination of power and speed of the motor based on the defined duty cycle. Example - elevator in the building.</td><td>2</td><td>0</td></tr>
<tr><td colspan="4">Select the motor for electric drives: type, power, speed, IP protection, cooling, mounting arrangements, thermal protection.</td><td>2</td><td>0</td></tr>
<tr><td colspan="4">Select power converter for electric drives: basic topology, input and output filters, analogue and digital input/output, encoder inputs, communication link, programming tools.</td><td>2</td><td>0</td></tr>
<tr><td colspan="4">Determination of the type and cross-section of the power cables based on calculation of load, voltage drop and short-circuit current.</td><td>2</td><td>0</td></tr>
<tr><td colspan="4">Type of the protection and switching device in electric drives (fuse, circuit-breaker, thermistor, contactor, bimetallic</td><td>2</td><td>0</td></tr>
</table>

	protection). Select the protection devices for electric drives with and without power converter.		
	Presentation of student seminars.		
	Electromagnetic compatibility (EMC) in electric drives. Du/dt, sine and RFI filter. Motor bearing currents and measures to eliminate these currents.	2	0
	Commissioning of the electric drives with power converters.	2	0
	Monitoring, visualisation and diagnostics in automated electric drives.	2	0
	Industrial communications in modern electric drives: Profibus, Ethernet, Modbus, CAN	2	0
	Examples of modern electric drives: automated electric drives for crane applications with slip-rings induction motor and thyristor voltage controller.	2	0
	Examples of modern electric drives: automated electric drives for crane applications with squirrel cage induction motor and four-quadrant IGBT frequency converter.	2	0
	Presentation of students' practical work.		
	List of laboratory exercises		LE hours
	Selection of motor for electric vehicles based on defined duty cycles		3
	Design power supply circuit of electric drives by program package "Ecodial".		6
	Converter parameter settings and commissioning of the electric drives for crane application with squirrel cage induction motor and four-quadrant IGBT frequency converter		3
	Converter parameter settings and commissioning of the electric drives for crane application with with slip-rings induction motor and thyristor voltage controller.		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	0.5
	Tests		Oral exam		Preparation for laboratory exercises	0.5
	Written exam		Project		(Other)	

Grading and evaluating student work in class and at the final exam	During the first part of the semester, each student has an independent seminar work from the design of electrical drive with a frequency converter and asynchronous motor. Seminar presents in front of other students, assistants and teachers. The rating of the seminar is the first part of the exam. The second part of the exam is taken at the end of the semester as practical work in which the students put into operation the drive with power converter. The requirement for passing grade is the positive assessment of seminar and practical work. Final grade (in percentage) is formed according to the formula:

<table>
<tr><td></td><td colspan="3">Grade(%) = 0,5 SW + 0.5 PW
where the activities in percentage:
• 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)

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">• http://www.abb.com
• http://www.siemens.com</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	AUTOMATION OF INDUSTRIAL PLANTS						
Code	FENA19	Year of study	2				
Course teacher	Ozren Bego, Ph.D., Associate Professor	Credits (ECTS)	7				
Associate teachers	Marin Despalatović, Ph.D., Associate Professor 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	Obligatory	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - understanding concept of modeling different technical processes and plants, and relationship in flow of matter, energy and information, - mathematical modelling of: fluid storage processes, heat exchange processes, matter shaping and transportation processes, - work with advanced technology for industrial automation.
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 relationship between different process state of matter, energy and information in various technical process, - build mathematical model of: - fluid flow and storage processes, - heat exchange processes, - matter shaping and transportation processes. - define advanced control structures for different technical processes, - define criteria for implementation industrial communication networks.

Course content broken down in detail by weekly class schedule (syllabus)	Course content	L or S hours	AE hours
	Process dynamics – introduction	2	
	Fluid flow and storage processes – model of tanks and valves	2	
	Fluid flow and storage processes – model of pumps, compressors, pipelines, mixing process	2	
	Heat exchange processes - dynamics	2	
	Heat exchange processes - control system	2	
	Matter shaping and transportation processes – part I	2	
	Matter shaping and transportation processes – part II	2	
	First midterm exam	2	
	Multivariable (MIMO) process control	2	
	Decoupling algorithms	2	
	Industrial communication networks – concept and criteria	2	
	Communication protocols – Modbus, Profibus, Ethernet based protocols	2	
	Plant visit	4	
	Second midterm exam	2	

	List of laboratory or design exercises	LE or DE hours
	Fluid storage modeling	2
	Fluid storage parameter identification	2
	Control of fluid storage	2
	Industrial networks – Profibus, Modbus, Ethernet	6
	Visualization – OPC servers	4
	Visualization – SCADA software	4
	Seminar: Design of control system; independent/group assignments.	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	1	Research		Practical training	
	Experimental work		Report		Laboratory attendance	1
	Essay		Seminar essay	1	Independent work	3.2
	Tests	0.2	Oral exam		Preparation for laboratory work	0.5
	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. Each midterm test consists of 4 questions and final tests consist of 6 questions, 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 + 0,35 LV + 0,3 (M1 + M2) the activities in percentage: • NP - attendance at lectures, • LV – laboratory assessment (independent/group work), • 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 Automatizacija industrijskih postrojenja, 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)	

NAME OF THE COURSE	BASICS OF ENERGY ENGINEERING						
Code	FENI36	Year of study	1.				
Course teacher	Ranko Goić, Ph.D., Full Professor	Credits (ECTS)	4				
Associate teachers	Josip Vasilj, Ph.D.; Stipe Vodopija, M.Sc.	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	15	0
Status of the course	Obligatory	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - understanding of basic concepts and characteristics of energy sources and energy conversion processes, - understanding of energy conversions in power plants - understanding of concepts of sustainable energy development and energy efficiency - understanding of interdependence of energy, environment and economy - preparation of spreadsheet models for calculation of electricity costs
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 characteristics of conventional and renewable energy, - apply of key concepts of sustainable energy use and energy efficiency, - prepare simple models for calculation of energy-economic parameters of power plants - prepare simple models for tariff system analysis and optimization of use of electrical energy,

Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours
	Sources and types of energy. Primary, transformed and useful forms of energy.	3
	Reserves, types and basic characteristics of non-renewable and renewable energy sources.	3
	Transformations of non-renewable energy sources in power plants.	3
	Transformations of renewable energy sources in power plants.	3
	Energy and environment. Global warming and influence on energy.	3
	Energy balances and flows. Prices and availability of energy.	3
	Energy efficiency and rational use of energy. Cogeneration.	3
	Principles of tariff systems in energy. Energy planning.	3
	Networked energy systems and its characteristics: electrical energy, gas, centralized heating systems.	3
	Energy laws. Energy markets.	3
	List of laboratory exercises	LE hours
	MS Excel model for calculation of energy-economic parameters of PV power plant.	3
	MS Excel model for calculation of energy-economic parameters of wind power plant.	3
	MS Excel model for calculation of energy-economic parameters of hydro power plant.	3
	MS Excel model for calculation of household electricity cost.	3

<table>
<tr><td></td><td colspan="5">Site visit to PV power plant or wind power plant.</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="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>1,4</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>0,7</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>1</td><td>Laboratory exercises</td><td>0,4</td></tr>
<tr><td>Tests</td><td>0,2</td><td>Oral exam</td><td></td><td>Preparation for laboratory exercises</td><td>0,2</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, covering all lectures, is being held after 14 weeks of lecturing in form of written test. The second midterm exam is carried out in form of seminar essay on selected topic after 12 weeks of lecturing. In the two final exams students that did not pass the first midterm exams must repeat the test. 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 % of written test in midterm, final or additional exam and positively graded seminar essay.
Grade (in percentage) is formed according to following formula:
Grade (%) = 0,5xKP+0,25xS1+0,15xS2+0,1xP,
Activities in percentage:
• KP - written test results
• S1 – grade of seminar essay
• S2 – grade of seminar essay presentation
• P – attendance at lectures
Grade (in number) is formed as follows:
• 50 % to 61 % - pass (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">Goić, R., "Predavanja iz Opće energetike ", Sveučilište u Splitu, FESB, Split, 2013. (internal script)</td><td></td><td>e-learning portal</td></tr>
<tr><td colspan="3">Duić, N., EnerPEDIA - http://www.powerlab.fsb.hr/enerpedia</td><td>1</td><td>www</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6">• B. Udovičić: Osnove energetike, Školska knjiga, Zagreb, 1991.
• H. Požar: Osnove energetike I, II i III, Školska knjiga, Zagreb, 1992.</td></tr>
<tr><td>Quality assurance methods that ensure</td><td colspan="6">• Evaluation of results in accordance with the above learning outcomes
• Feedback from students via surveys</td></tr>
</table>

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	COMPUTER APPLICATION IN ELECTRIC POWER SYSTEM						
Code	FENI30	Year of study	2				
Course teacher	Elis Sutlović, Ph.D. Full Professor	Credits (ECTS)	4				
Associate teachers		Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	15	0
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION			
Course objectives	Training students for: - acquisition of basic knowledge of logical and physical database design, - designing and creating simple databases, - creating additional database applications.		
Course enrolment requirements and entry competences required for the course	None		
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - understand the complete process of database creation, - apply conceptual, logical and physical process of database design, - design the entity–relationship model of data, - design a relational model of data, - physically realize a simpler database using an appropriate database management system, - create additional database applications		
Course content broken down in detail by weekly class schedule (syllabus)	Course content		L hours
	Information systems: concept, types, components, development methods. Information systems in electric power industry		2
	Data modelling and data models. Conceptual, logical and physical data model. Generations of data model.		2
	Entity–relationship model, concepts, structure, ER diagram, constraints. An example of entity–relationship model in transformer station.		2
	Relational model: concepts, structure, constraints. Relational model operations. Query languages.		2
	Conversion of entity-relationship model into a relational model. Examples.		2
	Database design process. Creation database applications. Traditional programming.		2
	An example of the whole process of designing the database of the main power system components.		2
	First midterm exam		
	Introduction to programming languages. FORTRAN: variables in general, declaration of variables, comments, input-output commands.		2
	FORTRAN: operators in general and examples, embedded functions and examples		2
	FORTRAN: field definitions, field elements and examples, dynamic fields		2
	FORTRAN: program flow control commands		2
	FORTRAN: Subsystems in general, modular structure, functional subprograms, examples.		2

	FORTRAN: Using an IMSL library in general, examples	2
	Second midterm exam	
	List of laboratory or design exercises	LE hours
	MS Access - Tables: creating simple table, introduction to data types and field properties	2
	MS Access - Manipulating with tables. Creating relationships between tables.	2
	MS Access - Sorting, searching, and filtering. Advanced use of queries.	2
	MS Access – Forms: creating, changing the look, adding controls and subforms, working with forms	2
	MS Access – Reports: creating, modifying, adding subreports	2
	MS Access – Creating a complete database with MS Access objects, entering data, working with data base	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	1,2
	Essay		Seminar essay	0,5	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

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. Each midterm test is carried out as written exam and it consists of 5 short theoretical questions and 1 numerical problems.

The requirement for passing grade is 50 % points on independent seminar, each midterm exam or the final exam. Grade (in percentage) is formed according to the formula:

$$\text{Grade}(\%) = 0{,}05\ AL + 0{,}25S + 0{,}35\ (M1 + M2)$$

the activities in percentage:

- AL – attendance at lectures and laboratory assessment,
- S – independent seminar result,
- M1, M2 – test results.

The final grade is determined as follows:

Percentage	Description	
50% do 61%	Sufficient	(2)
62% do 74%	Good	(3)
75% do 87%	Very Good	(4)
88% do 100%	Excellent	(5)

Required literature (available in the	**Title**	**Number of copies in the library**	**Availability via other media**

library and via other media)	1. *Varga, M.: Baze podataka konceptualno, logičko i fizičko modeliranje podataka, DRIP Biblioteka Informacijsko društvo, Zagreb, 1994.*		
	2. *Hahn, B. D.: Fortran 90 for Scientists and Engineers, J. W. Arrowsmith Ltd., Bristol, 1998,*		
Optional literature (at the time of submission of study programme proposal)	- *Strahonja, Varga, Pavić: Projektiranje informacijskih sustava, Zavod za informatički djelatnost, Zagreb 1992.* - *Pao, Y. C.: Engineering analisys – interactive methods and programs with Fortran, QuickBasic, Matlab and Mathematica, CRC Press, 2001.* - *Visual Numerics: IMSL Fortran subroutines for mathematical applications, Math. library vol. 1 & 2, Visual Numerics, 1997.*		
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	CONTROL OF ELECTRICAL MACHINES						
Code	FENI11	Year of study	1				
Course teacher	Dinko Vukadinović, Ph.D., Full Professor	Credits (ECTS)	6				
Associate teachers	Mateo Bašić, 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: - understanding of basic control principles in electrical machines systems, - synthesis of an electrical machine control system by using computer and experimental methods - using commercial converters in control systems of electrical machines	
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) identify controlled variables and flow of signals and power in control systems of electrical machines 2) classify certain power electronics switching devices in control systems of electrical machines 3) determine transfer functions of elements of separately-excited DC machine control system 4) make a simulation model of a controlled DC machine using absolute value optimum and symmetrical optimum 5) analyze volt per hertz and field-oriented control strategies of AC machines 6) define similarities and differences between the separately-excited DC machine control system and the field-oriented AC machine control system 7) explain principles of active and reactive power control of synchronous generator in the electric power system 8) operate a commercial converter in the induction motor control system	
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours
	Scope of electrical machines; types of electrical machines and controlled variables	1
	Power electronics semiconductor switches in converters for electrical machines supply	2
	Phase-controlled converters for DC and AC machines	2
	Power converters for DC machines	3
	Armature voltage control of the separately-excited DC machine	2
	Excitation flux control of the separately-excited DC machine	1
	Combined speed control of the separately-excited DC motor	1
	Absolute value optimum and symmetrical optimum in the DC motor control system	2
	Frequency converters for AC machines	3
	Volt per hertz control of induction machines	2
	Field-oriented control of induction machines	2
	Control of synchronous motors	2

	Control of synchronous generators in electric power systems	2
	The application of computers in control of electrical machines	1
	List of laboratory exercises	LE hours
	Measurement of transfer function parameters of the DC motor	4
	Full-controlled thyristor bridge as an actuator in the DC motor control system	4
	Determination of transfer functions of speed and armature current sensors	4
	DC motor speed control – measurement of steady-state characteristics	4
	Absolute value optimum and symmetrical optimum in the DC motor control system - simulation	4
	Absolute value optimum and symmetrical optimum in the DC motor control system - experiment	5
	Volt per hertz control of the induction motor using commercial frequency converter	5

Format of instruction	x lectures ☐ seminars and workshops ☒ exercises ☐ *on line* in entirety ☐ partial e-learning ☐ field work	x independent assignments ☒ multimedia x 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	1
	Midterm exams	0.3	Oral exam		Preparing for laboratory exercises	0.5
	Written exam	0.2	Project		(Other)	

Grading and evaluating student work in class and at the final exam	During the semester, two midterm exams are held - the first after 7 weeks of lectures and the second after 13 weeks of lectures. Each midterm exam consists of 4 problems, either theoretical or numerical. In the final exams, students take those parts of the course which they did not pass in the midterm exams. The requirement for passing grade is that the sum of the laboratory exercises' grade (L) and the midterms' grades (M1 and M2), expressed as a percentage, is 50% or more. The sum is calculated as Grade (%) = 0.25L + 0.375(M1 + M2) where the number of points achieved in each midterm exam has to be at least 50%. The students that do not pass the midterm exams take the final written exam which consists of 4 problems. The requirement for a positive evaluation of the final exam is at least 50% points achieved. In the final exam, the students that did not pass one of the midterm exams are presented with 4 problems from the corresponding part of the course. Subsequently, the grade is determined as follows: Grade (%) = 0.25L + 0.75(I) where I is the number of points achieved in the final written exam (at least 50%).

<table>
<tr><td></td><td colspan="3">The final grade for the course is determined as follows:

50% to 61% - Sufficient (2)
62% to 74% - Good (3)
75% to 87% - Very good (4)
88% 100% - Excellent (5)</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>D. Vukadinović: Predavanja iz Regulacije električnih strojeva za šk. god. 2014/15.
Bose, B.K.: Modern Power Electronics and AC Drives, Prentice Hall, 2002</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">Boldea I.: Synchronous Generators, CRC Press, 2005.</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 the performance at midterm exams and final exams
- Feedback from students via surveys
- Self-evaluation of teachers
- Feedback from graduated students</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="3"></td></tr>
</table>

NAME OF THE COURSE	CONTROL OF ELECTRICAL MACHINES LABORATORY						
Code	FENI27	Year of study	2				
Course teacher	Dinko Vukadinović, Ph.D., Full Professor	Credits (ECTS)	4				
Associate teachers	Mateo Bašić, Ph.D. Assistant Professor	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	15	0
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - synthesis of an electrical machine control system by using computer and experimental methods - using commercial converters in control systems of electrical machines
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: 1) make a synthesis of the cascade controlled DC machine using commercial converter 2) make a choice of the converter for certain induction motor 3) choose the measuring sensors for current, voltage and rotor speed of a controlled electrical machine 4) operate a commercial converter in a induction motor control system 5) design a real-time control algorithm for the induction motor

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

Course content	L hours	AE hours
Introduction. Scope of DC and AC electrical machines	2	
Overview of practical solutions for DC motor control	2	
Commissioning of commercial frequency converters for induction machines control; volt per hertz and field-oriented control	2	
Selection of frequency converter for induction machines	3	
Control systems of self-excited induction generators	2	
Role of digital signal processors and programming techniques	2	
Control of the three-phase inverter with IGBTs using a DSP; pulse width modulation techniques	2	
Current, voltage and rotor speed measurement in control systems of electrical machines; an overview of measurement methods and types of measuring instruments	2	
Estimation methods of magnetic flux linkages and electromagnetic torque of an induction machine	2	
Switched reluctance machine as an object of control	3	
Basic control systems with the switched reluctance machine	2	
Examples from practice with electrical machines; electro-cars and industrial solutions	2	
List of laboratory exercises		LE hours
DC motor speed control by Simoreg converter, made by Siemens		3

	Volt per hertz speed control of induction motor by the DSP	3
	Field-oriented speed control of induction motor by the DSP	3
	Induction motor control by the PC and Danfoss frequency converter	3
	Simulation of control system of the switched reluctance machine	3

Format of instruction	x lectures ☐ seminars and workshops ☒ exercises ☐ *on line* in entirety ☐ partial e-learning ☐ field work	x independent assignments ☒ multimedia x 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		Laboratory exercises	1
	Midterm exams	0.3	Oral exam		Auditory exercises	0.5
	Written exam	0.2	Project		(Other)	

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

During the semester, two midterm exams are held - the first after 7 weeks of lectures and the second after 13 weeks of lectures. Each midterm exam consists of 4 problems, either theoretical or numerical. In the final exams, students take those parts of the course which they did not pass in the midterm exams.

The requirement for passing grade is that the sum of the laboratory exercises' grade (L) and the midterms' grades (M1 and M2), expressed as a percentage, is 50% or more. The sum is calculated as

Grade (%) = 0.25L + 0.375(M1 + M2)

where the number of points achieved in each midterm exam has to be at least 50%.

The students that do not pass the midterm exams take the final written exam which consists of 4 problems. The requirement for a positive evaluation of the final exam is at least 50% points achieved. In the final exam, the students that did not pass one of the midterm exams are presented with 4 problems from the corresponding part of the course. Subsequently, the grade is determined as follows:

Grade (%) = 0.25L + 0.75(I)

where I is the number of points achieved in the final written exam (at least 50%).

The final grade for the course is determined as follows:

50% to 61% - Sufficient (2)
62% to 74% - Good (3)
75% to 87% - Very good (4)
88% 100% - Excellent (5)

Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	D. Vukadinović: Predavanja za šk. god. 2011/12.		e-learning portal
Optional literature (at the time of	S. N. Vukosavić: Digital Control of Electrical Drives, Springer, 2007		

submission of study programme proposal)	
Quality assurance methods that ensure the acquisition of exit competences	- Keeping records of student attendance - Annual analysis of the performance at midterm exams and final exams - Feedback from students via surveys - Self-evaluation of teachers - Feedback from graduated students
Other (as the proposer wishes to add)	

NAME OF THE COURSE	DESIGN OF ELECTRICAL NETWORKS AND SUBSTATIONS						
Code	FENI38	Year of study	2.				
Course teacher	Ranko Goić, Ph.D., Full Professor	Credits (ECTS)	4				
Associate teachers	Stipe Vodopija, MSc	Type of instruction (number of hours)	L	S	AE	LE	DE
			15	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 knowledge and principles of energy and construction related laws, standards and technical regulations, - making of design documentation - working in CAD software - calculation needed for equipment sizing, selection and specification	
Course enrolment requirements and entry competences required for the course	Passed exams in basic courses related to power system networks and substations	
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - recognize and interpret important parts of laws and technical standards in design process - describe differences between levels of design documentation - describe important parts of main design - use CAD software - prepare simple design of power line and substation - recognize important technical requirements and make basic calculations on the basis of which will be able to make a selection and specification of equipment	
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours
	Technical regulations and standards in electrical engineering. Power systems and construction related laws.	2
	Geodetic and other inputs for design. Graphical symbols and marking of electrical equipment. Terms of reference and particular conditions for design.	2
	Types and content of design documentation. Components of concept, main and executive design. Responsibility of designer.	2
	Basic calculations for sizing and choosing of equipment. Examples of ampacity and voltage drop calculations used for equipment sizing and selection. Other calculations.	2
	Design of cables and overhead lines. Selection of cable route. Selection of overhead line route. Specific calculations for cables and overhead lines design.	2
	Design of substations. Primary equipment. Earthing system. Secondary equipment. Wiring diagrams and schemes. Specific calculations for design of substations MV/LV, MV/MV, HV/MV.	3
	Specification of equipment and works. Making of bill of quantity.	2
	List of laboratory exercises	LE hours
	Introduction of working with AutoCAD. Graphical symbols and drawing of basic electrical elements. Blocks in AutoCAD.	2
	Advanced topics in AutoCAD-u (first part): Title blocks. Layers. Layouts for print.	2

	Advanced topics in AutoCAD-u (second part): coordinate systems, using of topographic and cadaster maps. Maps geocoding.	2
	Drawing of basic electrical schemes.	2
	Concept and main design for substation MV/LV. Layout. Basic calculations. Earthing system. Equipment specification and bill of quantity.	4
	Design of MV cable. Concept design - route selection. Main design – basic calculations, drawings, Equipment specification and bill of quantity.	4
	Design of electrical installations in buildings.	4
	Drawing of wiring diagrams.	4
	Seminar (preparatory part in lab.)	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	0,5	Research		Practical training	
	Experimental work		Report		Individual work	1,2
	Essay		Seminar essay	1	Laboratory exercises	1
	Tests		Oral exam		Preparation for laboratory exercises	0,2
	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 works during laboratory exercises. There are two midterms and final exams. The first midterm exam, covering all lectures, is being held after end of lecturing (8^{th} week) in form of written test. The second midterm exam is carried out in form of seminar work (making of selected concept design) after 13 weeks of lecturing. In the two final exams students that did not pass the first midterm exams must repeat the test. 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 % of written test in midterm, final or additional exam and positively graded seminar. Grade (in percentage) is formed according to following formula: Grade (%) = 0,4xKP+0,5xS+0,1xP Activities in percentage: • KP - written test results • S1 – grade of seminar • P – attendance at lectures Grade (in number) is formed as follows: • 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	**Title**	**Number of copies in the library**	**Availability via other media**

library and via other media)	Goić, R., "Predavanja iz projektiranja električlnih mreža i postrojenja", Sveučilište u Splitu, FESB, Split, 2015. (internal script)		e-learning portal
	Crtanje u AutoCAD-u, Naklada Lučić, 2012		-
Optional literature (at the time of submission of study programme proposal)	• Zbirka propisa za polaganje stručnog ispita iz elektrotehničke struke, Elektrotehničko društvo Zagreb, 2014. • Srb, V., "Električne instalacije i niskonaponske mreže", Tehnička knjiga, Zagreb, 1991.		
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	DESIGN OF MAGNETIC CIRCUITS							
Code	FENI42	Year of study	2.					
Course teacher	izv. prof. dr. sc. Marin Despalatović	Credits (ECTS)	4					
Associate teachers		Type of instruction (number of hours)	L	S	AE	LE	DE	
			30			15		
Status of the course	Elective	Percentage of application of e-learning	0					

COURSE DESCRIPTION		
Course objectives	Training students for understanding electric and magnetic quantities and procedures for designing inductors, transformers and electric machines.	
Course enrolment requirements and entry competences required for the course	Competences and skills acquired with the bachelor's degree in electrical engineering.	
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: 1. Analyze properties of various magnetic materials, 2. Compare methods for measuring material's magnetic properties, 3. Model magnetic circuits, 4. Use computer tools for calculation of electric and magnetic circuits, 5. Propose procedures and equations for designing various magnetic components based on given specifications, 6. Critically assess design procedures of magnetic components.	
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L or S hours
	The properties of magnetic materials: solid metals, powdered metals, ceramics, air, permanent magnets. Winding and core losses of magnetic components: hysteresis loop, eddy current losses, influence of higher harmonics on total losses.	2
	Measurements of material's magnetic properties, methods for determination of saturation curve and measuring core losses.	2
	Magnetic circuit: concentrated and distributed excitation, main and leakage fluxes, inductances, influence of circuit geometry on magnetic flux and density distribution, energy stored in magnetic field.	2
	Basics of linear and nonlinear magnetic circuit calculation.	2
	Computer tools for modeling and designing electric, magnetic and thermal quantities.	2
	Inductor design: inductance, maximum flux density, winding losses, optimum effective permeability, core losses, the thermal equation, current density in the windings, dimensional analysis.	2
	The procedure and equations for the design of inductors. Design examples of inductors for power electronics.	2
	First midterm exam	2
	Transformer design: ideal and real transformer, no load and load conditions, reflected impedance, magnetizing current and core losses, winding resistance and losses, magnetic leakage, equivalent circuit, voltage and power equations, optimization, power factor.	2
	The procedure and equations for the design of transformers, high frequency effects in the windings and the core.	2
	Design examples of transformers for power electronics.	2

	Basic machine concepts: phases, poles, slots, teeth, yokes, windings. Main dimensions of rotating machines: air gap, mechanical, electrical and magnetic loadability. Machine specifications and design principles.	2
	The procedure and equations for the design of AC electrical machines: stator core, winding and slot sizing, rotor slots, the magnetization current, resistances and inductances, losses and efficiency, temperature rise. Heat transfer: losses, heat removal, thermal equivalent circuit.	2
	Design examples of AC electrical machines.	2
	Second midterm exam	2
	List of laboratory or design exercises	LE or DE hours
	1. Measurement of saturation curve, hysteresis loop and core losses of magnetic materials	2
	2. Inrush current transients during energization of transformer	1
	3. Design of inductors for DC and AC electric drives	3
	4. Design of transformers for power electronics	3
	5. Stator and rotor design of AC machines	3
	6. Design of electric machines with permanent magnets	3

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

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	1,8
	Essay		Seminar essay		Laboratory exercises	0,5
	Tests	0,1	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	There are two midterm exams during semester. The first midterm exam is after 7 weeks of lecturing and the second one is after the next 6 weeks. By midterm exams students can pass the entire exam. On the exam (final, correctional and commission) students take the parts of course material which they did not pass on the midterm or previous exams. A separate part of the course material means the material of each midterm exam. The exams are carried out in written form. The duration of the midterm exams are 60 minutes, while exams are 2x60 minutes. The requirement for passing grade is at least 50% of points on each (midterm) exam and the positive assessment (minimum 50% of points) of all laboratory exercises. Grade (in percentage) is formed as follows: $$Grade(\%) = (ME1 + ME2 + LE) / 3$$ where ME1, ME2 - points obtained at (midterm) exams expressed in percentages LE - average grade of all laboratory exercises expressed in percentages The final grade is determined as follows:

<table>
<tr><td></td><td colspan="3">Percentage Grade
0% to 49% insufficient (1)
50% to 61% sufficient (2)
62% to 74% good (3)
75% to 87% very good (4)
88% to 100% excellent (5)

Examinations are held in accordance with the course calendar schedule.</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>R. Wolf: Osnove električnih strojeva, Školska knjiga, Zagreb, 1995.</td><td>1</td><td></td></tr>
<tr><td>The Simulation Platform for Power Electronic Systems, PLECS User Manual (Ver 4.0), Plexim GmbH, Zurich, 2016.</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">W. G. Hurley, W. H. Wölfle: Transformers and Inductors for Power Electronics: Theory, Design and Applications, John Wiley & Sons, Ltd, Chichester, 2013.
A. V. den Bossche, V. C. Valchev: Inductors and Transformers for Power Electronics, CRC Press, Taylor & Francis Group, LLC, Boca Raton, 2005.
I. Boldea, S. A. Nasar: The Induction Machines Design Handbook (2ed), CRC Press, Taylor & Francis Group, LLC, Boca Raton, 2010.
J. Pyrhonen, T. Jokinen, V. Hrabovcová: Design of rotating electrical machines, John Wiley & Sons, Ltd, Chichester, 2008.
D. C. Hanselman: Brushless permanent magnet motor design, Magna Physics Publishing, Lebanon, 2003.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">- Keeping records of students course attendance
- Annual review of the performance of the examinations
- 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	DESIGN OF POWER CONVERTERS						
Code	FENI43	Year of study	2.				
Course teacher	Božo Terzić, Ph.D., Full Professor	Credits (ECTS)	4				
Associate teachers	Goran Majić, Ph.D.	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	15	0
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - designing semiconductor power converters - permanent adoption and deepening of knowledge in the field of power converter
Course enrolment requirements and entry competences required for the course	Entry competences: - Basic knowledge of the courses Power Electronics and Semiconductor Power Convertersor
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - select the semiconductor power components for the appropriate type and power of semiconductor converter for a defined application, - calculate and choose capacitive and magnetic components for the semiconductor power converter, - calculate and select the cooling system on the basis of the converter losses calculation, - participate in the development and commissioning of a simple laboratory model of semiconductor converters - define procedure and carry out the type testing of the converter prototypes, - design of simple control electronic circuits for the power converter.

Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	Introduction. Areas of application of power converters. The divisions of the converters to the input / output variables. Basic converter topologies.	2	0
	The characteristics of semiconductor components used in power converters (IGBT transistor, tyristor, MOSFET transistor). Datasheet parameters of semiconductor components.	2	0
	The basic characteristics and types of inductors used in power converters. The basic principle of calculation and selection of inductors.	2	0
	The basic characteristics and types of capacitors used in power converters. The basic principle of calculation and selection of capacitors.	2	0
	Designing power circuit of three-phase IGBT inverter. Basic topologies of the IGBT power modules. Calculating conduction and switching losses of IGBT module.	2	0
	Air and liquid cooling systems for power converters. Designing air cooling systems.	2	0
	Basic characteristics and design of drivers for IGBT module. IGBT short-circuit protection realized within driver circuit.	2	0

	Design of DC link circuit of IGBT inverter including DC buses, capacitor banks and IGBT overvoltage protection.	2	0
	The control system of power converter. The basic structures and elements of microprocessor control system for IGBT inverter.	2	0
	Programming of microprocessor control system. Programming language and tools. Basic program structure, input/output variable, interrupts, controllers, PWM outputs.	2	0
	Communication interfaces between converters and humans or the superior system (RS485, RS232, Profibus, CANbus, Modbus, Ethernet,).	2	0
	Design and select components for electromagnetic compatibility of power converter (input chokes, RFI filter, du/dt filter, output sine filter).	2	0
	Standards, type testings and certification of power converters.	2	0
	List of laboratory exercises		LE hours
	Analysis of IGBT module datasheets and their selection for the defined structure and ratings of power converter.		3
	Driver specification for IGBT modules and their selection for a defined topology and ratings of power converter.		3
	Design of air cooling system for three phase IGBT inverter. Select of heatsink and fan.		3
	Mechanical arrangement of IGBT inverter including IGBTmodules, cooling system, drivers, DC and AC buses, capacitor banks.		3
	Preparing for a group seminar "Design and manufacture of laboratory model of power converter." Distribution of tasks to students.		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	2,5
	Essay		Seminar essay		Laboratory exercises	0.5
	Tests				Preparation for laboratory exercises	
	Written exam		Project		(Other)	

Grading and evaluating student work in class and at the final exam	The final grade is obtained based on assessment of laboratory exercises and oral presentation of practical work (built laboratory model of power converter), according to the formula: Grade(%) = 0,3 LE + 0,7 PW where the activities in percentage: • LV – laboratory exercise, • PW – practical work. The final grade is determined according to the following criteria: • 50-62% - sufficient (2) • 63-75% - good (3)

<table>
<tr><td></td><td colspan="3">• 76-88% - very good (4)
• 89-100% - excelent (5)

The practical work is presented at the first or second final exam.</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>2. I. Flegar: Elektronički energetski pretvarači, Kigen, Zagreb, 2010.
3. Application Manual Power Semiconductors, published by SEMIKRON International Gmbh, 2011.</td><td>10</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. T. Brodić: Osnove energetske elektronike – poluvodički energetski pretvarači, Zigo, Rijeka
2. M.H. Rashid: Power Electronics – Circuits, Devices and Applications, Pearson Prentice Hall, USA, 2004.
3. http://www.infineon.com/cms/en/product/power/igbt/igbt-module/igbt-module-1200v/channel.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	DIGITAL CONTROL SYSTEMS							
Code	FENI15	Year of study	2					
Course teacher	Ozren Bego, Ph.D., Associate Professor	Credits (ECTS)	6					
Associate teachers	Danijel Jolevski, Ph.D., Assistant Professor	Type of instruction (number of hours)	L	S	AE	LE	DE	
			45	0	0	15	0	
Status of the course	Obligatory	Percentage of application of e-learning	0					

COURSE DESCRIPTION

Course objectives	Training students for: - understanding idea of digital control systems, - analyze digital control systems, - digital controller design based on analytic and empiric methods, - design advanced digital control structures like cascade control, feedforward control, Smith predictor, etc.		
Course enrolment requirements and entry competences required for the course	Passed Control Engineering.		
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - define structure and elements of digital control system, - analyze digital systems with digital transfer function and in state space, - analyze stability of digital control system, - design digital controller with: - algebraic algorithms, - empiric algorithms, - grafoanalitic algorithms, - design and program industrial PID controller, - design advanced digital control structure like cascade control and feedforward control, - use digital control system in processes with large dead time (Smith predictor).		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L or S hours	AE hours
	Introduction in digital systems. Elements of digital control systems (sensors, A/D and D/A convertors, digital computers).	3	1
	Structure of digital control system. Sampling.	3	1
	Frequency spectrum of sampled signal. Aliasing effect.	3	1
	Extrapolation of digital signal. Zero-order hold.	3	1
	Description of linear discrete system by differential equation and Z transform.	3	1
	Inverse Z transform. Property of Z transform. Discrete transfer function.	3	1
	Description of digital control system in state space.	3	1
	First midterm exam	3	
	Stability of digital control system. Jury criteria, bilinear transform	3	1
	Synthesis of digital controller. Analytical criteria.	3	1
	Digital PID controller. PID parameter adjustment. Empiric approach	3	1
	Cascade control. Technical and symmetrical optimum.	3	1

	Advanced control structures. Feedforward control.	3	1
	Synthesis of unconventional controllers. Compensation and predictive controllers.	3	1
	Second midterm exam	3	
	List of laboratory or design exercises		LE or DE hours
	Introduction in MATLAB		2
	Simulation of sampling and extrapolation processes.		2
	Analyze of sampling time influence on control quality of DC motor with independent excitation.		2
	Syntheses of digital speed PID controller of DC motor with independent excitation.		4
	Relay method of empiric PID controller adjustment		2
	Smith predictor		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	1.5	Research		Practical training	
	Experimental work		Report		Laboratory attendance	0.5
	Essay		Seminar essay		Independent work	3.2
	Tests	0.2	Oral exam		Preparation for laboratory work	0.5
	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. Each midterm test consists of 3 theoretical questions and 2 numerical problems and final tests consist of 4 theoretical questions and 3 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 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.

	Title	**Number of copies in the library**	**Availability via other media**
Required literature (available in the library and via other media)	O. Bego: Predavanja iz predmeta Digitalni sustavi upravljanja, 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)	

NAME OF THE COURSE	DISTRIBUTED GENERATION						
Code	FENI40	Year of study	2				
Course teacher	Damir Jakus, Ph.D. Assistant Professor	Credits (ECTS)	4				
Associate teachers		Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	15	
Status of the course	Elective	Percentage of application of e-learning	30				

COURSE DESCRIPTION

Course objectives	Training students for: - Understanding the specifics related to the working principles and operating characteristics of renewable energy sources as well as project financing options - Implementation of a legislative framework that promotes production from RES - Assessment of the annual energy potential for various types of RES - Selection of the optimal parameters and project solutions for different RES - Analysis of network conditions after connection of RES
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 different RES technologies, explain their methods of operation and list main system components for different RES plants - Estimate the annual electricity production for certain types of RES power plants and evaluate project profitability - Define the basic technical requirements which need to be met by RES when connecting to the power system - Conduct the RES grid connection analysis and elaborate gird impacts - Explain the impact of RES large scale integration on power system development, planning, operation and management - Select the parameters for standalone and grid connected system - Define different electricity storage options and explain basic characteristics and their methods of operation - Explain the potential role of electricity storage in modern power systems, .

Course content broken down in detail by weekly class schedule (syllabus)	Course content	L or S hours	AE hours
	1 Overview of the current state of Croatian power system and guidelines for further development. Review of the EU energy policy guidelines. Overview of the legal framework for eligible producers of electricity and incentive methods.	2	
	2 Wind power plants: wind energy, wind turbine types, generators types, other parts of the wind turbines, internal network design and grid connection, onshore and off-shore plants, production control, wind forecasting...	4	

	3	Photovoltaic power plants: solar radiation, calculation of solar radiation on a tilted surface, the basic structure and working principle of solar cells, characteristic parameters of solar cells and their temperature and irradiation dependence, different types of photovoltaic modules, other components of standalone and grid connected PV system, connection to the electricity network, sizing of an autonomous system, ...	3		
	4	Solar thermal power plants: basic design and operating principles, sun tracking system, solar heating and passive architecture	2		
	5	Small hydro power plants: different types of HPP and hydro turbines, hydro turbine selection, calculation of electricity generation, other parts of small HPP, the environment impact, ..	4		
	6	Biomass: different type of biomass, energy crops, process and environmental aspects of the production of bioethanol / biodiesel, wood biomass, biogas production and landfill gas, ...	2		
	7	Geothermal power plants: selection of suitable locations, types of geothermal energy, direct use of heat energy, different means of electricity production, heat pumps, ...	2		
	8	Marine and ocean energy: tidal power, power plants on ocean currents, wave energy converters, ocean thermal energy converters, operating principles, site selection, energy potential, …	3		
	9	The variability of RES production and the impact on power system regulation reserves. Technical conditions for connecting RES to the power system.	3		
	10	Profitability analysis for RES	2		
	11	Methods of storing electricity: pumped hydro storage, compressed air storage, flywheels, electrochemical storage technologies,…, the role of electricity storage in modern power systems, the ability to provide ancillary services to power system, ...	3		

	List of laboratory or design exercises	LE or DE hours
	1. Technical visit to roof mounted PV power plant	2
	2. Technical visit to wind power plant	3
	3. Introduction to software package Homer	2
	4. Project assignment regarding standalone and grid connected system design and profitability calculation	2
	5. Project assignment regarding solar collector system design and profitability analysis	2
	6. Techno-economic analysis of investment in PV power plant	2
	7. Analysis of RES connection impacts on power losses and voltage profile change in the MV distribution network	2

Format of instruction	☒ lectures ☐ seminars and workshops ☐ exercises ☐ *on line* in entirety ☐ partial e-learning	☒ independent assignments ☒ multimedia ☒ laboratory ☐ work with mentor

<table>
<tr><td></td><td colspan="6">☒ field work</td><td></td></tr>
<tr><td>Student responsibilities</td><td colspan="7">- The presence on lectures in the amount of at least 70 % of the scheduled time.
- Completed all required laboratory exercises.
- Completed and positively graded seminar assignment.</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>0,5</td><td>Self work</td><td>1</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>Laboratory work</td><td>0.5</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="7">During the semester there will be two midterm exams covering lectures. The first midterm exam will be in the eighth week of summer semester, and the second one in the last week of summer semester. As a part of laboratory exercises students will be given their work assignments which will be graded after completion. Student can pass the class by passing two midterm exams and by completing their laboratory work assignments. In the two final exams in February and March, students can pass reaming part(s) which they didn’t pass through midterm exams. Also, if the student passes one part of class materials through first final exam, then he is not obliged to re-take that part of the exam in the second final exam. The class subject is divided into two parts according to separation defined for midterm exams.

Students who have failed to pass the class after two final exams can try to pass the subject by taking the disciplinary exam which is organized in first part of autumn term. The last chance to pass the subject is through commission exam which will be held in the second part of the autumn exam period. During the disciplinary and commission exam students have to re-take whole exam covering both subject parts regarding their previous results in mid-term and final exams. In autumn term the requirement for positive mark is that the student has at least 50% success on the exam as well as positive mark from seminar assignment.
The requirement for positive mark is that the student has at least 50% points from each part of the course subject during midterm and final exams (or 50% points for the entire course subject on disciplinary and commission exam), as well as positively evaluated seminar assignment. The final score (in percentage) is formed on the basis of all activities according to the formula:

Grade (%) = 0,35xG1 + 0,35xG2 + 0,3xS
Grade (%) = 0,7xG + 0,3xS (for disciplinary and commission exam)

wherein:
• G1, G2 - points obtained for each subject part during midterms and(or) final exams
• G - points obtained during disciplinary and commission exam
• S – point given for seminar assignment

The final grade is determined as follows:
Grade (%) Mark
50 % do 61% sufficient (2)
62 % do 74 % good(3)
75 % do 87 % very good(4)</td></tr>
</table>

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

Exam terms:
The first and second final exam: February / March
The disciplinary and commission exam: August / September

Under the Article 65 of the Faculty Statute, the student is required to participate in all forms of teaching and attend: lectures at least 70% of scheduled time and laboratory exercises 100% of scheduled time. If you do not meet these requirements, the student will not be able to take the examination.</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>Jakus, D.: Obnovljivi izvori energije, skripta + slajdovi s predavanja + dodatni materijali</td><td></td><td>e-learning</td></tr>
<tr><td>Jakus, D., Krstulović Opara, J. : Obnovljivi izvori energije - upute za laboratorijske vježbe -, Split 2013.</td><td></td><td>e-learning</td></tr>
<tr><td>Šljivac, D., Šimić, Z.: Obnovljivi izvori energije s osvrtom na uštede, udžbenik, ETF Osijek, 2008.</td><td></td><td></td></tr>
<tr><td>Rajkovič, D.: Proizvodnja i pretvorba energije, Rudarsko-geološko-naftni fakultet, Zagreb, 2011</td><td></td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">- L. Freris, D.Infield: Renewable Energy in Power Systems, Wiley, 2008
- T. Ackerman: Wind Power in Power Systems, Wiley, 2012.
- J. Twidell, T. Weir: Renewable Energy Resources, Taylor & Francis, 2005.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">- Keeping records of student class attendance
- Annual review of the exam success
- Feedback from students via surveys
- Self-evaluation of teachers
- Feedback on the subject relevance from the former students who have already graduated</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="3"></td></tr>
</table>

NAME OF THE COURSE	DISTRIBUTION NETWORKS AND DISPERSED GENERATION						
Code	FENI32	Year of study	2				
Course teacher	Matislav Majstrović, Ph.D. Full Professor Elis Sutlović, Ph.D. Full Professor	Credits (ECTS)	4				
Associate teachers		Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	15	0
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - acquiring knowledge about the role, capabilities and characteristics of dispersed power generation, - deepening of knowledge about the power distribution networks analysis - adoption and acquire knowledge about the development and operation of distribution 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: 1. Classify and analyse types of distribution systems 2. Compare the characteristics of distributed power sources 3. Apply technical regulations and standards in the area of distributed power sources design 4. Planning the distribution networks development with dispersed sources 5. Design and dimension the distribution network 6. Determine the impact of distributed generation on distribution system 7. Determine the Influence of dispersed sources on Distribution Management System (DMS)	
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours
	Generally on the application of distribution systems (gas, water, electricity, etc.), power distribution networks.	2
	Dispersed generation of electricity. Cogeneration.	2
	Small hydropower plants. Onshore wind farms.	2
	Offshore wind farms. Photovoltaic systems.	2
	Integration of distributed energy resources into a grid.	2
	Modeling of distribution network components.	2
	Impact of dispersed generation on power distribution systems	2
	First midterm exam	
	Power quality. Protection of distribution networks with distributed generation.	2
	Impacts of distributed generation on systems stability, control and reliability.	2
	Distribution network design and dimensioning.	2
	Development of electricity infrastructure	2

	Optimal size and location of distribution network components.	2
	The impact of distributed sources on the building cost and the control of the distribution network.	2
	Second midterm exam	
	List of laboratory exercises	LE hours
	Concept of the Flexible Alternating Current Transmission System - description of the relevant elements.	2
	Tyristor-Switched Capacitors - TSCs)	2
	Tyristor-Switched Reactors -TSRs	2
	Tyristor-Controlled Reactor - TCR	2
	Static voltage regulation	2
	Basic principles of power flow regulation	2
	High-voltage DC Transmission Systems	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	2,3
	Essay		Seminar essay		Laboratory exercises	0,5
	Tests	0,2	Oral exam		Preparation for laboratory exercises	
	Written exam		Project		(Other)	

Grading and evaluating student work in class and at the final exam	There are two midterms and final exams. The first midterm exam is after 7 weeks of lecturing and the second one is after the next 6 weeks. Each midterm test consists of 4 theoretical questions and final tests consist of 6 theoretical questions. 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(%) = 0,05 AL + 0,15LA + 0,40 (M1 + M2) the activities in percentage: • AL - attendance at lectures, • LA – laboratory assessment, • M1, M2 – test results. The final grade is determined as follows: Percentage Description 50% do 61% Sufficient (2) 62% do 74% Good (3) 75% do 87% Very Good (4) 88% do 100% Excellent (5)

<table>
<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>1. Gonnen, T.: Electric Power Distribution System Engineering, Mc Graw-Hill Book, New York, 1976.</td><td></td><td></td></tr>
<tr><td>2. Lakervi, E.; Holmes, E.J.: Electricity distribution network design, Peter Pereginns, London, 1989.</td><td></td><td></td></tr>
<tr><td>3. Kersting, W. H., Scott W., G.: Distributed Power Generation, Marcel Dekker, New York, 2002.</td><td></td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">• Jenkins, N., Allan, R., Crossley, P., Kirschen D., Strbac, G.: Embedded Generation, IEE Power and Energy Series 31, London, 2000
• Kersting, W. H.: Distribution System Modeling and Analysis, CRC Press, London, 2002
• Willis, H. L.: Spatial Electric Load Forecasting, Marcel Dekker, New York, 2002</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	ELECTRIC SERVO DRIVES						
Code	FENI20	Year of study	2.				
Course teacher	Božo Terzić, Ph.D., Full Professor	Credits (ECTS)	4				
Associate teachers	Goran Majić, Ph.D.	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	15	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 drives - permanent deepening of knowledge in the small electric motors		
Course enrolment requirements and entry competences required for the course	Entry competences: - Basic knowledge of the course Electric Drives - Basic knowledge of the course Power Converters - Basic knowledge of the course Electric Machines		
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 and robotics.	2	0
	Mechanical systems in servo drives. Calculation and reduction of moment of inertia. Mechanical transmissions, shafts, bearings and mechanical couplings.	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
	The permanent magnet motors. Brushless DC motors (BLDCM). Voltage and current waveforms of the BLDCM. Control structures of BLDCM drives. Sensorless control of the BLDCM.	2	0
	Permanent magnet synchronous motor (PMSM). Voltage and current waveforms of the PMSM. Vector control of PMSM. Sensorless control of PMSM.	2	0
	Servo drives with induction motor (IM). Rotor flux oriented vector control of the IM.	2	0
	Sensorless control of induction motor. Speed estimators based on stator voltage and current measurement. MRAS estimators.	2	0
	Presentation of student seminars.		

<table>
<tr><td rowspan="13"></td><td colspan="2">Linear motors. Power converters for linear motors. Basic control structures for linear motors.</td><td>2</td><td>0</td></tr>
<tr><td colspan="2">Switched reluctance motor (SRM). Power converters for SRM. Basic control structures for SRM.</td><td>2</td><td>0</td></tr>
<tr><td colspan="2">Torque motors. Operation principle, construction and control of torque motors.</td><td>2</td><td>0</td></tr>
<tr><td colspan="2">Motor speed and rotor position sensors. Incremental, absolute and sin/cos encoder. Resolver.</td><td>2</td><td>0</td></tr>
<tr><td colspan="2">Communication interfaces in servo drives (PROFIBUS, Industrial Ethernet, CAN open, Profinet)</td><td>2</td><td>0</td></tr>
<tr><td colspan="2">Examples of servo drives in machine tools and robotics.</td><td>2</td><td>0</td></tr>
<tr><td colspan="2">Presentation of students' practical work.</td><td></td><td></td></tr>
<tr><td colspan="3">List of laboratory exercises</td><td>LE hours</td></tr>
<tr><td colspan="3">Control of Brushless DC motor.</td><td>3</td></tr>
<tr><td colspan="3">Vector control of permanent magnet synchronous motor.</td><td>3</td></tr>
<tr><td colspan="3">Servo drive with stepper motor in microstep operation</td><td>3</td></tr>
<tr><td colspan="3">Positioning system with permanent magnet synchronous motor</td><td>3</td></tr>
<tr><td colspan="3">Positioning system with induction motor</td><td>3</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="2">☒ independent assignments
☒ multimedia
☒ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="4">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</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>1</td><td>Laboratory exercises</td><td>0.5</td></tr>
<tr><td>Tests</td><td></td><td>Oral exam</td><td></td><td>Preparation for laboratory exercises</td><td>0.5</td></tr>
<tr><td>Written exam</td><td></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">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(%) = 0,5 SW + 0.5 PW
where the activities in percentage:
• 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)</td></tr>
</table>

<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	ELECTRIC SWITCHING DEVICES						
Code	FENI50	Year of study	2.				
Course teacher	Rino Lucić, Ph.D., Full Professor	Credits (ECTS)	4				
Associate teachers		Type of instruction (number of hours)	L	S	AE	LE	DE
			30			15	
Status of the course	elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - acquiring knowledge of switching devices, switching overvoltages - sizing and selection of switching devices		
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 the working principle and characteristics of electrical switching devices, - define the characteristic values for the selection of switching devices in the network - simulate switching overvoltages in electrical network using software tools, - analyze the results of the simulation of switching overvoltages		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L or S hours	AE hours
	Theory of electrical contacts. Thermal and electrodynamic stresses	2	
	Basic theory of electric arc.	2	
	AC circuits interruption, busbar short circuit,short-line fault, disconnection of unloaded transmission lines, transformers and cables. Connecting the two systems out of synchronism, the opposition of phases.	6	
	Switching transients.	4	
	DC circuits interruption,	6	
	Power of arc at closing and interruption	2	
	Switching techniques in the air, oil, gas SF6 and vacuum	2	
	Design of switches, circuit breakers, switches, contactors, disconnectors, fuses and surge arresters.	2	
	List of laboratory or design exercises		LE or DE hours
	The basics of the program package ATP-EMTP		3
	Three-pole disconnection of unloaded cables		3
	Switching transients of isolated network with different load characteristics. Overvoltage factors		3
	Switching transients of grounded network with different load characteristic for isolated network. Overvoltage factors		3
	Switching transients of low-resistance grounded network with different load characteristic for isolated network. Overvoltage factors		3
Format of instruction	☒ lectures	☐ independent assignments	

<table>
<tr><td></td><td colspan="3">☐ seminars and workshops
☐ exercises
☐ on line in entirety
☐ partial e-learning
☐ field work</td><td colspan="3">☐ multimedia
☒ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">The presence at the lectures 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>0,7</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>Independent 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></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></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="6">During the semester there will be two tests. The first test will be at the eighth week of classes, the second at the first week of the exam period. Student can pass the entire exam by tests.
At the two final exams, students take parts of the curriculum that did not pass by tests. If at the first final exam student passes one of the two parts of curriculum that part of curriculum the student does not have to take on another final exam.
The condition for positive assessment is that the student has at least 50% of each part of the curriculum at the tests or at the final exam The final grade (in percent) is formed on the basis of all activities according to the formula:

Rating (%) = 0.1 * LV + 0.45 * (G1 + G2)

wherein the activity is expressed in percentage according to:

LV - percentage obtained by laboratory exercises,
G1, G2 - percentage obtained by tests or exams of the parts of curriculum given in lectures.

Students who did not pass the exam after two final exams can pass the exam at the last week of August or the first week of September. Last chance to take the exam in this school year is a commission exam. In a commission exam all students take the entire curriculum, and the condition for positive assessment is that the student has at least 50% of entire curriculum.

The final score (in percentage) is formed on the basis of all activities according to the formula:

Rating (%) = 0.1 * LV + 0.9 * G

wherein the activity is expressed in percentage according to:

LV - percentage obtained by laboratory exercises,
G - percentage obtained by exams of the entire curriculum given in lectures.

The final grade is determined as follows:

Rating Grade
50% to 61% sufficient (2)</td></tr>
</table>

<table>
<tr><td></td><td colspan="3">62% to 74% good (3)
75% to 87% very good (4)
88% 100% excellent (5)

Under Article 48 of the Statute of the Faculty, the student is required to participate in all forms of teaching activities: lessons attendance at least 70% and 100% of laboratory exercises. Student should make 100% of laboratory reports. If a student does not meet these requirements, s student will not be able to take the 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>R.Lucic: 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">- B. Belin: Introduction to electric switching apparatus, ŠK Zagreb, 1978.
- K. Meštrović: switching devices for medium and high voltage, Graphis, 2007.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">- Keeping records of his attendance
- Annual review of the performance of the examinations
- Student survey in order to evaluate teachers
- Self-evaluation of teachers
- Feedback from students who have already graduated from the relevance of the course content</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="3"></td></tr>
</table>

NAME OF THE COURSE	ELECTRICAL INSTALLATIONS TESTING						
Code	FENI29	Year of study	2.				
Course teacher	Rino Lucić, Ph.D., Full Professor	Credits (ECTS)	4				
Associate teachers		Type of instruction (number of hours)	L	S	AE	LE	DE
			30			15	
Status of the course	elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - practical knowledge related to the testing of electrical installations, - application of standards on testing of electrical installations, - independently testing of electrical installations		
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: - acquire practical knowledge for testing of electrical installations, - apply the relevant Croatian standards for testing of electrical installations, - explain the basic requirements for testing of electrical installations, - analyze the results of tests of electrical installations		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L or S hours	AE hours
	Introduction: The effect of electric current on humans.	2	
	Characteristics and classification of electrical installations	2	
	Sources of danger. Safety measures.	6	
	Earthing. Measurement methods.	4	
	Checking and measurement. Testing protection against indirect contact in fault conditions	6	
	Examination of the other conditions laid down by standards in electrical installations	2	
	Testing and verification of protection against atmospheric overvoltage.	2	
	Inspection and testing of lightning installation.	2	
	List of laboratory or design exercises		LE or DE hours
	Checking the continuity of conductor		2
	Insulation resistance measurement		2
	Measurement of fault loop impedance		2
	Measurement of line loop impedance and calculation of short circuit current		3
	Testing of parameters of RCD		2
	Measurement of grounding grid resistance		2
	Measurement of soil conductivity		2
Format of instruction	☒ lectures ☐ seminars and workshops ☐ exercises ☐ *on line* in entirety	☐ independent assignments ☐ multimedia ☒ laboratory ☐ work with mentor	

<table>
<tr><td></td><td colspan="6">☐ partial e-learning
☐ field work</td><td>☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="7">The presence at the lectures 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>0,7</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>Independent 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></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></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="6">During the semester there will be two tests. The first test will be at the eighth week of classes, the second at the first week of the exam period. Student can pass the entire exam by tests.
At the two final exams, students take parts of the curriculum that did not pass by tests. If at the first final exam student passes one of the two parts of curriculum that part of curriculum the student does not have to take on another final exam.
The condition for positive assessment is that the student has at least 50% of each part of the curriculum at the tests or at the final exam The final grade (in percent) is formed on the basis of all activities according to the formula:

Rating (%) = 0.1 * LV + 0.45 * (G1 + G2)

wherein the activity is expressed in percentage according to:

LV - percentage obtained by laboratory exercises,
G1, G2 - percentage obtained by tests or exams of the parts of curriculum given in lectures.

Students who did not pass the exam after two final exams can pass the exam at the last week of August or the first week of September. Last chance to take the exam in this school year is a commission exam. In a commission exam all students take the entire curriculum, and the condition for positive assessment is that the student has at least 50% of entire curriculum.

The final score (in percentage) is formed on the basis of all activities according to the formula:

Rating (%) = 0.1 * LV + 0.9 * G

wherein the activity is expressed in percentage according to:

LV - percentage obtained by laboratory exercises,
G - percentage obtained by exams of the entire curriculum given in lectures.

The final grade is determined as follows:

Rating Grade
50% to 61% sufficient (2)
62% to 74% good (3)
75% to 87% very good (4)
88% 100% excellent (5)</td></tr>
</table>

<table>
<tr><td></td><td colspan="3">Under Article 48 of the Statute of the Faculty, the student is required to participate in all forms of teaching activities: lessons attendance at least 70% and 100% of laboratory exercises. Student should make 100% of laboratory reports. If a student does not meet these requirements, s student will not be able to take the 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>R.Lucic: 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">- G. G. Seip: Electrical Installation Handbook-Third Edition, John&Wiley, 2000.
- E. Mileusnić: Testing of low voltage electrical installations, ZIRSI,2006.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">- Keeping records of his attendance
- Annual review of the performance of the examinations
- Student survey in order to evaluate teachers
- Self-evaluation of teachers
- Feedback from students who have already graduated from the relevance of the course content</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">ELECTRICAL POWER SWITCHYARDS AND SUBSTATIONS</td></tr>
<tr><td>Code</td><td>FENI07</td><td>Year of study</td><td colspan="4">1.</td></tr>
<tr><td>Course teacher</td><td>Tonći Modrić, Ph.D., Assistant Professor</td><td>Credits (ECTS)</td><td colspan="4">6</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2"></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>0</td><td>15</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="4">0</td></tr>
<tr><td colspan="7">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="6">Training students for:
- understanding the basic theoretical and practical knowledge in substations,
- understanding the concepts of different electrical power switchyards and substations,
- analysis of various substation circuit configurations,
- selection of optimum substation circuit configuration,
- independently connecting of different protection relays in electrical power switchyard based on default schemes.</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="6">Attended course: Elements of Electrical Power Switchgears / Electrical Power Switchgears</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:
- sketch different main circuit configurations of the electrical power switchyards and substations,
- draw diagrams (schemes) of typical bays in substation,
- analyse different main circuit configurations in the electrical power switchyards,
- select the main circuit configuration of the electrical power switchyards,
- determine reliability of different main circuit configurations of the electrical power switchyards,
- evaluate the various methods of power transformer connection,
- categorize the systems of secondary equipment in the electrical power switchyard,
- distinguish the role and importance of electrical power switchyard grounding system.</td></tr>
<tr><td rowspan="8">Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="5">Course content</td><td>L hours</td></tr>
<tr><td colspan="5">Role of electrical power switchyards and substations in power system. Types, basic functions and construction principles of electrical power switchyards and substations.</td><td>2</td></tr>
<tr><td colspan="5">Basic system concepts of electrical power switchyards.
The classification of circuit configuration schemes.</td><td>5</td></tr>
<tr><td colspan="5">The structures of typical electrical power switchyard bays. Examples.</td><td>4</td></tr>
<tr><td colspan="5">Fundamentals of reliability theory and its application in selection of optimal single-line diagram and electrical power switchyard type.
Examples of calculation.</td><td>5</td></tr>
<tr><td colspan="5">Types and basic functions of substations.
Influences of the electrical network to substations.</td><td>3</td></tr>
<tr><td colspan="5">Power transformer on load operation: harmonics, unsymmetrical currents.</td><td>2</td></tr>
<tr><td colspan="5">Parallel operation of power transformers. Examples.</td><td>2</td></tr>
</table>

<table>
<tr><td></td><td colspan="5">Auxiliary consumption of substation (sources, loads and distribution of auxiliary voltages).</td><td>3</td></tr>
<tr><td></td><td colspan="5">Basic elements and types of secondary (auxiliary) systems.
The classic concept of secondary equipment (circuitry management, signaling, blocking, protection, measurements).</td><td>3</td></tr>
<tr><td></td><td colspan="5">Protective relay system in electrical power switchyard (overcurrent protection, ground fault protection, distance protection, differential protection, Buchholz relay, power transformer and bus protection).</td><td>3</td></tr>
<tr><td></td><td colspan="5">Protection measures (safety) in the power system. Grounding.
Lightning protecting of electrical power switchyards.</td><td>4</td></tr>
<tr><td></td><td colspan="5">Typical layouts of electrical power switchyards and substations.</td><td>3</td></tr>
<tr><td></td><td colspan="5">List of laboratory exercises</td><td>LE hours</td></tr>
<tr><td></td><td colspan="5">Electromechanical differential protection of power transformers.</td><td>3</td></tr>
<tr><td></td><td colspan="5">Static differential and overcurrent protection of power transformers.</td><td>3</td></tr>
<tr><td></td><td colspan="5">Numerical protection in the electrical power switchyard.</td><td>3</td></tr>
<tr><td></td><td colspan="5">Realization of Boolean algebra and switching functions.</td><td>3</td></tr>
<tr><td></td><td colspan="5">Controlling, signalling and interlocking of disconnectors in electrical power switchyard.</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="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 and submitted all written reports with measurement and calculation results.</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>1,7</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>3,0</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>Laboratory exercises</td><td>0,6</td></tr>
<tr><td>Tests</td><td>0,2</td><td>Oral exam</td><td></td><td>Preparation for laboratory exercises</td><td>0,4</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. Each midterm test consists of 4 theoretical questions and 1 numerical problem. Each final test consists of 8 theoretical questions and 2 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 with submitted all written reports and 50 % points on each midterm exam or the final exam. Grade (in percentage) is formed according to the formula:
Grade (%) = 0,05 NP + 0,05 LV + 0,45 (M1 + M2)
the activities in percentage:
• NP – attendance at lectures,
• LV – laboratory assessment,
• M1, M2 – midterm test results.
The final grade is determined as follows:
• 50 - 61 % sufficient (2)
• 62 - 74 % good (3)</td></tr>
</table>

<table>
<tr><td></td><td colspan="3">• 75 - 87 % very good (4)
• 88 - 100 % excellent (5)</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>T. Modrić: Autorizirana predavanja, FESB</td><td></td><td>e-learning portal</td></tr>
<tr><td>T. Modrić: Materijali za laboratorijske vježbe, 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">• H. Požar: Visokonaponska rasklopna postrojenja, Tehnička knjiga, Zagreb, 1990.
• R. Milošević: Vakuumski električni sklopni aparati, Graphis, Zagreb, 2011.
• A. Dolenc: Transformatori, Sveučilište u Zagrebu, 1968.
• J. D. McDonald: Electric Power Substation Engineering, CRC Press, 2003.
• J. J. Winders: Power transformers: Principles and Applications, Marcel Dekker Inc., New York-Bassell, 2002.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">- Evaluation of student presence on lectures
- 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>

<table>
<tr><td>NAME OF THE COURSE</td><td colspan="6">ELECTROMAGNETICS</td></tr>
<tr><td>Code</td><td>FENI01</td><td>Year of study</td><td colspan="5">1.</td></tr>
<tr><td>Course teacher</td><td>Slavko Vujević, Ph.D., Full Professor</td><td>Credits (ECTS)</td><td colspan="5">8</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2"></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">0</td></tr>
<tr><td colspan="7">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="6">Training students for:
- understanding of electromagnetic phenomena in power engineering,
- application of Maxwell equations in solving of static and dynamic electromagnetic problems,
- mathematical representation and solving of complex electromagnetic problems.</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:
- define the fundamental equations of electromagnetic fields,
- classify electromagnetic fields due to their characteristics,
- apply the fundamental laws of electromagnetic fields,
- describe mathematically complex electromagnetic phenomena,
- solve complex static and dynamic electromagnetic problems,
- mathematically describe electromagnetic waves on the power lines.</td></tr>
<tr><td rowspan="5">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">Basic terms. Maxwell equations in differential and integral form. Lorentz force. Electromagnetic potentials. Electromagnetic wave equations. Boundary conditions at the interface between two different media. Poynting theorem. Power transfer from the source to the load. Accumulated electromagnetic energy.</td><td>3</td><td>2</td></tr>
<tr><td colspan="4">Electrostatic field: electrostatic field equations, conductor in the electrostatic field, Coulomb law, Gauss law, electric voltage and electric potential, calculating the capacitance from accumulated energy, electric dipole, electrostatic energy, surface force density and force in electrostatic field, charge imaging, the general solution of the Laplace equation, dielectric and conductive sphere in a uniform electric field, the capacitance of eccentric cylinders, partial capacitances.</td><td>9</td><td>6</td></tr>
<tr><td colspan="4">The electromagnetic field due to time-independent currents. Stationary current field: basic equations of the stationary current field, ground resistance, current source imaging, the cylindrical conductor and the dielectric in a uniform current field, conductive and dielectric sphere in a uniform current field, a circular metal plate on the surface of a homogeneous soil, segment of cylindrical conductor, earthing grid, average potential method.</td><td>6</td><td>4</td></tr>
<tr><td colspan="4">Magnetostatic field: magnetic properties of materials, magnetostatic field outside and inside the current-carrying</td><td>9</td><td>6</td></tr>
</table>

	conductors, imaging of thin current-carrying wire, magnetostatic energy, calculation the inductance from the accumulated energy, cylindrical conductor and sphere in a uniform magnetostatic field, magnetic dipole, surface force density and force in magnetostatic field, segment of cylindrical conductor, Neumann formula.		
	Electrodynamic field: Maxwell equations in moving and rest medium, quasistatic electromagnetic field, time-harmonic electrodynamic field, retarded potentials, theory of electric circuits and its limitations, skin effect, the internal impedance of the cylindrical conductor, electromagnetic waves, plane wave, time-harmonic wave at the interface between two different media.	9	6
	Waves on power lines: two-wire power line, wave at the interface between two lossless transmission lines, Petersen rule.	3	2
	Two midterm exams		

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	Attendance 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	3	Research		Practical training	
	Experimental work		Report		Individual work	4.7
	Essay		Seminar essay		Laboratory exercises	
	Tests	0.2	Oral exam		Preparation for laboratory exercises	
	Written exam	0.1	Project		(Other)	

Grading and evaluating student work in class and at the final exam	There are two midterm exams. After two midterm exams, student can pass the entire exam. In the two final exams students take course parts that they did not pass in the preliminary exams. If in the first final exam student passes one of the two course parts, that course part the student does not have to take in the second final exam. The requirement for a positive evaluation of the course part is that the student has completed at least 50 % points from that course part, with the additional condition that the theoretical and numerical parts are passed with at least 20 % points. Theoretical and numerical part of the course parts both contribute 50 % points. The final grade (in percentage) can be calculated using the formula: Grade (%) = (G1 + G2) / 2 where activities in percentage are: G1 - points from the first course part, G2 - points from the second course part. Students who did not pass the entire exam after two final exams can pass the exam in the two additional exams. In the two additional exams students take the entire course. The requirement for a positive assessment of the additional exams is that the student has completed at least 50 % points from the entire course, with the

<table>
<tr><td></td><td colspan="3">additional condition that the theoretical and numerical parts are passed with at least 20 % points. Theoretical and numerical part of the entire course both contribute 50 % points.
The final grade can be calculated as follows:
• 50 % to 61 % - pass (2)
• 62 % to 74 % - good (3)
• 75 % to 87 % - very good (4)
• 88 % to 100 % - excellent (5)
Both midterm exams consist of two theoretical questions and two numerical problems. Two final exams and two additional exams consist of four theoretical questions and four numerical problems.</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>Vujević, S., "Predavanja iz Teorijske elektrotehnike", Sveučilište u Splitu, FESB, Split, 2015. (lecture notes – electronic version)</td><td></td><td>e-learning portal</td></tr>
<tr><td>Vujević, S., "Auditorne vježbe iz Teorijske elektrotehnike", Sveučilište u Splitu, FESB, Split, 2015. (lecture notes – electronic version)</td><td></td><td>e-learning portal</td></tr>
<tr><td>Kurtović, M.: "Teorijska elektrotehnika, Predavanja", Sveučilište u Splitu, FESB, Split, 2004. (lecture notes – electronic version)</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">• Bosanac, T.: "Teoretska elektrotehnika", Tehnička knjiga, Zagreb, 1973.
• Haznadar, Z.; Štih, Ž.: "Elektromagnetizam, svezak 1, 2", Školska knjiga, 1997.
• Berberović, S.: "Teorijska elektrotehnika - odabrani primjeri", Graphis, Zagreb, 1998.</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	ELECTROMAGNETIC COMPATIBILITY						
Code	FENI28	Year of study	2.				
Course teacher	Rino Lucić, Ph.D., Full Professor	Credits (ECTS)	4				
Associate teachers		Type of instruction (number of hours)	L	S	AE	LE	DE
			30			15	
Status of the course	elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - practical and theoretical knowledge related to electromagnetic compatibility, - application of standards on electromagnetic compatibility in electrical installations, - solving problems of electromagnetic compatibility		
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: - acquire practical and theoretical knowledge about the sources, mode of transmission and effect of electromagnetic interference on electrical and electronic devices, - apply relevant standards for achieving electromagnetic compatibility, - explain the basic requirements for the implementation of measures for electromagnetic compatibility, - analyze the results of the measurement and define procedures for achieving electromagnetic compatibility.		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L or S hours	AE hours
	Introductionto electromagnetic compatibility.	2	
	Sources and influence of electromagnetic interference on environment.	2	
	Perturbations in stationary regime and its suppression. Voltage and current quality.	6	
	Electrostatic discharge, electromagnetic transients and its suppression.	4	
	Grounding, shielding and bonding.	4	
	Protection of electric installations, telecommunication installations and consumers, practical examples.	2	
	Concept of protection zones.	2	
	Protection of secondary circuits.	2	
	Electromagnetic compatibility.standards.	2	
	List of laboratory or design exercises		LE or DE hours
	The basics of the program package ATP-EMTP		2
	Simulation of switching transients.		2
	Simulation of surge transients.		2
	Simulation of surge arresters.		3
	Simulation of electromagnetic coupling on transmission lines.		2

<table>
<tr><td></td><td colspan="6">Measurement of environmental electric and magnetic field.</td><td>2</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">The presence at the lectures 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>0,7</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>Independent 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></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">During the semester there will be two tests. The first test will be at the eighth week of classes, the second at the first week of the exam period. Student can pass the entire exam by tests.
At the two final exams, students take parts of the curriculum that did not pass by tests. If at the first final exam student passes one of the two parts of curriculum that part of curriculum the student does not have to take on another final exam.
The condition for positive assessment is that the student has at least 50% of each part of the curriculum at the tests or at the final exam The final grade (in percent) is formed on the basis of all activities according to the formula:

Rating (%) = 0.1 * LV + 0.45 * (G1 + G2)

wherein the activity is expressed in percentage according to:

LV - percentage obtained by laboratory exercises,
G1, G2 - percentage obtained by tests or exams of the parts of curriculum given in lectures.

Students who did not pass the exam after two final exams can pass the exam at the last week of August or the first week of September. Last chance to take the exam in this school year is a commission exam. In a commission exam all students take the entire curriculum, and the condition for positive assessment is that the student has at least 50% of entire curriculum.

The final score (in percentage) is formed on the basis of all activities according to the formula:

Rating (%) = 0.1 * LV + 0.9 * G

wherein the activity is expressed in percentage according to:

LV - percentage obtained by laboratory exercises,
G - percentage obtained by exams of the entire curriculum given in lectures.

The final grade is determined as follows:</td></tr>
</table>

<table>
<tr><td></td><td colspan="3">Rating Grade
50% to 61% sufficient (2)
62% to 74% good (3)
75% to 87% very good (4)
88% 100% excellent (5)

Under Article 48 of the Statute of the Faculty, the student is required to participate in all forms of teaching activities: lessons attendance at least 70% and 100% of laboratory exercises. Student should make 100% of laboratory reports. If a student does not meet these requirements, s student will not be able to take the 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>R.Lucic: 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">- T. Williams & K Amstrong: "EMC for Systems and Instalations", Newnes, 2000.
- E. P. Hasse: Overvoltage Protection of Low Voltage Systems, P.Peregrinus, London, 1992.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">- Keeping records of his attendance
- Annual review of the performance of the examinations
- Student survey in order to evaluate teachers
- Self-evaluation of teachers
- Feedback from students who have already graduated from the relevance of the course content</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="3"></td></tr>
</table>

NAME OF THE COURSE	EMBEDDED COMPUTER SYSTEMS						
Code	FENI13	Year of study	1				
Course teacher	Ozren Bego, Ph.D., Associate Professor	Credits (ECTS)	6				
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	Obligatory	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - understanding idea of embedded computer systems, - understanding concept of microprocessors and its periphery, - programing microprocessors in assembler, - design of simpler embedded computer devices.		
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 and choose microprocessor in embedded system, - design microprocessor based device, - program microprocessor, - analyze quality and functionality of embedded computer system.		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L or S hours	AE hours
	Introduction in course. Introduction in microprocessors.	2	
	Standard microprocessor architecture. Functions of ALU, instruction decoder, accumulators/registers,	2	
	Model of Atmel ATmega16 microcontroller.	2	
	Addressing modes. Review of modes in ATmega16,	2	
	Microprocessor instructions. Review of ATmega16 instructions.	2	
	Microprocessor busses. Memory types	2	
	Concept of transfer data between I/O and CPU; programming I/O. Review of ATmega16 periphery.	2	
	Interrupted access to periphery. Application on ATmega16.	2	
	Periphery: A/D and D/A convertors.	2	
	Periphery: parallel data transfer.	2	
	Periphery: serial data transfer. Synchronous and asynchronous serial transfer.	2	
	Standards and protocols for serial data transfer.	2	
	Higher languages for microprocessor programing.	2	
	List of laboratory or design exercises		LE or DE hours
	Introduction in ATmega16 microcontroller and IDE AVR Studio.		3
	Introduction in Easy AVR 5A platform for development embedded system with Atmel microcontrollers.		3
	Programing ATmega16 – instructions.		6
	Peripheral of ATmega16 – interrupts.		2

	Peripheral of ATmega16 – timer/counter, PWM.	2
	Peripheral of ATmega16 – ADC, comparator, LCD.	2
	Seminar: Design of embedded computer system; independent/group assignments.	12

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	1.5	Independent work	1.7
	Tests	0.2	Oral exam		Preparation for laboratory work	0.5
	Written exam	0.1	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. Grade (in percentage) is formed according to the formula: Grade(%) = 0,05 NP + 0,1 LV + 0,85 IA the activities in percentage: • NP - attendance at lectures, • LV – laboratory assessment, • IA – independent assigment.

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 Ugradbeni računalni sustavi, 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)	

NAME OF THE COURSE	ENERGY STORAGE SYSTEMS						
Code	FENI41	Year of study	2.				
Course teacher	Ozren Bego, Ph.D., Associate Professor	Credits (ECTS)	4				
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	

<table>
<tr><td></td><td colspan="3">Active devices for connecting battery storage to grid: active front end (AFE).</td><td>2</td><td></td></tr>
<tr><td></td><td colspan="3">Applications in grid stabilization: load levelling, rotating reserve, UPS, voltage regulation,…</td><td>2</td><td></td></tr>
<tr><td></td><td colspan="4">List of laboratory exercises</td><td>LE hours</td></tr>
<tr><td></td><td colspan="4">Supercapacitors – modelling</td><td>3</td></tr>
<tr><td></td><td colspan="4">Supercapacitors – monitoring system</td><td>3</td></tr>
<tr><td></td><td colspan="4">Batteries – modelling</td><td>3</td></tr>
<tr><td></td><td colspan="4">Batteries – monitoring SOC</td><td>3</td></tr>
<tr><td></td><td colspan="4">Presentation of independent assignments</td><td>3</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="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>1</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>1</td><td>Laboratory exercises</td><td>0,5</td></tr>
<tr><td>Tests</td><td>0</td><td>Oral exam</td><td>0,5</td><td>Preparation for laboratory exercises</td><td></td></tr>
<tr><td>Written exam</td><td>0</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="5">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.</td></tr>
<tr><td>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></td><td colspan="3">O. Bego: Predavanja iz predmeta Sustavi za pohranu energije</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="5">Robert A. Huggins: Energy storage, Springer, 2010.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="5">- 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="5"></td></tr>
</table>

NAME OF THE COURSE	ENGINEERING ECONOMY						
Code	FENI37	Year of study	2.				
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, MSc	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: - 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 - assess and choose optimal techno-economic option for business decisions based on feasibility models

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 from 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) Exception for grading is option 2 for final exam, in which max. grade is 4.

Required literature (available in the	**Title**	**Number of copies in the library**	**Availability via other media**

library and via other media)	Goić, R., "Predavanja iz Inženjerske ekonomike", Sveučilište u Splitu, FESB, Split, 2014. (internal script)		e-learning portal
	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	FLEXIBLE TRANSMISSION SYSTEMS						
Code	FENI35	Year of study	2				
Course teacher	Nijaz Dizdarević, Ph.D., Assistant Professor	Credits (ECTS)	4				
Associate teachers		Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	15	0
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - understanding the concept of the Flexible Alternating Current Transmission System (FACTS), - introduction to types and definitions of FACTS devices, - acquiring knowledge of FACTS devices usage in generation, transmission and distribution sectors.	
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: - understand the application of devices based on power electronics in electric power systems, - calculate the loading limit of transmission system, - conduct a calculation to increase transmission system capability with respect to voltage, impedance and angle, - compare the characteristics and applicability of conventional and FACTS devices, - integrate the methods and computational tools for FACTS application in transmission: voltage regulation and shunt reactive power compensation, regulation of power flow through series element, voltage and angle stability, damping of electromechanical oscillations in power system, - conduct independently analytical research and estimate benefits of the FACTS devices.	
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours
	Fundamentals of electric power transmission.	2
	Transmission system limit loading.Increase of transmission system capability with respect to voltage, impedance and angle.	2
	Reactive power compensation devices: conventional and thyristor-based.	2
	Concept of the Flexible Alternating Current Transmission System (FACTS).	2
	Types and definitions of FACTS devices.	2
	Shunt, series and combined shunt-series devices.	2
	Comparison of conventional and FACTS devices.	2
	First midterm exam	
	Usage of FACTS devices in generation, transmission and distribution sectors.	2
	Application in transmission: voltage regulation and shunt reactive power compensation.	2

<table>
<tr><td></td><td colspan="6">Application in transmission: regulation of power flow through series element, voltage and angle stability.</td><td>2</td></tr>
<tr><td></td><td colspan="6">Application in transmission: damping of electromechanical oscillations in power system.</td><td>2</td></tr>
<tr><td></td><td colspan="6">Technical experience from practical examples.</td><td>2</td></tr>
<tr><td></td><td colspan="6">Installation cost comparison between conventional and FACTS devices.</td><td>2</td></tr>
<tr><td></td><td colspan="6">Second midterm exam</td><td></td></tr>
<tr><td></td><td colspan="6">List of laboratory exercises</td><td>LE hours</td></tr>
<tr><td></td><td colspan="6">Concept of the Flexible Alternating Current Transmission System - description of the relevant elements.</td><td>2</td></tr>
<tr><td></td><td colspan="6">Tyristor-Switched Capacitors - TSCs)</td><td>2</td></tr>
<tr><td></td><td colspan="6">Tyristor-Switched Reactors -TSRs</td><td>2</td></tr>
<tr><td></td><td colspan="6">Tyristor-Controlled Reactor - TCR</td><td>2</td></tr>
<tr><td></td><td colspan="6">Static voltage regulation</td><td>2</td></tr>
<tr><td></td><td colspan="6">Basic principles of power flow regulation</td><td>2</td></tr>
<tr><td></td><td colspan="6">High-voltage DC Transmission Systems</td><td>2</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">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</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>2,3</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>0,2</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></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="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. Each midterm test consists of 4 theoretical questions and final tests consist of 6 theoretical questions. 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(%) = 0,05 AL + 0,15LA + 0,40 (M1 + M2)
the activities in percentage:
• AL - attendance at lectures,
• LA – laboratory assessment,
• M1, M2 – test results.
The final grade is determined as follows:
Percentage Description</td></tr>
</table>

<table>
<tr><td></td><td colspan="3">50% do 61% Sufficient (2)
62% do 74% Good (3)
75% do 87% Very Good (4)
88% do 100% Excellent (5)</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>1. Hingorani, N.; Gyugyi, L.: Understanding FACTS: Concept and Technology of Flexible AC Transmission Systems, IEEE Press, ISBN 0-7803-3455-8, 2000.</td><td></td><td></td></tr>
<tr><td>2. Kundur, P.: Power system stability and control, EPRI McGraw-Hill, ISBN 0-07-035958-X, 1994.</td><td></td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">- CIGRÉ TF 14/37/38/39.24, FACTS technology for open access, Report, 2001
- CIGRÉ TF 14-27, Unified Power Flow Controller (UPFC), Report, 2000
- CIGRÉ TF 14-19, Static synchronous compensator (STATCOM), Report, 1999
- CIGRÉ TF 38-01-06, Load flow control in high voltage power systems using FACTS controllers, Report, 1996
- IEEE, FACTS Application, IEEE catalogue number 96TP116-0, 1996
Gyugyi L., Solid-state synchronous voltage sources for dynamic compensation and real-time control of AC transmission lines, IEEE Emerging Practices in Technology, IEEE Standards Press, 1993</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	FUNDAMENTALS OF MECHANICAL CONSTRUCTIONS							
Code	FESI01	Year of study	1					
Course teacher	Željko Domazet, Ph.D., Full Professor	Credits (ECTS)	6					
Associate teachers	Miro Bugarin, PH.D., Assistant Professor Petra Bagavac, assistant	Type of instruction (number of hours)	L	S	AE	LE	DE	
			45		15			
Status of the course	Obligatory	Percentage of application of e-learning	40%					

COURSE DESCRIPTION

Course objectives	Training students for: - Reading and making technical drawings - permanent knowlage of general mechanival engineering - Solving simple engineering constructive elements		
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: - Create 2D and 3D techical drawings - understand any technical drawing - apply general laws of mechanics - design simple engineering constructive elements - recognize and use fundamental machine elements		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	S hours
	Introduction. Machines, design. Standards. Technical drawings.	2	
	Ortogonal projection on 2 or 3 planes	3	
	Projections of a geom. body	2	
	Metrics tasks	2	
	Tolerances. CAD	2	
	I. colloquium	2	
	Strength of materials. Stresses, strains, Hookes law.	3	
	Materials in mechanical engineering. Design.	3	
	Fasteners, screws, bolts, springs	3	
	Bearings, cluches, shafts	3	
	Gears, chains, friction and belt drives	3	
	II. colloquium	2	
	List of exercises		
	Metrics tasks, cross sections, intersection		4
	Technical drawings		3
	Strength control of machine elements		4
	Design of some simple machine elements		4
Format of instruction	☒ lectures ☒ seminars and workshops ☒ exercises ☐ *on line* in entirety ☐ partial e-learning	☒ independent assignments ☐ multimedia ☒ laboratory ☐ work with mentor ☐ (other)	

<table>
<tr><td></td><td colspan="6">☐ field work</td><td></td></tr>
<tr><td>Student responsibilities</td><td colspan="7">Lectures 70%, Exercises 100%, 3 practical tasks (individual 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>1.7</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>2</td><td></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="7">Evaluation of gained knowledge in form of two colloquiums.
Maximal score is 100 points, while minimum is passing of exam is with 50 points.
Exam: individual,practical.
Mode of exam: written form.</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">Ž. Domazet, L. Krstulović-Opara „OSNOVE MEHANIČKIH KONSTRUKCIJA“, Skripta FESB.</td><td></td><td colspan="2">E-learning</td></tr>
<tr><td colspan="3">V. Hrgešić, J. Baldani „MEHANIČKE KONSTRUKCIJE“ FER-Zagrb</td><td>5</td><td colspan="2">Library FESB</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="7">- K.-H. Decker „ELEMENTI STROJEVA“ Tehnička knjiga, Zagre</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="7">- Student evaluations
- Registering student’s attendance to course</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="7"></td></tr>
</table>

NAME OF THE COURSE	FUNDAMENTALS OF ROBOTICS							
Code	FELI01	Year of study	1					
Course teacher	Mojmil Cecić, Ph.D., Full Professor	Credits (ECTS)	4					
Associate teachers	Stanko Kružić, mag. ing.	Type of instruction (number of hours)	L	S	AE	LE	DE	
			30	0	0	15	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 or S 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 or DE hours
	Homogeneous Transformations		1
	Direct Kinematics		1
	Inverse Kinematics Problem		1

	Analytical Jacobian	2
	Dynamics	1
	Kinematics and Dynamics of Typical Manipulator Structure	2
	Programing languages	1
	Programming of mobile robot	1
	Trajectory generation, Motion Control of Mobile Robots	1
	The Visual Servoing Problem	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	1,5	Research		Practical training	0,2
	Experimental work		Report		Individual work	2,0
	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 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	HIGH VOLTAGE ENGINEERING						
Code	FENI06	Year of study	1				
Course teacher	Petar Sarajčev, Ph.D., Full Professor	Credits (ECTS)	6				
Associate teachers		Type of instruction (number of hours)	L	S	AE	LE	DE
			45			15	
Status of the course	Obligatory	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - understanding basic insulating properties of materials - carrying out analysis (analytical and numerical) of power system overvoltages - designing overvolatge protection of high voltage transformer stations and switchyards - understanding metal-oxide surge arrester selection procedure - carrying out insulation coordination procedure
Course enrolment requirements and entry competences required for the course	Completed Undergraduate course of Electrical engineering and information technology
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - understand layout and functioning of the high voltage testing facility - explain the procedure for testing high voltage apparatus - apply methods for power system overvoltage analysis - select metal-oxide surge arresters for specific applications - carry out insulation coordination procedure

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

Course content	L or S hours	AE hours
Gaseous, liquid and solid insulating materials	3	
Townsed theory, Paschen law	3	
Natural and artificial pollution of external insulation	3	
High voltage testing laboratory	3	
Marx generator. Generating impulse test voltages. Methods for proving nominal insulation level	3	
Temporary, switching and lightning overvoltages. Analytical and numerical analysis of power system overvoltages	6	
Travelling waves. Bewley's lattice	3	
Backflashover, shielding failure, TLAs	3	
Metal-oxide surge arresters	3	
Insulation coordination	6	

List of laboratory or design exercises	LE or DE hours
Analysis of switching overvoltages using Matlab/Simulink	4
Analysis of switching overvoltages using EMTP-ATP	3
Metal-oxide surge arresters in power system transient analysis	3
Insulation coordination of high voltage air-insulated transformer station	3

Format of instruction	☒ lectures	☐ independent assignments

<table>
<tr><td></td><td colspan="3">☐ seminars and workshops
☒ exercises
☐ on line in entirety
☐ partial e-learning
☐ field work</td><td colspan="3">☒ 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>2,5</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>Laboratory excercises</td><td>0,5</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></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="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. Each midterm test consists of 10 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(%) = 0,5 (M1 + M2)
the activities in percentage: M1, M2 – test results.</td></tr>
<tr><td rowspan="2">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">P. Sarajčev, Autorizirana predavanja, 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="6">- E. Kuffel, W.S. Zaengl, J. Kuffel, High voltage engineering: Fundamentals, Second edition, Elsevier, Oxford, 2008.
- J. A. Martinez-Velasco (Ed.), Power system transients: Parameter determination, CRC Press, Boca Raton, 2010.</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	HYDRAULIC AND PNEUMATIC SYSTEMS						
Code	FETI01	Year of study	2				
Course teacher	Jani Barle, Ph.D., Full Professor	Credits (ECTS)	4				
Associate teachers	Alen Kovač	Type of instruction (number of hours)	L	S	AE	LE	CE
			30	0	0	15	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.		
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.		1
	Basic elements of pneumatic systems (check, pressure control and directional control valves).	2	
	Methods for development of pneumatic systems.		2
	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.		2
	Valve combinations. Electropneumatic systems.	2	
	Introduction to hydraulics. Basic physical principles of hydraulics. Fundamental hydraulic problems: cleanness, temperature, cavitation.	2	
	Typical hydraulic systems demonstrations.		1
	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.		2

	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.		2
	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.		2
	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.		1

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	1,5	Research		Practical training	
	Experimental work		Report		Individual work	2,0
	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)

Required literature (available in the	**Title**	**Number of copies in the library**	**Availability via other media**

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	LIGHTNING PROTECTION AND GROUNDING						
Code	FENI23	Year of study	2.				
Course teacher	Slavko Vujević, Ph.D., Full Professor	Credits (ECTS)	4				
Associate teachers	Dino Lovrić, Ph.D., Research Assistant	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	15	0
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for understanding and application of specialized knowledge of: - lightning protection of structures, - lightning protection of electric power plants and transmission lines, - protection against atmospheric and switching surges, - grounding of electric power plants and transmission lines, - grounding 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: - design a system for lightning protection of structures, - design a system for protection against lightning flashes to electric power plants and transmission lines, - design a system for overvoltage protection of electrical and electronic systems within a structure, - design a system for overvoltage protection of electric power plants and transmission lines, - measure the apparent resistivity of the soil, - interpret geoelectric sounding data by a computer program, - measure grounding resistance, touch voltage, step voltage and transferred potentials, - comment on methods for numerical modelling of grounding systems, - analyze the results of numerical modelling of grounding system.	
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours
	Lightning protection historical background. Isoceraunic level. Mechanisms of lightning. Types and polarity of lightning.	2
	The most important data to protect against lightning. Impulse generators. International and national technical regulations and standards for lightning protection.	2
	Numerical modelling of electrical networks using finite element technique. Theoretical background of software package EMTP.	2
	The main content of the set of standards HRN EN 62305. The effects of lightning. Damages and losses on structures and services. Risk and risk components. Protective measures. Protective levels.	2
	Risk management in compliance with HRN EN 62305-2.	2
	Design of LPS system. Design of air-termination system. Active air-terminations - nonclassical LPS.	2
	Design of down-conductor system. Design of earth-termination system.	2
	The internal LPS. Overvoltage protection of internal systems. Coordinated overvoltage protection.	2

	Overvoltage protection of information technology systems. Overvoltage protection of data networks.	2
	The surges in electric power networks. Electrogeometric model. Lightning protection of transmission lines and electric power plants.	2
	The selection of features of metal oxide surge arresters. Lightning protection of low-voltage networks. Risk of electric shock. Touch voltage. Step voltage. Personal lightning protection.	2
	Interpretation of geoelectric sounding data. The measurement of the grounding resistance.	2
	Numerical modelling of grounding systems.	2
	Two midterm exams	
	List of laboratory exercises	LE hours
	Numerical modelling of electrical networks using software package EMTP-RV	3
	Numerical modelling of surge arrester using software package EMTP-RV	3
	Assessment of the risk due to lightning flashes to the structure	3
	Professional visit to electric power plants	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	Attendance 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	1.7
	Essay		Seminar essay		Laboratory exercises	0.4
	Tests	0.2	Oral exam		Preparation for laboratory exercises	0.1
	Written exam	0.1	Project		(Other)	

Grading and evaluating student work in class and at the final exam	There are two midterm exams. After two midterm exams, student can pass the entire exam. In the two final exams students take course parts that they did not pass in the preliminary exams. If in the first final exam student passes one of the two course parts, that course part the student does not have to take in the second final exam. The requirement for a positive evaluation of the course part is that the student has completed at least 50 % points from that course part. The final grade (in percentage) can be calculated using the formula: Grade (%) = 0.1*LV + 0.45*(G1 + G2) where activities in percentage are: LV - laboratory assessment, G1 - points from the first course part, G2 - points from the second course part. Students who did not pass the entire exam after two final exams can pass the exam in two additional exams. In the two additional exams students take the entire course. The requirement for a positive assessment of the additional exams is that the student has completed at least 50 % points from the entire course. The final grade (in percentage) can be calculated using the formula: Grade (%) = 0.1*LV + 0.9*G

<table>
<tr><td></td><td colspan="3">where activities in percentage are: LV - laboratory assessment, G - points from the entire course.
The final grade can be calculated as follows:
• 50 % to 61 % - pass (2)
• 62 % to 74 % - good (3)
• 75 % to 87 % - very good (4)
• 88 % to 100 % - excellent (5)
Each of the midterm exams consists of ten theoretical questions. Two final exams and two additional exams consist of twenty theoretical questions.</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>Vujević, S.: "Predavanja iz predmeta Zaštita od munje i uzemljenje", Sveučilište u Splitu, FESB, Split, 2014. (lecture notes – electronic version)</td><td></td><td>e-learning portal</td></tr>
<tr><td>Hasse, P.; Wiesinger, J. and Zischank, W., "Priručnik za zaštitu od munje i uzemljenje", Kigen d.o.o., Zagreb, 2009.</td><td>5</td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">• Padelin, M., "Zaštita od groma", Školska knjiga, Zagreb, 1987.
• Corray, V. (editor), "Lightning Protection", IET, 2010.
• Kizilcay, M., Prikler, L., "ATP-EMTP Beginner's Guide for EEUG Members", European EMTP-ATP Users Group, 2000.</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	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, assistant	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: - 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.

	Title	**Number of copies in the library**	**Availability via other media**
Required literature (available in the library and 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 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	MEASUREMENTS OF PROCESS QUANTITIES						
Code	FENI19	Year of study	1.				
Course teacher	Goran Petrović, Ph.D., Associate Professor	Credits (ECTS)	6				
Associate teachers	Juraj Alojzije Bosnić, assistant	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: - signal conditioning and analogue processing of signals - measuring of different kinds of process variables		
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: - make basic circuits for analogue processing, - use the basic protocols for communication between smart sensors and PC, - make temperature sensors calibration, - use thermal imaging camera, - make force and pressure sensors calibration, - recommend appropriate sensors for displacement, temperature, force, pressure, velocity, level, flow, light, … - make Labview program for monitoring, control and data acquisition.		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	Instrument accuracy and parameters that affect an instrument's performance. Static features of sensors.	2	0
	Dynamic features of sensors Transfer functions and frequencies responses of first and second order systems.	2	0
	Operation amplifier and signal conditioning. Amplification, summation, integration, derivation and filtering of analog signals.	2	0
	Transfer signals on long distances. Analog and digital modulations techniques.	2	0
	Interfaces for signal transferring (USART, RS232, RS 485). Communication protocols (HART, M Bus, MODBUS, Ethernet)	2	0
	Displacement sensors. Potentiometric, inductive, capacitive, ultrasound, optical, magnetostrictive, magnetoresistive. Hall effect sensors.	2	0
	Measuring of thermal quantities. Resistance thermometers. Thermistors. Linearization.	2	0
	First midterm exam		0
	Thermoelectric effects. Thermocouples. Pyroelectric effects. Thermal radiation. Thermography.	2	0
	Pressure measurements. Diaphragms, Bourdon tubes. Microphones. Force and moment measurements. Strain gauges. Piezo electric transducers. Charge amplifier.	2	0

	Velocity measurements. Doppler effect. Angular velocity. Incremental and absolute encoder. Accelerometers and vibrations.	2	0
	Level measurements. Direct level sensing. Indirect level sensing. Flow measurement. Bernoulli equation.	2	0
	Flow measurement instruments: Pitot tube, Orifice plate, Venturi tube, Rotameter, Turbine meter, Electromagnetic.	2	0
	Moisture and humidity. Photometric quantities: Luminous intensity. Luminous flux. Illuminance.	2	0
	Second midterm exam		0
	List of laboratory exercises		LE hours
	Principles of Labview coding (Data type, Input output variables)		3
	Loops and structures in Labview. Creating graphical user interface.		3
	Static characteristics of transducers. (Displacement and temperature)		3
	Thermistor and thermocouple. Linearization.		3
	Thermography. Measurement of thermal flux.		3
	Pressure, force, velocity and level measurement		3
	Educational Laboratory Virtual Instrumentation Suite (signal conditioning)		3
	Educational Laboratory Virtual Instrumentation Suite (photometry)		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 10 theoretical questions and numerical problems and final tests consist of 20 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**
	G. Petrović: Skripta s predavanja, FESB		e-learning portal
Optional literature (at the time of submission of study programme proposal)	Alan S. Morris: Measurement and Instrumentation Principles. Butterworth-Heinemann, Oxford. 2001. William C. Dunn: Fundamentals of Industrial Instrumentation and Process Control, McGraw-Hill, 2005.		
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">MODELING OF ELECTROMECHANICAL SYSTEMS</td></tr>
<tr><td>Code</td><td>FENI12</td><td>Year of study</td><td colspan="4">1.</td></tr>
<tr><td>Course teacher</td><td>Marin Despalatović, Ph.D., Associate Professor</td><td>Credits (ECTS)</td><td colspan="4">6</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2"></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>Obligatory</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:
1. Modeling of electromechanical systems, especially different types of electrical machines and drives,
2. Analysis of electric drives characteristics using tools for computer modeling and simulation (Matlab, Simulink, SymPowerSystems, PLECS).</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="6">Competences and skills acquired with the bachelor degree in Electrical Engineering.</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. Comment electromechanical energy conversion,
2. Compare different types of electrical machines using general two axis machine model,
3. Propose variables transformation matrix and object model suitable for the system synthesis,
4. Model different types of electromechanical systems,
5. Estimate the model parameters based on measurements of electrical and/or mechanical quantities,
6. Analyze the computer obtained responses of electric machinery variables by comparing them with corresponding measurements obtained in the laboratory,
7. Predict the characteristics of electrical drive based on the theoretical knowledge and use of tools for computer modeling and simulation.</td></tr>
<tr><td rowspan="8">Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="5">Course content</td><td>L or S hours</td></tr>
<tr><td colspan="5">Basic analysis of electromechanical systems: linear equations of magnetically coupled circuits, basic concepts and definitions, simulation of magnetically coupled circuits with saturated core.</td><td>2</td></tr>
<tr><td colspan="5">Electromechanical energy conversion - accumulated magnetic energy, electromagnetic force and torque.</td><td>2</td></tr>
<tr><td colspan="5">The general model of electrical machine: structure, assumptions and omissions, the equations of the electrical machine in a general form, the balance of power in the electric machine.</td><td>2</td></tr>
<tr><td colspan="5">The voltage equation in the original coordinates, flux linkages, inductance matrix, resulting space vectors of two-phase variables.</td><td>2</td></tr>
<tr><td colspan="5">The equation of the electromagnetic torque in the original coordinates, the conditions for a permanent electromechanical energy conversion.</td><td>2</td></tr>
<tr><td colspan="5">Transformation of coordinates: the transformation between two rotating reference frames of different speeds, matrix and vector form of transformation, resulting space vectors of three-phase variables.</td><td>2</td></tr>
<tr><td colspan="5">General transformation matrix of three-phase variables, the transformation of symmetric three-phase circuit with resistances,</td><td>2</td></tr>
</table>

	inductive and capacitive elements, the transformation of symmetric three-phase sinusoidal system.	
	First midterm exam	2
	Two axis theory of electric machines: general model with transformed variables, transformation to the stationary reference frame, voltage equations and the torque equation in the stator coordinate system, the reduction of parameters and equivalent circuit schematic for direct and quadrature axis.	2
	Electric machine with salient poles on the rotor: determination of inductance based on a comparison with the general model, transformation to the rotor reference frame, voltage equations and the torque equation in the rotor coordinate system, a comparison with the general model of electric machine.	2
	Electric machine with a constant air gap: voltage equations and torque equation in an arbitrarily rotating reference frame, the equivalent circuit diagram. The per unit system: base values, the application of the per unit values on the two axis models of electric machines.	2
	DC machine: reduction of general model equations to DC machine configuration. DC machine as a linear dynamic system. Startup and sudden load of separately excited DC machine: analytical solutions, simulation of chopper (thyristor converter) fed DC machine.	2
	Induction machine: reduction of the three-phase induction motor to two-axis model, steady state voltage equations, initial conditions, linearized model of induction machine, a model of a lower order, simulation of frequency converter fed induction machine.	2
	Synchronous machine: reduction of synchronous machine without damper winding to two-axis model, modeling of synchronous machine with damping winding, modeling of synchronous machine with permanent magnets on the rotor, steady state voltage equations, the power angle, electromagnetic torque, initial conditions, simulation of inverter fed synchronous machine.	2
	Second midterm exam	2
	List of laboratory or design exercises	LE or DE hours
	1. Simulation of transients in the transformer.	4
	2. Simulation of saturation - switching transformer to the grid.	2
	3. Simulation of transients in the elementary electromechanical device.	4
	4. Transformations of variables between three-phase and two-phase rotating reference frames.	4
	5. Simulation of transients in the DC machine.	4
	6. Simulation of transients in the induction machine.	4
	7. Simulation of transients in the synchronous machine.	4
	8. Simulation of transients in the AC machine with permanent magnets.	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 laboratory exercises.	

	Class attendance	1,0	Research		Practical training	

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)*	Experimental work		Report		Individual work	3,3
	Essay		Seminar essay		Laboratory exercises	1,0
	Tests	0,1	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

There are two midterm exams during semester. The first midterm exam is after 7 weeks of lecturing and the second one is after the next 6 weeks. By midterm exams students can pass the entire exam. On the exam (final, correctional and commission) students take the parts of material which they did not pass on the midterm or previous exams. A separate part of the material means the material of each midterm exam. The exams are carried out as written tests. The duration of the midterm exams are 60 minutes, while exams are 2x60 minutes.

The requirement for passing grade is at least 50% of points on each (midterm) exam and the positive assessment (minimum 50% of points) of all laboratory exercises. Grade (in percentage) is formed as follows:

$$\text{Grade}(\%) = (\text{ME1} + \text{ME2} + \text{LE}) / 3$$

where
ME1, ME2 - points obtained at (midterm) exams expressed in percentages
LE - average grade of all laboratory exercises expressed in percentages

The final grade is determined as follows:

Percentage	Grade
0% to 49%	insufficient (1)
50% to 61%	sufficient (2)
62% to 74%	good (3)
75% to 87%	very good (4)
88% to 100%	excellent (5)

Exam group: 22
Examinations are held in accordance with the course calendar schedule.

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

Title	Number of copies in the library	Availability via other media
M. Jadrić, B. Frančić: Dinamika električnih strojeva, Graphis, Zagreb, 2004.	3	
The Simulation Platform for Power Electronic Systems, PLECS User Manual (Ver 4.0), Plexim GmbH, Zurich, 2016.		e-learning portal
SimPowerSystems User's Guide, The MathWorks, Inc., Natick, 2010.		e-learning portal

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

P. C. Krause, O. Wasynczuk, S. D. Sudhoff, S. Pekarek: Analysis of Electric Machinery and Drive Systems (3rd Edition), Wiley-IEEE Press, New York, 2013.
C.-M. Ong: Dynamic Simulation of Electric Machinery (Using Matlab/Simulink), Prentice Hall, Upper Saddle River, 1998.

Quality assurance methods that ensure

- Keeping records of students course attendance
- Annual review of the performance of the examinations

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	NUMERICAL METHODS AND SIMULATION						
Code	FENI02	Year of study	1.				
Course teacher	Rino Lucić, Ph.D., Full Professor	Credits (ECTS)	6				
Associate teachers	Dino Lovrić, Ph.D., Senior Researh Assistant	Type of instruction (number of hours)	L	S	AE	LE	DE
			30			30	
Status of the course	regular	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - understanding of the role of engineering modeling of electromagnetic fields and circuits, - independently developing a computer program for electric circuit calculation by the finite elements technique, - independently developing a computer program for static electric field calculation by the finite elements technique, - understanding and use of modern programs of engineering modeling technique finite element in electrical engineering		
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: - write a computer code for solution of nonlinear equations in Matlab - write a computer code for solution of electric circuit problem in Matlab - analyze the results obtained by circuits modeling, - write a computer code for solution of 1D and 2D static electromagnetic field problem in Matlab, - analyze the results obtained modeling electrostatic and magnetostatic field problem		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L or S hours	AE hours
	Introduction to engineering numerical modeling. Numerical methods for solving nonlinear equations. Numerical methods for solving systems of linear equations	4	
	Interpolation of a function. Lagrange polynomials.	3	
	Fundamentals of the finite element technique. Approximation of functions by the finite element technique. The finite element technique in electric circuit problem, stationary and nonstationary problem.	4	
	Numerical integration methods. Gauss quadrature formula.	3	
	Numerical solution of ODEs: initial and boundary value problem. Transient analysis of circuits	4	
	Weak and strong formulations. Numerical solution of ordinary differential equations using the finite element method. The method of moments. The method of collocation. The method of least squares. Galerkin method. Numerical solution of 1D electromagnetic field.	4	
	The weighted residual method. Numerical solutions of partial differential equations using the finite element method. Potential equations. Triangular finite element.	4	

	Quadrilateral finite elements. Isoparametric mapping. Numerical solution od 2D electromagnetic field.	4	
	List of laboratory or design exercises		LE or DE hours
	Uvod u Matlab		4
	Solution of a system of differential and algebraic equations using Matlab		3
	Steady state circuit analysis using the finite element technique - part 1		2
	Steady state circuit analysis using the finite element technique - part 1		2
	Transient circuit analysis using the finite element technique - part 1		3
	Transient circuit analysis using the finite element technique - part 1		2
	Solution of Laplace equation in 1 D by the finite element method - part 1		3
	Solution of Laplace equation in 1 D by the finite element method - part 2		3
	Solution of Laplace equation in 2 D by the finite element method - part 1		3
	Solution of Laplace equation in 2 D by the finite element method - part 2		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 at the lectures 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		Independent work	3
	Essay		Seminar essay		Laboratory exercises	1
	Tests	0,2	Oral exam		Preparation for laboratory exercises	0,7
	Written exam	0,1	Project		(Other)	

Grading and evaluating student work in class and at the final exam	During the semester there will be two tests. The first test will be at the eighth week of classes, the second at the first week of the exam period. Student can pass the entire exam by tests. At the two final exams, students take parts of the curriculum that did not pass by tests. If at the first final exam student passes one of the two parts of curriculum that part of curriculum the student does not have to take on another final exam. The condition for positive assessment is that the student has at least 50% of each part of the curriculum at the tests or at the final exam The final grade (in percent) is formed on the basis of all activities according to the formula: Rating (%) = 0.1 * LV + 0.45 * (G1 + G2) wherein the activity is expressed in percentage according to: LV - percentage obtained by laboratory exercises, G1, G2 - percentage obtained by tests or exams of the parts of curriculum given in lectures. Students who did not pass the exam after two final exams can pass the exam at the last week of August or the first week of September. Last chance to take the exam in this school year is a commission exam. In a commission exam all students take the

<table>
<tr><td></td><td colspan="3">entire curriculum, and the condition for positive assessment is that the student has at least 50% of entire curriculum.

The final score (in percentage) is formed on the basis of all activities according to the formula:

Rating (%) = 0.1 * LV + 0.9 * G

wherein the activity is expressed in percentage according to:

LV - percentage obtained by laboratory exercises,
G - percentage obtained by exams of the entire curriculum given in lectures.

The final grade is determined as follows:

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

Under Article 48 of the Statute of the Faculty, the student is required to participate in all forms of teaching activities: lessons attendance at least 70% and 100% of laboratory exercises. Student should make 100% of laboratory reports. If a student does not meet these requirements, s student will not be able to take the 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>R.Lucic: 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">- G. W. Rektenwald: Numerical Methods with Matlab: Implementations and Applications, Pearsons, 2000.
- V. Jovic: Introduction to engineering numerical modeling, Aquarius Engineering, Split, in 1993.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">- Keeping records of his attendance
- Annual review of the performance of the examinations
- Student survey in order to evaluate teachers
- Self-evaluation of teachers
- Feedback from students who have already graduated from the relevance of the course content</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="3"></td></tr>
</table>

NAME OF THE COURSE	POWER CABLES						
Code	FENI33	Year of study	2.				
Course teacher	Nikša Kovač, Ph.D., Full Professor	Credits (ECTS)	4				
Associate teachers		Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	15	0
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - acquiring knowledge about power cable systems taking into account heating and ampacity; - mastering standard procedures of determening losses, heating and ampacities of power cable systems.
Course enrolment requirements and entry competences required for the course	Completed undergraduate study of Electrical Engineering and Information Technology.
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - search for standard procedures of determining losses, heating and ampacities for a specific system of power cables, - calculate losses of power cable systems, - analyze power cable systems with regard to heating and ampacity, - propose a suitable system of power cables according to given quantities.

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

Course content	L hours	AE hours
Cable components	2	0
Cable installation	2	0
Bonding arrangements	2	0
Dielectric losses	2	0
Joule losses in the conductor	2	0
Joule losses in screens, sheaths and armor	2	0
Electrical and thermal analogy	2	0
First midterm exam		
Conductive heat transfer	2	0
Thermal resistances of power cable domains	2	0
Thermal capacitances of power cable domains	2	0
Cable heating under steady-state conditions	2	0
Cable ampacity under steady-state conditions	2	0
Cable rating with moisture migration taken into account	2	0
Second midterm exam		

List of laboratory exercises	LE hours
Dielectric losses of power cable	3
Joule losses in the conductor	3
Joule losses in screens, sheaths and armor	3
Power cable heating under steady-state conditions	3

	Power cable ampacity under steady-state conditions	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 ☒ consultations
Student responsibilities	The presence on lectures in the amount of at least 70 % of the times scheduled. All laboratory exercises are to 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	1,3	Research		Practical training	
	Experimental work		Report		Individual work	1,3
	Essay		Seminar essay		Laboratory exercises	0,5
	Tests	0,2	Oral exam		Preparation for laboratory exercises	0,5
	Written exam	0,1	Project		Consultations	0,1

Grading and evaluating student work in class and at the final exam	There are two midterm exams. The first midterm exam is after 7 weeks of lecturing, and the second one is after the next 6 weeks. There are four exams in the examination periods. The exams consist of the material not passed in the midterm exams. The lowest passing point is 50% in each midterm exam, or 50% in the exams. The final grades are formed according to this scale: 50% - 61% - sufficient (2), 62% - 74% - good (3), 75% - 87% - very good (4), 88% - 100% excellent (5). The midterm exams and final ones are held in accordance with the Calendar of teaching activities.

Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	N. Kovač: Autorizirana predavanja, FESB		e-learning portal
	G. J. Anders, Rating of Electric Power Cables, New York, IEEE Press, 1997.	0	Internet

Optional literature (at the time of submission of study programme proposal)	G.J. Anders, Rating of Electric Power Cables in Unfavorable Thermal Environment, New Jersey, IEEE Press/Wiley, 2005.
Quality assurance methods that ensure the acquisition of exit competences	- Class attendance evidence - Annual analysis of the pass rate successfulness - Student evaluation of the teacher - Feedback from students who finished graduate studies on the relevance of the course.
Other (as the proposer wishes to add)	

NAME OF THE COURSE	POWER ENGINEERING IN BUILDINGS						
Code	FENI39	Year of study	2				
Course teacher	Tonko Garma, Ph.D. Assistant Professor	Credits (ECTS)	4				
Associate teachers	-	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	15	0
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - Understanding power engineering in buildings - Independent measurements of electrical and non-electrical quantities referent for power aspects in buildings - Independent calculations and analysis of the data referent for energy audit - Suggestion of actions leading towards improvement of energy efficiency in simple and complex 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: - Apply basic indicators of the energy efficiency in buildings - Comment methods for measurements of the electrical and non-electrical quantities in buildings - Applying software tools, simulate outcome of the measurements for the energy efficiency improvement - Conduct measurements of the relevant electrical and non-electrical quantities - Analyze energy consumption in buildings - Analyze measurement results - Suggest measurements for the energy class improvement		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L or S hours	AE hours
	Introduction: Electrical power engineering in building. Concepts related to building and energy efficiency. User responsibility. Legislation.	2	
	Fundamentals of building physics and power engineering, quantities and mutual relations	2	
	Energy efficiency in buildings (energy potential in buildings, electrical appliances efficiency, energy efficiency in lighting systems)	2	
	Review of energy efficiency improvement actions	2	
	Alternative energy sources in buildings, zero-energy buildings and smart buildings	2	
	Building energy audit (electrical engineering part: power distribution, electrical heating, electrical lighting, preparation of the hot water)	2	
	Action to reduce energy efficiency from electrical engineer POV	2	
	Measurements in building and energy audits: measurement of the non-electrical quantities (IR thermography, dimensions,	2	

	relative pressure, relative humidity, lighting level, water consumption)		
	Measurements in building and energy audits: measurement of the electrical quantities (direct, semi-direct, and indirect measurements of the active, reactive and apparent power, measurements of the electrical energy consumption)	2	
	Central surveillance and control system - CSCS (control, signalization and regulation of the HVAC system, remote measurements of the temperature and gas concentration)	2	
	Examples of the calculation for energy efficiency in buildings in case of electrical quantities (photovoltaic systems, LENI factor for lighting systems)	2	
	Examples of the calculation for energy efficiency in buildings in case of non-electrical quantities (HVAC systems, hot water system)	2	
	Example of simple and complex investment return calculation	2	
	List of laboratory or design exercises		LE or DE hours
	Measurements in building and energy audits: measurement of the non-electrical quantities (IR thermography, dimensions, relative pressure, relative humidity, lighting level, water consumption)		3
	Measurements in building and energy audits: measurement of the electrical quantities (direct, semi-direct, and indirect measurements of the active, reactive and apparent power, measurements of the electrical energy consumption)		3
	Simulations of the energy efficiency improvement actions in case of simple and complex systems		4
	Independent work		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		

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		Independent work	1
	Essay		Seminar essay	0,5	Laboratory exercises	1
	Tests	0,5	Oral exam		(Other)	
	Written exam		Project		(Other)	

Grading and evaluating student work in class and at the final exam	Student grade is derived from seminar essay and quality of independent work. Pre-conditions for passing the exam are positive essay and practical skills.		
Required literature (available in the	**Title**	**Number of copies in the library**	**Availability via other media**

library and via other media)	1. Tonko Garma, " Elektroenergetika u zgradarstvu", FESB, Split, 2015. (autorizirana predavanja) 2. Grupa autora: „Energetska učinkovitost u zgradarstvu“, HEP Toplinarsvo, Zagreb, 2007. 3. Grupa autora: „ Priručnik za energetsko certificiranje zgrada“, UNDP, Zagreb, 2010		e-learning portal
Optional literature (at the time of submission of study programme proposal)	- Mladen Andrassy, Ivanka Boras, Srećko Švaić, “Osnove termografije”, Naklada Ljevak, Zagreb, 2012. - Željko Novinc, “Elektrotehničke instalacije“, Kigen, Zagreb, 2007.		
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	POWER QUALITY MONITORING						
Code	FENI18	Year of study	2.				
Course teacher	Tomislav Kilić, Ph.D., Full Professor	Credits (ECTS)	4				
Associate teachers	Tonko Garma, Ph.D. Assistant Professor	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	15	0
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION		
Course objectives	Training students for: - understanding of basic principles of power quality, - application power quality standards, - measurement and analysis of power quality in power systems, - actions for power quality improvement.	
Course enrolment requirements and entry competences required for the course	Measurement and signal analysis	
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: 1. apply basic power quality indicators in power systems, 2. evaluate methods for power quality measurement, 3. simulate influence of non-linear loads on power system, 4. propose system for power quality monitoring, 5. analyse measuring results of power quality, 6. recommend measures for power quality improvement.	
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours
	Introduction to Power Quality. Definition of Power Quality. Power Quality Terminology. Responsibilities of the Suppliers and Users of Electrical Power. Power Quality Standards.	2
	Power Frequency Disturbance. Common Power Frequency Disturbances. Cures for Low-Frequency Disturbances.	2
	Electrical Transients**.** Examples of Transient Models and Their Response. Types and Causes of Transients. Examples of Transient Waveforms.	2
	Voltage Sag. Causes of Voltage Sags. Methods for Voltage sags recording.	2
	Harmonics. Definition of Harmonics and Harmonic Number. Harmonic Analysis. Total Harmonic Distortion.	2
	Causes of Voltage and Current Harmonics: adjustable speed drives, fluorescent lighting, rectifier banks, computer and data-processing loads, arc furnaces.	2
	Effect of Harmonics on Power System Devices. Guidelines for Harmonic Voltage and Current Limitation.	2
	First midterm exam	2
	Grounding and Bonding. Problems in Power Systems due to Grounding Anomalies. Power Ground Systems.	2
	Active and Reactive Power. Power Factor. Power Factor Correction. Static var Compensators.	2
	Electromagnetic Interference. Frequency Classification. Causes and Methods for Electromagnetic Interference Mitigation.	2

	Measuring and Solving Power Quality Problems. Harmonic Analysers. Oscilloscopes. Data Loggers and Chart Recorders. Transient-Disturbance Analysers.	2
	Power Quality Measurements. Number of Test Locations. Test Duration. Instrument Setup.	2
	Virtual Instrumentation for Power Quality Measurement..	2
	Second midterm exam	2
	List of laboratory exercises	LE hours
	Measurement and analysis of power quality in Sub Station TS „FESB“	6
	Simulation of non-linear loads influence on power system in MATLAB or LabVIEW	7
	Presentation of simulation results	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	0,2	Individual work	1,5
	Essay		Seminar essay		Laboratory exercises	0,5
	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	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 10 theoretical questions and numerical problems and final tests consist of 20 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 40 % points on each midterm exam or the final exam. Grade (in percentage) is formed according to the formula: Grade(%) = 0,05 NP + 0,25 LV + 0,35 (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**
	T. Kilić: Autorizirana predavanja, FESB		e-learning portal

Optional literature (at the time of submission of study	• Ž. Novinc: *Kakvoća električne energije*, GRAPHIS, ZAgreb, 2003. • J. Arrillaga, N. R. Watson, S. Chen: *Power System Quality Assessmen*t, John Wiley & Sons, Ltd, 2000. • C. Sankaran: *Power Quality*, CRC Press LLC, 2002.

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">POWER PLANTS</td></tr>
<tr><td>Code</td><td>FENI08</td><td>Year of study</td><td colspan="5">1</td></tr>
<tr><td>Course teacher</td><td>Elis Sutlović, 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 Vasilj, 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>45</td><td>0</td><td>0</td><td>15</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">0</td></tr>
<tr><td colspan="7">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="6">Training students for:
- acquisition of advanced knowledge about the process of converting various forms of energy into electricity,
- detailed knowledge about the main components and about various solutions of power plants,
- deepening of knowledge about the properties, advantages and disadvantages as well as the operating parameters of different types of power plants.</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. Explain the process of energy conversion into steam turbine power plants, gas turbine power plants and in combined-cycle power plants.
2. Describe conversion processes in nuclear power plants.
3. Compare and choose the most suitable type and appropriate solution of thermal power plant under given conditions.
4. Determine the optimal basic parameters of hydroelectric power plant according to capability of water flow.
5. Select solution of hydroelectric power plant for given conditions, propose preliminary design and specify the fundamental characteristics of main equipment.
6. Design, compare and explain the different solutions of power plant circuit diagrams.</td></tr>
<tr><td rowspan="7">Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="5">Course content</td><td>L hours</td></tr>
<tr><td colspan="5">Repetition: classification of energy forms, conversion of energy forms into electricity. The basic characteristics of the production and consumption of electricity. Types and classification of power plants. Structure of Croatian power system.</td><td>3</td></tr>
<tr><td colspan="5">A review of fundamental thermodynamic principles, thermodynamic properties, and the thermodynamic laws.</td><td>3</td></tr>
<tr><td colspan="5">Cycles of open and closed systems. Conversion of the aggregation state.</td><td>3</td></tr>
<tr><td colspan="5">Steam-electric power station: steam power cycles, Rankine cycle, methods to increase the efficiency of the Rankine cycle, combined heat and power generation.</td><td>3</td></tr>
<tr><td colspan="5">Main components on steam power plants: steam turbines, boilers with the system of removal and treatment of combustion gases, condensers</td><td>3</td></tr>
<tr><td colspan="5">Gas turbine power plants, Combined-cycle power plants, Nuclear power plants</td><td>3</td></tr>
</table>

	Thermal power plant control. Energy characteristics of thermal power plant. Environmental impacts of thermal power plants. The EU Emissions Trading System.	3
	First midterm exam	
	Basic characteristics and types of hydroelectric power plants. The main components of HPP.	3
	Water turbines: The characteristics of certain types of water turbines; Power losses in the turbine; Principles of similarity and specific speed of a turbine; Cavitation; Application range for water turbines; Rotational speed selection.	3
	Water flow analysis. Energy characteristics of HPP. Advantages and disadvantages of HPP. Environmental impacts of HPP.	3
	Wind power plants. Photovoltaic power plants.	3
	Power plant single line diagrams. The characteristics of electric generators. PQ diagram.	3
	Basic concept and application of generator protection	3
	Second midterm exam	
	List of laboratory exercises	LE hours
	Circuit for control and monitoring of a synchronous generator in power plant	3
	Circuit for protection of a synchronous generator in power plant	3
	Excitation in power plant generators	3
	Single-line diagram of the main circuits and single-line diagrams of own consumption in the HPP Zakučac	3
	Visit and tour of the HPP Zakučac	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	1,5	Research		Practical training	
	Experimental work		Report		Individual work	3
	Essay		Seminar essay		Laboratory exercises	0,5
	Tests	0,3	Oral exam		Preparation for laboratory exercises	0,5
	Written exam	0,2	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 6 theoretical questions and final tests consist of 10 theoretical questions. 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(%) = 0,05 (AL + LA) + 0,45 (M1 + M2)

<table>
<tr><td></td><td colspan="3">the activities in percentage:
• AL - attendance at lectures,
• LA – laboratory assessment,
• M1, M2 – test results.

The final grade is determined as follows:

Percentage Description
50% do 61% Sufficient (2)
62% do 74% Good (3)
75% do 87% Very Good (4)
88% do 100% Excellent (5)</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>1. H. Požar: Osnove energetike, svezak I, II i III, Školska knjiga, Zagreb 1992,</td><td>10</td><td></td></tr>
<tr><td>2. E. Sutlović: Predavanja, 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">- Požar, H.: Proizvodnja električne energije, I i II dio, skripta, ETF, Zagreb, 1966.
- Pilić-Rabadan LJ., Stipaničev D., Milas Z.: Hidroenergetska i aeroenergetska postrojenja, Školska knjiga Zagreb, 1996.</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	POWER SYSTEM ANALYSIS						
Code	FENI05	Year of study	1				
Course teacher	Ranko Goić, Ph.D., Full Professor Petar Sarajčev, Ph.D., Associate Professor	Credits (ECTS)	6				
Associate teachers	Stipe Vodopija, Assistant	Type of instruction (number of hours)	L	S	AE	LE	DE
			45			15	
Status of the course	Obligatory	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - power system analysis - setting-up and solving problems of short-circuit analysis in power systems - understanding different network earthing practices - setting-up and solving problems of unbalanced network conditions - understanding and permanent adoption of static and dynamic stability concepts - understanding and permanent adoption of power flow solution methods - setting-up and solving power flow problems	
Course enrolment requirements and entry competences required for the course	Completed Undergraduate course of Electrical engineering and information technology	
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - define relationships between current and voltage phasors during different short-circuit types - understand the need for different network earthing practices - apply different approaches to the solution of short-circuit problems, network unbalanced conditions and other phenomena - mathematically formulate and solve single-machine dynamic stability problems - analysis and solve power flow problems	
	Course content	L hours
	Introduction to the power system analysis. Symmetrical components. Superposition, linear transformations. Per-unit values.	3
	Analysis of short-circuits. Three-phase short circuit. Double phase short circuit. Single-pole short circuit.	3
	Double phase to earth short circuit. Earth fault in isolated network. Distribution of short circuit currents in three-phase transformer windings, currents in the transformer earthed neutrals.	3
	Earth fault factor. Network earthing from the short-circuit current perspective. Relationships between currents and voltages from different short-circuit types.	3
	Power flow analysis	3
	Introduction to the power system stability studies. Static stability analysis. Edith Clark method.	3
	Dynamic stability of single-machine system. Equal area method.	3
	List of laboratory or design exercises	LE hours
	Distribution system power flow analysis using the PowerCAD software package	3
	Transmission system power flow analysis using the PowerCAD software package	3

	Short-circuit analysis using the PowerCAD software package	3
	Current/voltage analysis during single pole short circuit in a MV network using Matlab	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		

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	2,0
	Essay		Seminar essay		Laboratory exercises	1,0
	Tests	0,5	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 weeks of lecturing and the second one is after the next 6 weeks. Each midterm test consists of 10 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(%) = 0,5 (M1 + M2) the activities in percentage: M1, M2 – test results. Grade (in number) is formed as follows: • 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**
	Lectures on elearning portal.		e-learning portal

Optional literature (at the time of submission of study programme proposal)	- M. Ožegović, K. Ožegović, Električne energetske mreže I-VI, Opal Computing, Split. - A. R. Bergen, V. Vittal – Power System Analysis, 2nd edition, Prentice Hall, 2000 - N. Rajaković, M. Ćalović, P. Stefanov, A. Savić – 100 Rešenih zadataka iz Analize Elektroenergetskih Sistema, Beograd 2002.
Quality assurance methods that ensure the acquisition of exit competences	- Evaluation of results in accordance with the above learning outcomes - Feedback from students via surveys - Self-evaluation of teachers - Institutional and non-institutional evaluations
Other (as the proposer wishes to add)	

<table>
<tr><td>NAME OF THE COURSE</td><td colspan="6">POWER SYSTEM OPERATION AND CONTROL</td></tr>
<tr><td>Code</td><td>FENI09</td><td>Year of study</td><td colspan="5">2</td></tr>
<tr><td>Course teacher</td><td>Elis Sutlović, 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">Tomić Ivan Vjeko</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>15</td><td>15</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">0</td></tr>
<tr><td colspan="7">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="6">Training students for:
- acquiring knowledge of classical and modern control systems in power plants and overall power system,
- understanding the issues as well as methods and procedures in the process of power system control, both in traditionally organized and in the restructured and liberalized system,
- introduction to the operating principles of ENTSO-e.</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. Identify and describe the functions of the system operator.
2. Explain the process of load-frequency control of isolated power system and of interconnected power system.
3. Calculate and coordinate primary, secondary and tertiary regulation in the process of load–frequency control.
4. Explain the process of reactive power and voltage control in electric power systems
5. Calculate and coordinate operational measures to maintain voltage limit in transmission and distribution networks.
6. Describe and classify system services and ancillary services in a liberalized power system.
7. Describe and identify the requirements to the SCADA system at the level of the power facility.
8. Describe and analyze the SCADA in power system.
9. Apply the appropriate software tools for power system operating and control.</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 hours</td><td>AE hours</td></tr>
<tr><td colspan="4">Functions of system operator. The issue of regulation in the electric power system.</td><td>2</td><td>0</td></tr>
<tr><td colspan="4">Load–frequency control: basic concepts and characteristics of speed governing, regulation of a generator</td><td>2</td><td>2</td></tr>
<tr><td colspan="4">Load–frequency control: load modelling, composite frequency response characteristics of the system–</td><td>2</td><td>4</td></tr>
<tr><td colspan="4">Load–frequency control: primary control, secondary control, tertiary control, AGC</td><td>2</td><td>4</td></tr>
<tr><td colspan="4">Load–frequency control: regulation of interconnected networks, tie-line oscillations, quality of control</td><td>2</td><td>3</td></tr>
</table>

	Load–frequency control: – under-frequency load shedding, frequency protection relays	2	0
	Load–frequency control: – operating principles of ENTSO-e	2	0
	First midterm exam		
	Reactive power and voltage control – production and absorption of reactive power	2	
	Reactive power and voltage control – primary voltage regulation, secondary voltage regulation, tertiary voltage regulation	2	
	Reactive power and voltage control – operating principles of ENTSO-e	1	
	System services and ancillary services in a liberalized power system. Ancillary services in the Croatian power system	3	
	Concept of SCADA systems	2	
	The hierarchical structure and functions of remote control centers in the Croatian power system	2	
	Second midterm exam		
	List of laboratory or design exercises		LE or DE hours
	PowerWorld Simulator – basic features of PowerWorld		2
	PowerWorld Simulator – creating one line diagram and inserting data of various elements		2
	PowerWorld Simulator – creating model of “small grid 1” and simulation of Load–frequency control on simulation case.		2
	PowerWorld Simulator – simulation of Load–frequency control on the model of Dalmatia transmission network		2
	PowerWorld Simulator – creating model of “small grid 2” and simulation of Reactive power and voltage control on simulation case.		2
	PowerWorld Simulator – simulation of Reactive power and voltage control on the model of Dalmatia transmission network.		2
	Visit and tour of „Network control center – Split“		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	1,5	Research		Practical training	
	Experimental work		Report		Individual work	3,5
	Essay		Seminar essay		Laboratory exercises	0,5
	Tests	0,2	Oral exam	0,1	Preparation for laboratory exercises	0,2
	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 first midterm is carried out as written exam and it consists of 3 theoretical questions and 2 numerical problems.

<table>
<tr><td></td><td colspan="3">The second mid-term is carried out as oral exam and it consists of 4 to 5 theoretical questions.
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(%) = 0,05 (AL + LA) + 0,45 (M1 + M2)
the activities in percentage:
• AL - attendance at lectures,
• LA – laboratory assessment,
• M1, M2 – test results.
The final grade is determined as follows:
<u>Percentage Description</u>
50% do 61% Sufficient (2)
62% do 74% Good (3)
75% do 87% Very Good (4)
88% do 100% Excellent (5)</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>E. Sutlović: Predavanja iz upravljanja i vođenja u elektroenergetskom sustavu</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. Kundur: Power System Stability and Control, McGraw_HillUCTE Operation Handbook, 2004
- J. Machowski. J. Bialek, J. Bumby: Power System Dynamics: Stability and Control, Wiley, 2008.
- E. Mariani and S.S. Murthy: Advanced Load Dispatch for Power System: Principles, Practices and Economies, Springer-Verlag, London, 1997.
- Wood, B. Wollenberg: Power Generation, Operation and Control, ISBN 0-471-09182-0, John Wiley &Sons, 1984.
- M. i K. Ožegović: Električne mreže II, FESB, Split, 1980.
- Čalović, M.S.: Eksploatacija elektroenergetskih sistema, Beopres, Beograd, 1999.</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	POWER SYSTEM PLANNING						
Code	FENI04	Year of study	1				
Course teacher	Elis Sutlović, Ph.D., Full Professor	Credits (ECTS)	6				
Associate teachers		Type of instruction (number of hours)	L	S	AE	LE	DE
			45	0	15	0	0
Status of the course	Obligatory	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - understanding the issues and systematic approach to the planning process in the power system, both in traditional organized and in restructured and liberalized system, - adoption of simple and introduction to more complex procedures of energy balance of electricity calculations, - acquiring knowledge of methods and procedures in planning power system operation and in planning power system development.		
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: - understand and concisely describe the processes of deregulation, restructuring and liberalization of the energy sector, - forecast the electricity consumption of a certain consumption area for the purpose of planning the development of the system in a defined period, - calculate the possible production of hydroelectric power plants in a given period with the given restrictions, - conduct a simple calculation of energy balance of electricity, - apply the appropriate software tools for more precise calculations of energy balance of electricity, - integrate the methods and computational tools for planning the future power system, - apply appropriate methods for daily load curves forecasting - apply the appropriate software tools for unit commitment and economic dispatch in power system, - integrate methods and computational tools in the process of the power system operation planning.		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	Repetition: Energy and Energy System: all forms of energy (advantages, disadvantages, reserves), energy system, energy balance. World energy crisis and vision of development.	2	0
	Characteristics of electric energy consumption, daily load curve, load duration curve, approximation of duration curve.	2	0
	Characteristics of power generation unit.	1	1
	Hydropower plants production, conservation requirements.	4	2

	Energy production cost model: basic concept, the optimal commitment of hydro plants, power requirement on thermal power plants	4	2
	Energy production cost model: schedule and dispatch of thermal power plants, fuel costs, processing results.	4	2
	Energy production cost model: electricity shortage and correction of schedule and dispatch of thermal power plants	2	2
	First midterm exam		
	Other approaches to electric power production simulation, probabilistic models of electric power production costing, definition of LOLP	2	2
	Overhaul management of thermal power plants. Security of supply.	2	0
	The management of HPP seasonal reservoirs: optimizations criteria, a method of minimizing the production costs of the power system.	2	0
	Evaluation of power plants capabilities in the power system.	2	0
	Planning the development of the electrical power system: methods in forecasting electricity consumption, long-term energy production planning, methods and models of planning the future power system, development strategy.	4	1
	Planning the operation of the power system: time decomposition of the activities of the power system operation, forecasting the daily load diagram, economic dispatch of power units, control of power system, analysis of previous work.	4	1
	Information systems and databases in power systems	2	0
	Deregulation, restructuring and liberalization of the energy sector	2	0
	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.	

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	3,7
	Essay		Seminar essay		(Other)	
	Tests	0,2	Oral exam	0,1	(Other)	
	Written exam		Project		(Other)	
Grading and evaluating student	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					

<table>
<tr><td>work in class and at the final exam</td><td colspan="3">that did not pass the midterm exams take part. The first midterm is carried out as written exam and it consists of 2 theoretical questions and 2 numerical problems. The second mid-term is carried out as oral exam and it consists of 4 to 5 theoretical questions.
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(%) = 0,05 AL + 0,5 M1 + 0,45 M2
the activities in percentage:
• AL - attendance at lectures,
• M1, M2 – test results.
The final grade is determined as follows:
Percentage Description
50% do 61% Sufficient (2)
62% do 74% Good (3)
75% do 87% Very Good (4)
88% do 100% Excellent (5)</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>E. Sutlović: Predavanja, FESB</td><td></td><td>e-learning portal</td></tr>
<tr><td>Udovičić, B.: Elektroenergetika, Školska knjiga, Zagreb, 1983</td><td>5</td><td></td></tr>
<tr><td>Udovičić, B.: Elektroenergetski sustav, Kigen, Zagreb, 2005.</td><td>5</td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">- H. Požar: Snaga i energija u elektroenergetskim sistemima, Informator, Zagreb, 1985.
- M.S. Čalović, A.T. Sarić: Planiranje elektroenergetskih sistema, Beopres, Beograd, 2000.
- E. Mariani and S.S. Murthy: Advanced Load Dispatch for Power System: Principles, Practices and Economies, Springer-Verlag, London, 1997.</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	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)					
Grading and evaluating student	Professional training is not evaluated. Students are obliged to complete professional training in accordance with the Regulation on professional training and to write a									

<table>
<tr><td>work in class and at the final exam</td><td colspan="3">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	PROTECTION AT SUBSTATIONS						
Code	FENI10	Year of study	2				
Course teacher	Petar Sarajčev, Ph.D., Full Professor	Credits (ECTS)	7				
Associate teachers		Type of instruction (number of hours)	L	S	AE	LE	DE
			45			15	
Status of the course	Obligatory	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - understanding basic principles of power system protection - permanent adoption of principles of distribution network relay protection design - permanent adoption of transformer protection design - setting up and solving transformer differential protection problems - understanding principles of distance protection		
Course enrolment requirements and entry competences required for the course	Completed Undergraduate course of Electrical engineering and information technology		
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - calculate and select current transformers for relay protection applications - design protection of distribution network considering its neutral point treatment - calculate distribution network relay protection function settings - design protection of power transformers (two and three windings) - select appropriate numerical relays for transformer protection - calculate protection settings of distance relays		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L or S hours	AE hours
	Treatment of neutral point earthing in distribution networks. Short-circuit calculations overview. Earth fault. Petersen coil.	6	
	Current and voltage transformers, Toroid transformers	3	
	Distribution nework relay protection fundamentals. Overcurrent protection, Earth-fault protection, Overvoltage protection, Directional protection	6	
	Relay protection in insulated distribution networks, Protection of neutral earthing resistor, Busbar protection	6	
	Power transformer relay protection, Differential protection, REF protection, Thermal protection, Overcurrent protection, Reverse interlocking	6	
	Transmission network relay protection fundamentals, Distance protection, In-feed compensation, Impedance measurement, Quadrilateral protection characteristic, Power swing blocking	6	
	Teleprotection schemes, Breaker failure	3	
	List of laboratory or design exercises		LE or DE hours
	Electromechanical, static and numerical protection relays, Testing protection relay functions		3
	DIGSI software package by Siemens for protection relay settings		6
	SIGRA software package by Siemens for post-mortem analysis		3

<table>
<tr><td></td><td colspan="6">Visit to the GIS substation and live interaction with protection relays</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="3">☐ independent assignments
☒ multimedia
☒ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6"></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>2,5</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>2,5</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>Laboratory excercises</td><td>1,0</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">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 10 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(%) = 0,5 (M1 + M2)
the activities in percentage: M1, M2 – test results.</td></tr>
<tr><td rowspan="2">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. Sarajčev, Autorizirana predavanja, FESB</td><td></td><td colspan="2">e-learning portal</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6">- P. M. Anderson, Power system protection, IEEE Press, New York, 1999.</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	SEMICONDUCTOR POWER CONVERTERS						
Code	FENI14	Year of study	1.				
Course teacher	Božo Terzić, Ph.D., Full Professor	Credits (ECTS)	6				
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	Obligatory	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - understanding the topologies and working principle of semiconductor power converters - permanent adoption and deepening of knowledge in the field of power converter		
Course enrolment requirements and entry competences required for the course	Entry competences: - Basic knowledge of the course Power Electronics		
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - select the type and ratings of power converter for defined applications, - parametrize and put into operation power converter in simpler application, - simulate power converter selected configuration in software package MATLAB, - measure and analyze the converter voltage and current waveforms in the time and frequency domain, - design power and control circuit of power converter with IGBT power switch, - predict and analyse impact of the power converter to the grid.		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	Introduction. Areas of application of power converters. The divisions of the converter to the input / output variables. Basic topologies. The characteristics of semiconductor components used in power converters.	2	0
	Direct (galvanic non isolated) dc converters: step up, step down, step up/down, bridge circuit. Indirect (galvanic isolated) dc converters: the forward and bridge circuit. The influence of the dead time to the output voltage.	2	0
	Four-quadrant thyristor converter for DC drive. High-voltage thyristor converter, application for DC power transmission. Improving the power factor and reduce the current harmonics with thyristor converter.	2	0
	AC voltage converters. Thyristor circuit breakers (on-off control). The phase voltage control. Applications: Soft-start of the induction motors, static VAR compensation.	2	0
	Inverters. Single-phase inverter in a bridge configuration. Pulse width modulation techniques: one pulse, multi pulse, sine and modified sine wave modulation. Closed-loop control.	2	0
	Three-phase voltage source six pulse inverter. Space vector modulation. Three-phase current source inverter.	2	0
	Multilevel inverters. Diode clamped multilevel inverter, Flying capacitor multilevel inverter, Cascaded multilevel inverter.	2	0

	First midterm exam		
	Voltage source PWM rectifier with IGBT switches and LCL filter. Voltage oriented control in synchronous rotating coordinates. The filter resonance effect.	2	0
	Power converter in wind power plants. Basic topology and control structure of the converterr for asynchronous, synchronous and permanent magnet generators.	2	0
	Power converters in solar power plants. The characteristics of photovoltaic systems. The basic topology of the converters for photovoltaic systems.	2	0
	Drivers for thyristor and IGBT transistor. Overvoltage and short-circuit protection for converter with IGBT transistors.	2	0
	Electromagnetic compatibility of power converters. Type of electromagnetic interference and measures for their mitigation.	2	0
	Designing power circuit of converter with IGBT module. Microprocessor control of power converter.	2	0
	Second midterm exam		
	List of laboratory exercises		LE hours
	Simulation of dc/dc step-up and step-down converters		3
	Measurement and analysis of voltage and current waveforms of dc/dc step-up converter		3
	Simulation of three-phase four-quadrant thyristor converter		3
	Measurement and analysis of voltage and current waveforms of three-phase thyristor converter		3
	Simulation of three-phase vector controlled inverter		3
	Microprocessor control of three phase inverter		3
	Simulation of three-phase PWM rectifier with LCL filter		3
	Measurement and analysis of voltage and current waveforms of three-phase PWM rectifier		3
	Simulation of induction motor supplied by inverter and sine filter		3
	Frequency characteristics of three-phase inverter with and without sine filter		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	2,3
	Essay		Seminar essay		Laboratory exercises	1
	Tests	0,2	Oral exam	0.5	Preparation for laboratory exercises	1
	Written exam		Project		(Other)	
Grading and evaluating student work in class and at the final exam	There is one midterm exam after 7 weeks of lecturing. The second part of the exam is taken orally on the final exam. Midterm test is carried out as written test and lasts 90 minutes, and it consists of 10 theoretical questions and numerical problems. The requirement for passing grade is the positive assessment of laboratory exercises, 50					

<table>
<tr><td></td><td colspan="3">% points on midterm exam and the positive assessment of oral exam. Final grade (in percentage) is formed according to the formula:
Grade(%) = 0,2 LV + 0,3 MT + 0.5 OE
where the activities in percentage:
• LV – laboratory assessment,
• MT – midterm test result,
• OE – oral exam result
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)

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, i.e. written exam for first part of course and oral exam for the second one. 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>1. 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">1. Flegar: Elektronički energetski pretvarači, Kigen, Zagreb, 2010.
2. T. Brodić: Osnove energetske elektronike – poluvodički energetski pretvarači, Zigo, Rijeka
3. M.H. Rashid: Power Electronics – Circuits, Devices and Applications, Pearson Prentice Hall, USA, 2004.
4. Bose, B.K.: Power Electronics and Variable Drives, IEEE Press, New York, 1997.</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	SYNCHRONOUS MACHINES AND EXCITATION SYSTEMS						
Code	FENI34	Year of study	2.				
Course teacher	Ivica Jurić-Grgić, Ph.D., Associate Professor Mate Dabro, Ph.D., Assistant Professor	Credits (ECTS)	4				
Associate teachers		Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	15	0
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - permanent adoption of knowledge that are competitive in the field of regulation and exploitation of synchronous machines, - analysis of transient stability of a synchronous generator using modern software packages.	
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 principles of synchronous generator operating stand alone as well as operating on an infinite bus. - explain basic principles of synchronous generator automatic turbine governing system. - explain basic principles of synchronous generator excitation systems. - employ EMTP-RV program for synchronous generator transient analysis. - analyse transient stability of a synchronous generator. - analyse power system transient stability.	
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours
	Synchronous machine and dynamic model of synchronous machine.	2
	Stand alone operation of a synchronous generator. Synchronous generator operation on an infinite bus.	2
	Operating characteristics of synchronous generator. Capability curve of a synchronous generator.	2
	Excitation system models of synchronous generator.	2
	Asynchronous operation of wound rotor and salient-pole synchronous generator.	2
	Automatic turbine governing system.	4
	Small disturbance angle stability of a synchronous generator.	4
	Transient stability of a synchronous generator.	4
	Digital turbine governors for power system stability studies.	2
	Digital excitation system models for power system stability studies.	2
	List of laboratory exercises	LE hours
	Modelling of synchronous generator with turbine governing and excitation systems using EMTP-RV program.	3
	Analysis of small disturbance angle stability of a synchronous generator using EMTP-RV program.	3

<table>
<tr><td></td><td colspan="6">Analysis of transient stability of a synchronous generator using EMTP-RV program.</td><td>3</td></tr>
<tr><td></td><td colspan="6">A visit to the high voltage substations</td><td>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="4">☐ independent assignments
☒ multimedia
☒ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="7">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 eachactivity 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>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>0,2</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">During the semester there will be two midterm tests. The first test will be at the eighth week of classes, the second at the first week of the exam period. Student can pass the entire exam by midterm tests.
At the two final exams, students take parts of the curriculum that did not pass by midterm tests. If at the first final exam student passes one of the two parts of curriculum that part of curriculum the student does not have to take on another final exam.
The condition for positive assessment is that the student has at least 50% of each part of the curriculum at the midterm tests or at the final exams. The final grade (in percent) is formed on the basis of all activities according to the formula:

Rating (%) = 0.1 * LV + 0.45 * (G1 + G2)

wherein the activity is expressed in percentage according to:

LV -percentage obtained by laboratory exercises,
G1, G2 - percentage obtained by midterm tests or final exams of the parts of curriculum given in lectures.

Students who did not pass the exam after two final exams can pass the exam at the last week of August or the first week of September. Last chance to take the exam in this school year is a so-called commission exam. In a so-called commission exam all students take the entire curriculum, and the condition for positive assessment is that the student has at least 50% of entire curriculum.

The final score (in percentage) is formed on the basis of all activities according to the formula:

Rating (%) = 0.1 * LV + 0.9 * G

wherein the activity is expressed in percentage according to:
LV -percentage obtained by laboratory exercises,
G - percentage obtained by exams of the entire curriculum given in lectures.</td></tr>
</table>

<table>
<tr><td></td><td colspan="3">The final grade is determined as follows:

Rating Grade
50% to 61% sufficient (2)
62% to 74% good (3)
75% to 87% very good (4)
88% 100% excellent (5)</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>I. Jurić- Grgić, M. Dabro: 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">M. Kurtović: Sinkroni strojevi, Sveučilište u Splitu, FESB, Split, 2010. (interna skripta u elektroničkom obliku)
P. Kundur: Power system stability and control, Electric Power Research Institute, California, 1993.
J. Machovski, J.W. Bialek, J.R. Bumby: Power system dynamics stability and control, second edition, Wiley & Sons, 2008.
IEEE Standard 421.5-2005: Recommended Practice for Excitation System Models for Power System Stability Studies</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">- Evaluation of students presence on lectures
- 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>

<table>
<tr><td>NAME OF THE COURSE</td><td colspan="6">TRANSIENTS IN ELECTRICAL MACHINES</td></tr>
<tr><td>Code</td><td>FENI21</td><td>Year of study</td><td colspan="4">2.</td></tr>
<tr><td>Course teacher</td><td>Marin Despalatović, Ph.D., Associate Professor</td><td>Credits (ECTS)</td><td colspan="4">4</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2"></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>15</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">0</td></tr>
<tr><td colspan="7">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="6">Training students for analyzing electrical machines in transient operating modes and practical application of techniques for processing measured and simulated signals (filtering, Fourier analysis, linear and nonlinear regression).</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="6">Competences and skills acquired with the bachelor degree in Electrical Engineering.</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. Model saturation of magnetic circuits in electrical machines,
2. Compare transfer functions for various types of electrical machines,
3. Propose procedures for determination of electrical machines parameters,
4. Estimate model parameters based on measurements of electrical and/or mechanical quantities,
5. Analyze computer obtained responses of electric machine variables by comparing them with corresponding measurements obtained in the laboratory,
6. Predict transients in electrical machines using tools for computer modeling and simulation.</td></tr>
<tr><td rowspan="10">Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="5">Course content</td><td>L or S hours</td></tr>
<tr><td colspan="5">Modeling and simulation of saturation of magnetic circuits in the electrical machine.</td><td>2</td></tr>
<tr><td colspan="5">Induction machine: Analytical solutions of voltage equations with constant speed, (eigenvalues) natural frequency and the time constant of the transient components.</td><td>2</td></tr>
<tr><td colspan="5">Modeling of squirrel cage induction machines with pronounced suppression of current in the rotor, voltage equations, double cage and deep rotor bar equivalent circuit diagrams.</td><td>2</td></tr>
<tr><td colspan="5">Simulation and analysis of dynamic characteristics during startup and re-connection after a brief interval. Intermittent operation modes. Forced oscillations.</td><td>2</td></tr>
<tr><td colspan="5">Application of small displacement method, calculation and analysis of eigenvalues, transfer functions, stability analysis, the model of a lower order, simplified analytical solutions, comparison with separately excited DC machine.</td><td>2</td></tr>
<tr><td colspan="5">Modeling and simulation of the stator and rotor faults, interruption of stator (rotor) phase, broken rotor bar, inter-turn short circuit.</td><td>2</td></tr>
<tr><td colspan="5">Synchronous machine: initial and transient inductances, operator impedances and time constants.</td><td>2</td></tr>
<tr><td colspan="5">First midterm exam</td><td>2</td></tr>
</table>

	Standardized methods for determining the parameters of a synchronous machine according to IEC and IEEE standards.	2
	Analysis of symmetrical sudden short circuit at a constant speed, the influence of damper winding. Two-pole short-circuit current harmonics in the stator, the application of the method of symmetrical components.	2
	Analysis of transient stability. Dynamic run-up and synchronization. Forced oscillations. Modeling and simulation of saturation of magnetic circuits in two axis. Cross-magnetization effects in electrical machines.	2
	Application of small displacement method, calculation and analysis of eigenvalues, transfer functions, stability analysis, the model of a lower order, simplified analytical solutions.	2
	Modeling of AC machines with permanent magnets, rotor with and without damper winding.	2
	Simulation of the dynamic operating modes (startup, sudden load, forced oscillation), the application of small displacements method, simplified transfer functions.	2
	Second midterm exam	2
	List of laboratory or design exercises	LE or DE hours
	1. The saturation of magnetic circuits in electrical machines.	3
	2. Determination of the induction machine parameters.	2
	3. Transients in the induction machine.	2
	4. Determination of the synchronous machine parameters.	2
	5. Transients in the synchronous machine.	2
	6. Determination of the permanent magnet synchronous machine parameters.	2
	7. Transients in the permanent magnet synchronous machine.	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 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	1,0	Research		Practical training	
	Experimental work		Report		Individual work	1,8
	Essay		Seminar essay		Laboratory exercises	0,5
	Tests	0,1	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	There are two midterm exams during semester. The first midterm exam is after 7 weeks of lecturing and the second one is after the next 6 weeks. By midterm exams students can pass the entire exam. On the exam (final, correctional and commission) students take the parts of material which they did not pass on the midterm or previous exams. A separate part of the material means the material of each midterm exam. The exams are carried out as written tests. The duration of the midterm exams are 60 minutes, while exams are 2x60 minutes.

<table>
<tr><td></td><td colspan="3">The requirement for passing grade is at least 50% of points on each (midterm) exam and the positive assessment (minimum 50% of points) of all laboratory exercises. Grade (in percentage) is formed as follows:

Grade(%) = (ME1 + ME2 + LE) / 3
where
ME1, ME2 - points obtained at (midterm) exams expressed in percentages
LE - average grade of all laboratory exercises expressed in percentages

The final grade is determined as follows:

Percentage Grade
0% to 49% insufficient (1)
50% to 61% sufficient (2)
62% to 74% good (3)
75% to 87% very good (4)
88% to 100% excellent (5)

Exam group: 14
Examinations are held in accordance with the course calendar 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>M. Jadrić, B. Frančić: Dinamika električnih strojeva, Graphis, Zagreb, 2004.</td><td>3</td><td></td></tr>
<tr><td>The Simulation Platform for Power Electronic Systems, PLECS User Manual (Ver 4.0), Plexim GmbH, Zurich, 2016.</td><td></td><td>e-learning portal</td></tr>
<tr><td>SimPowerSystems User's Guide, The MathWorks, Inc., Natick, 2010.</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. C. Krause, O. Wasynczuk, S. D. Sudhoff, S. Pekarek: Analysis of Electric Machinery and Drive Systems (3rd Edition), Wiley-IEEE Press, New York, 2013.
C.-M. Ong: Dynamic Simulation of Electric Machinery (Using Matlab/Simulink), Prentice Hall, Upper Saddle River, 1998.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">- Keeping records of students course attendance
- Annual review of the performance of the examinations
- 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	DIPLOMA THESIS							
Code	FEXX02	Year of study	2					
Course teacher		Credits (ECTS)	30					
Associate teachers		Type of instruction (number of hours)	L	S	AE	LE	DE	
Status of the course	Mandatory	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, - being independent in solving problems under the given conditions, - applying scientific-research and ethical principles, - writing and presenting the project results.							
Course enrolment requirements and entry competences required for the course	Acquired 60 ECTS credits							
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	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							
Course content broken down in detail by weekly class schedule (syllabus)	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.							
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*	Class attendance		Research		Practical training			
	Experimental work		Report		Individual work	30		
	Essay		Seminar essay		(Other)			
	Tests		Oral exam		(Other)			

equal to the ECTS value of the course)	Written exam		Project		(Other)	

Grading and evaluating student work in class and at the final exam	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.		
Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	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.		Web site of the Faculty
Optional literature (at the time of submission of study programme proposal)			
Quality assurance methods that ensure the acquisition of exit competences	- Self-evaluation of teachers - Student survey of the whole study programme		
Other (as the proposer wishes to add)			

3. STUDY PERFORMANCE CONDITIONS

3.1. Places of the study performance

Buildings of the constituent part (name existing, under construction and planned buildings)	
Identification of building	FESB
Location of building	R. Boškovića 32
Year of completion	2008.
Total square area in m^2	29.477

3.2. List of teachers and associate teachers

CODE	Course	Teachers and associate teachers
FENI22	Analysis of Electromagnetic Fields and Circuits	Slavko Vujević, Ph.D., Full Professor Associate teacher: Dino Lovrić, Ph.D., Research Assistant
FENI44	Application of Analytical Methods in Electromagnetic Compatibility	Silvestar Šesnić, Ph.D., Assistant Professor
FENI16	Automated Electrical Drives	Božo Terzić, Ph.D., Full Professor Associate teacher: Goran Majić, Ph.D.
FENA19	Automation of Industrial Plants	Ozren Bego, Ph.D., Associate Professor Associate teacher: Marin Despalatović, Ph.D., Associate Professor; Danijel Jolevski, Ph.D., Assistant Professor
FENI36	Basics of Energy Engineering	Ranko Goić, Ph.D., Full Professor Associate teacher: Josip Vasilj, Ph.D. Stipe Vodopija, M.Sc.
FENI30	Computer Application in Electric Power System	Elis Sutlović, Ph.D. Full Professor
FENI11	Control of Electrical Machines	Dinko Vukadinović, Ph.D., Full Professor Associate teacher: Mateo Bašić, Ph.D. Assistant Professor
FENI27	Control of Electrical Machines Laboratory	Dinko Vukadinović, Ph.D., Full Professor Associate teacher: Mateo Bašić, Ph.D. Assistant Professor
FENI38	Design of Electrical Networks and Substations	Ranko Goić, Ph.D., Full Professor

		Associate teacher: Stipe Vodopija, MSc
FENI42	Design of Magnetic Circuits	Marin Despalatović, Ph.D., Associate Professor
FENI43	Design of Power Converters	Božo Terzić, Ph.D., Full Professor Associate teacher: Goran Majić, Ph.D.
FENI15	Digital Control Systems	Ozren Bego, Ph.D., Associate Professor Associate teacher: Danijel Jolevski, Ph.D., Assistant Professor
FENI40	Distributed Generation	Damir Jakus, Ph.D. Assistant Professor Josip Vasilj, Ph.D.
FENI32	Distribution Networks and Dispersed Generation	Associate teacher: Matislav Majstrović, Ph.D. Full Professor, Elis Sutlović, Ph.D. Full Professor
FENI20	Electric Servo Drives	Božo Terzić, Ph.D., Full Professor Associate teacher: Goran Majić, Ph.D.
FENI50	Electric Switching Devices	Rino Lucić, Ph.D., Full Professor
FENI29	Electrical Installations Testing	Rino Lucić, Ph.D., Full Professor
FENI07	Electrical Power Switchyards andSubstations	Tonći Modrić, Ph.D., Assistant Professor
FENI28	Electromagnetic Compatibility	Rino Lucić, Ph.D., Full Professor
FENI01	Electromagnetics	Slavko Vujević, Ph.D., Full Professor
FENI13	Embedded Computer Systems	Ozren Bego, Ph.D., Associate Professor Associate teacher: Danijel Jolevski, Ph.D., Assistant Professor
FENI41	Energy Storage Systems	Ozren Bego, Ph.D., Associate Professor Associate teacher: Danijel Jolevski, Ph.D., Assistant Professor
FENI37	Engineering Economy	Ranko Goić, Ph.D., Full Professor Associate teacher: Josip Vasilj, Ph.D.; Damir Jakus, Ph.D., Assistant Professor; Stipe Vodopija, MSc
FENI35	Fexible Transmission Systems	Nijaz Dizdarević, Ph.D., Assistant Professor
FESI01	Fundamentals of Mechanical Constructions	Željko Domazet, Ph.D., Full Professor Associate teacher: Miro Bugarin, PH.D., Assistant Professor; Petra Bagavac, assistant

FELI01	Fundamentals of Robotics	Mojmil Cecić, Ph.D., Full Professor Associate teacher: Stanko Kružić, mag. ing.
FENI06	High Voltage Engineering	Petar Sarajčev, Ph.D., Full Professor
FETI01	Hydraulic and Pneumatic Systems	Jani Barle, Ph.D., Full Professor Associate teacher: Alen Kovač
FENI23	Lightning Protection and Grounding	Slavko Vujević, Ph.D., Full Professor Associate teacher: Dino Lovrić, Ph.D., Research Assistant
FENI03	Measurements and Signal Processing	Goran Petrović, Ph.D., Associate Professor Associate teacher: Juraj Alojzije Bosnić, assistant
FENI19	Measurements of Process Quantities	Goran Petrović, Ph.D., Associate Professor Associate teacher: Juraj Alojzije Bosnić, assistant
FENI12	Modeling of Electromechanical Systems	Marin Despalatović, Ph.D., Associate Professor
FENI02	Numerical Methods and Simulation	Rino Lucić, Ph.D., Full Professor Associate teacher: Dino Lovrić, Ph.D., Senior Researh Assistant
FENI33	Power Cables	Nikša Kovač, Ph.D., Full Professor
FENI39	Power Engineering in Buildings	Tonko Garma, Ph.D. Assistant Professor
FENI08	Power Plants	Elis Sutlović, Ph.D. Full Professor Associate teacher: Josip Vasilj, Ph.D.
FENI18	Power Quality Monitoring	Tomislav Kilić, Ph.D., Full Professor Tonko Garma, Ph.D. Assistant Professor
FENI05	Power System Analysis	Ranko Goić, Ph.D., Full Professor Petar Sarajčev, Ph.D., Full Professor
FENI09	Power System Operation and Control	Elis Sutlović, Ph.D., Full Professor Associate teacher: Tomić Ivan Vjeko
FENI04	Power System Planning	Elis Sutlović, Ph.D., Full Professor
FEXX06	Professional Training	
FENI10	Protection at Substations	Petar Sarajčev, Ph.D., Full Professor
FENI14	Semiconductor Power Converters	Božo Terzić, Ph.D., Full Professor Associate teacher: Goran Majić, Ph.D.

FENI34	Synchronous Machines and Excitation Systems	Ivica Jurić-Grgić, Ph.D., Associate Professor Mate Dabro, Ph.D., Assistant Professor
FENI21	Transients in Electrical Machines	Marin Despalatović, Ph.D., Associate Professor
FEXX02	Diploma Thesis	

3.3. 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 Undergraduate study: - Industrial process control (FETC06) Master's degree study: - Hydraulics and pneumatics(FETL17) - Maintenance management (FETL04) - Product life management (FETM06) Doctorate degree study: - 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-	IPA IV project ME4CataLOgue “Further development and implementation of the Croatian Qualifications Framework (CQF)”, 2013-2015.

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	**Ozren Bego, Ph.D., Associate Professor**
The course he/she teaches in the proposed study programme	Embedded microprocessor systems Digital control systems Automation of Industrial Processes 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	Elements of industrial automation, Undergraduate study: Electrical Engineering and Information Technology.

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)	Jolevski, Danijel; Bego, Ozren; Sarajcev, Petar: **Control structure design and dynamics modelling of the organic 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	**Mojmil Cecić, Ph.D., Full Professor**
The course he/she teaches in the proposed study programme	Fundamentals of Robotics
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. Automatics I (Vocational Study Programme) 2. Automatics II (Vocational Study Programme) 3. Automatic Control I (Undergraduate Study Programme) 4. Automatic Control II (Undergraduate Study Programme) 5. System Theory (Undergraduate Study Programme) 6. Nonlinear Control Systems (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 years in the field of the course (5 works at most)	1. Stančić, Ivo; Cecić, Mojmil; Ljubičić, Ante; Identification of UAV Engine Parameters. // WSEAS TRANSACTIONS ON 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?-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	**Mate Dabro, Ph.D., Assistant Professor**
The course he/she teaches in the proposed study programme	Synchronous Machines and Excitation Systems
GENERAL INFORMATION ON COURSE TEACHER	
Address	Bračka 13, 21000 Split, Croatia
Telephone number	+385 21 405-687
E-mail address	Mate.dabro@hep.hr
Personal web page	-
Year of birth	1955.
Scientist ID	236276
Research or art rank, and date of last rank appointment	Research associate, 11/7/2014
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Assistant professor, 16/9/2014
Area and field of election into research or art rank	Technical Sciences, Field Electrical engineering
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Croatian Electrical Utility (HEP), Production Department
Date of employment	1/2/1983
Name of position (professor, researcher, associate teacher, etc.)	Adviser
Field of research	Power engineering, Hydro engineering
Function	-
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Faculty of Electrical Engineering and Computing (FER)
Place	Zagreb
Date	21/12/1999
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 (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)	-
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)	• Jurić-Grgić, I.; Lucić, R.; Dabro, M.: "A coupled nonuniform transmission line analysis using FEM",

	International Transactions on Electrical Energy Systems, Vol.23 (8), 2013, pp. 1365–1372. • Dabro, M.; Jurić-Grgić, I.; Martinović, M.: "Improvement of Synchronous Generator Power Stability Using Hydraulic Digital Governor", International Journal on Engineering Applications (IREA), Vol. 1 (5), 2013, pp. 263-267. • Dabro, M.; Jurić-Grgić, I.; Lucić, R.: "Optimization of Hydraulic Digital Governor parameters using EMTP-RV", International Journal on Engineering Applications (IREA), Vol. 1 (2), 2013, pp. 90-93. • Dabro, M.; Jurić-Grgić, I.; Lucić, R.: "EMTP-RV Model of Hydraulic Digital Governor", International Review on Modelling and Simulations (IREMOS), Vol. 4 (6), 2011, pp. 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)	• Dabro Mate; Radić Čedo; Jurić Vedran; Radmilo Goran : "Reversible hydroelectric power plant Korita RHE Korita", Zbornik radova 10. Savjetovanja HRO CIGRÉ / Filipović-Grčić, Božidar (ur.). - Zagreb : Hrvatski ogranak CIGRÉ, Zagreb , 2011. (C2-03) 1-10 (ISBN: 953-6408-95-3) • Koncepcija modela vođenja i optimiranja rada HES-a (hidroenergetskog sustava) Cetine, FESB, Split, 2004. • Analiza automatizacije hidroelektrana vodotoka Cetine s osnova sigurnosti, stabilnosti, optimiranja pogona hidroelektrana i pružanja usluga EES-u, FESB, Split, 2005. • Koncepcija modela vođenja i optimiranja rada HES-a Like i Gacke, FESB, Split, 2006. • Analiza automatizacije hidroelektrana vodotoka Like i Gacke s osnova sigurnosti, stabilnosti, optimiranja pogona hidroelektrana i pružanja usluga EES-u, FESB, Split, 2006.
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	**Marin Despalatović, Ph.D., Associate Professor**
The course he/she teaches in the proposed study programme	Modeling of Electromechanical Systems Transients in Electrical Machines Design of Magnetic Circuits
GENERAL INFORMATION ON COURSE TEACHER	
Address	R. Boškovića 32, HR-21000 Split
Telephone number	+385 (0)21 305 813
E-mail address	marin.despalatovic@fesb.hr
Personal web page	
Year of birth	1976.
Scientist ID	248733
Research or art rank, and date of last rank appointment	Senior scientific associate, November 22nd, 2012.
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Associate professor, September 20th, 2016.
Area and field of election into research or art rank	Technical Sciences – Field Electrical Engineering
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	University of Split, Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Date of employment	May 10th, 2001.
Name of position (professor, researcher, associate teacher, etc.)	Associate professor
Field of research	Research and teaching in electrical machines and drives
Function	
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD (in Electrical Engineering)
Institution	University of Split, Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Place	Split
Date	April 24th, 2009.
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)	Electrical Machines – 113 – Undergraduate Study: Electrical Engineering and Information Technology Modeling of Electromechanical Systems – 231 – Graduate Study: Electrical Engineering Electrical Drives – 261, 262, 263 – Graduate Study: Mechanical Engineering Electrical Drives – 511 – Vocational Study: Electrical Engineering Design of Low Voltage Facilities – 511 – Vocational Study: Electrical 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. Majić, G.; Despalatović, M.; Terzić, B.; Slutej, A.: Influence of Dead-time on Design of LCL-filter for Three-phase Voltage Source Converter, EDPE Conference Proceedings, 2013. 2. Despalatović, M.; Jadrić, M.; Terzić, B.: Modeling of Saturated Synchronous Generator Based on Steady-State Operating Data, IEEE Transactions on Industry Applications, 48(1), 2012. 3. Terzić, B.; Despalatović, M.; Slutej, A.: Magnetization Curve Identification of Vector-Controlled Induction Motor at Low-Load Conditions, Automatika, 53, 2012. 4. Jadrić, M.; Terzić, B.; Despalatović, M.; Majić, G.; Slutej, A.; Šimić, T.: Identification of Rotor Resistance and Transient Inductance of Induction Motors Using Frequency Selection Criterion, Proc. of the XXth International Conference on Electrical Machines, 2012. 5. Jadrić, M.; Despalatović, M.; Terzić, B.: Development of synchronous generator saturation model from steady-state operating data, Electric Power Systems Research, 80(11), 2010.
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 2. A safer and more efficient cogeneration / trigeneration facilities, co-financing EU fund for science and innovation 3. Development of electrical drives for large industrial cranes working in heavy duty conditions, collaboration with ABB Crane Systems 4. On-line parameter identification of synchronous generator, MZOŠ 5. State and parameter estimation of electrical machines, MZT
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)	Evaluation organizer University of Split Scale from 2 (sufficient) to 5 (excellent) Course: Electrical Drives – 511, average grade 4.0 Electrical Machines – 113, average grade 4.2 Modeling of Electromechanical Systems – 231, average grade 4.5

First and last name and title of teacher	**Nijaz Dizdarević; Ph.D. Assistant Professor**
The course he/she teaches in the proposed study programme	Flexible transmission systems
GENERAL INFORMATION ON COURSE TEACHER	
Address	Zagreb
Telephone number	
E-mail address	ndizdar@eihp.hr
Personal web page	www.eihp.hr/~ndizdar
Year of birth	1966.
Scientist ID	190646
Research or art rank, and date of last rank appointment	Higher Scientific Associate, 2006.
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Assistant professor, 2005.
Area and field of election into research or art rank	Technical Sciences, Field Electrical engineering
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Energy Institute Hrvoje Pozar
Date of employment	2002.
Name of position (professor, researcher, associate teacher, etc.)	Counsel and Higher Scientific Associate
Field of research	POLICY, LEGAL AND REGULATORY ASPECTS OF ELECTRICITY MARKET Energy policy, legal and regulatory development National and regional power, gas and RES road maps and action plans Benchmarking and regional market design, analysis and compliance Monitoring of security of supply and competition issues Policy aspects of renewable energy sources and environment protection POWER SYSTEM OPERATIONAL ISSUES Power system stability, control and regulation Connection and operation of utility-scale and distributed generation Transmission and distribution network analysis Congestion management and balancing mechanisms
Function	Counselor
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	University of Zagreb, Faculty of Electrical Engineering and Computing, Dept. Power Systems,
Place	Zagreb
Date	October 2001.
INFORMATION ON ADDITIONAL TRAINING	
Year	1996-1998
Place	Stockholm, Sweden
Institution	Royal Institute of Technology
Field of training	Pre-doctoral scholarship from the Svenska Institutet
Year	2006-2007

Place	Vienna, Austria
Institution	Energy Community Secretariat
Field of training	Sabbatical term (establishment of Energy Community institutions and legal/regulatory framework)
Year	July 2009
Place	Cambridge, MA, USA
Institution	HARVARD Kennedy School
Field of training	infrastructure in a market economy – public private partnerships (executive education program)
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 (3)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	Swedish (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)	FLORENCE SCHOOL OF REGULATION (RSCAS/EUI) Invited lecturer in the FSR training courses for energy regulatory institutions and energy companies (on Acquis Communautaire and on Wholesale electricity markets)
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. Collection, Reporting and Auditing in the Energy Community", Energy Institute Hrvoje Pozar, Zagreb, Croatia, 2011, Study for the Energy Community Secretariat and the Regulatory Board in Vienna, Austria 2. N. Dizdarević (unutar grupe autora), "Energetski i financijski aspekti poslovnog odnosa HEP-a d.d. i ovisnih društava u sastavu HEP Grupe s društvima DIOKI d.d. i DINA-Petrokemija d.d. uključujući cijenu električne energije u razdoblju od 2008. do 2010. godine", Energetski institut Hrvoje Požar, Zagreb, Hrvatska, 2011, Vještački nalaz za Ured za suzbijanje korupcije i organiziranog kriminaliteta (USKOK) Državnog Odvjetništva Republike Hrvatske (DORH) 3. N. Dizdarević (unutar grupe autora), "Nacrt Zakona o tržištu električne energije - konzultantske usluge vezane uz usklađenje energetskog zakonodavstva Republike Hrvatske s Trećim liberalizacijskim paketom EU", Energetski institut Hrvoje Požar, Zagreb, Hrvatska, 2011, naručitelj Ministarstvo gospodarstva, rada i poduzetništva Republike Hrvatske 4. N. Dizdarević (unutar grupe autora), "Energetski i financijski aspekti isporuke električne energije HEP d.d. (Hrvatska) - TLM d.d. (Hrvatska) - Aluminij d.d. (Bosna i Hercegovina) u razdoblju 2007.-2010.", Energetski institut Hrvoje Požar, Zagreb, Hrvatska,

	2011, Vještački nalaz za Ured za suzbijanje korupcije i organiziranog kriminaliteta (USKOK) Državnog Odvjetništva Republike Hrvatske (DORH) 5. N. Dizdarević (within the group of authors), "Assistance to regulators in introducing and improving service quality regulation in the Energy Community", Energy Institute Hrvoje Pozar, Zagreb, Croatia, 2010, Study for the Energy Community Secretariat and the Regulatory Board in Vienna, Austria
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. "Analysis of the European Commission's opinions on the certification of transmission system operator according to the ITO model", Energy Institute Hrvoje Pozar, Zagreb, Croatia, 2013, Study for the HEP- TSO, Zagreb, Croatia 2. "Recommendations for implementation and elaboration of the content of application for the certification of transmission system operator according to the ITO model", Energy Institute Hrvoje Pozar, Zagreb, Croatia, 2013, Study for the HEP-TSO, Zagreb, Croatia 3. "Technical and economic aspects of voltage regulation as ancillary service", Energy Institute Hrvoje Pozar, Zagreb, Croatia, 2012, Study for the ISO BiH, Sarajevo, BiH
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	**Željko Domazet, Ph.D., Full Professor**
The course he/she teaches in the proposed study programme	Fundamentals of Mechanical Structures
GENERAL INFORMATION ON COURSE TEACHER	
Address	R. Boškovića 32
Telephone number	+385/21/305777
E-mail address	Zeljko.domazet@fesb.hr
Personal web page	www.fesb.hr
Year of birth	1954
Scientist ID	95632
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 – permanent position 2005.
Area and field of election into research or art rank	Technical sciences, mechanical engineering, general mechanical engineering (structures)
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	University of Split Faculty of Electr. Eng., Mech. Eng. and Naval Arch.
Date of employment	1980.
Name of position (professor, researcher, associate teacher, etc.)	Full professor - permanent position
Field of research	metal structures, fatigue
Function	head of Department of Mechanical Eng. And Naval Arch.
INFORMATION ON EDUCATION – Highest degree earned	
Degree	Dr.sc.
Institution	FSB-Zagreb
Place	Zagreb
Date	1993.
INFORMATION ON ADDITIONAL TRAINING	
Year	1988., 1990.
Place	Darmstadt, Germany
Institution	Fraunhofer Institut fuer Betriebsfestigkeit
Field of training	Fatigue
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)	
Authorship of university/faculty textbooks in the field of the course	L. Krstulović-O., Ž. Domazet: Dizajn industrijskih proizvoda V.Grubišić, Ž. Domazet: Pogonska čvrstoća-interna skripta Ž. Domazet, L. Krstulović-O., Osnove mehaničkih konstrukcija
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1. Domazet, Željko; Lukša, Francisko; Stanivuk, Tatjana. **An optimal design approach for calibrated rolls with respect to fatigue life**. // *International journal of fatigue*. **59** (2014) ; 50-63 2. Krstulović-Opara, Lovre; Domazet, Željko; Garafulić, Endri. **Detection of osmotic damages in GRP boat hulls**. // *Infrared physics & technology*. **60** (2013.) ; 359-364 3. Domazet, Željko; Lukša, Francisko; Bugarin, Miro. **Fatigue Strength of the Rolls with Grooves**. // *Applied Mechanics and Materials*. **459** (2014) ; 330-334 4. Domazet, Željko; Lukša, Francisko; Stanivuk, Tatjana. **The influence of rolling speed on the fatigue life of rolls with grooves**. // *International journal of damage mechanics*. (2014) 5. Krstulović-Opara, Lovre; Garafulić, Endri; Klarin, Branko; Domazet, Željko. **Application of gradient based IR thermography to the GRP structures inspection**. // *Key Engineering Materials*. **488-489** (2012) ; 682-685
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. Domazet, Željko; Lukša, Francisko. **Influence of Rolling Temperature on Fatigue Life of Calibrated Rolls**. // *Advanced materials research*. **742** (2013) ; 482-487 2. Domazet, Željko; Lukša, Francisko; Šušnjar, Marko; Korun Curić, Kristina. **Stress-time History of Rolls with Grooves**. // *Transactions of FAMENA*. **35** (2011) , 3; 67-74 3. Krstulović-Opara, Lovre; Domazet, Željko; Klarin, Branko; Garafulić, Endri. **The Application of IR Thermography to the NDT and Thermal Stress Analysis**. // *HDKBR info*. **1** (2012.) , 6/7; 17-22 4. Krstulović-Opara, Lovre; Klarin, Branko; Neves, Pedro; Domazet, Željko. **Thermal imaging and Thermal Stress Analysis of the impact damage of composite materials**. // *Engineering failure analysis*. **18** (2011) ; 713-719 5. Vesenjak, Matej; Krstulović-Opara, Lovre; Ren, Zoran; Domazet, Željko.

	Cell shape effect evaluation of polyamide cellular structures. // *Polymer testing*. **29** (2010) , 8; 991-994
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?	„Training for administrative and educational personnel“ part of the EU project ME4CataLOgue (Mechanical Engineering for Catalogue)
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	University of Split, Rector price, 2015.
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 are confidential matter and kept by employer (University of Split, FESB)

First and last name and title of teacher	**Tonko Garma, Ph.D. Assistant Professor**
The course he/she teaches in the proposed study programme	Instrumentation and testing in the working environment Power engineering in buildings
GENERAL INFORMATION ON COURSE TEACHER	
Address	Getaldićeva 9
Telephone number	091-4305-803
E-mail address	garma@fesb.hr
Personal web page	-
Year of birth	1983.
Scientist ID	325635
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 , june 2014
Area and field of election into research or art rank	Electrical Engineering
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	FESB
Date of employment	August 25, 2014
Name of position (professor, researcher, associate teacher, etc.)	professor
Field of research	Science and education
Function	Assistant Professor
INFORMATION ON EDUCATION – Highest degree earned	
Degree	Dr.-Ing.
Institution	TU Muenchen
Place	Muenchen
Date	1.2.2011.
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)	Italian, 3
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	German, 1/2
COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme	Professional work in field related to proposed subject

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. Garma, Tonko; Krstulović-Opara, Lovre. Nalaz termovizijskih mjerenja TS VE Jelinak 12/110 kV/kV, 2014. (izvješće). 2. Garma, Tonko; Krstulović-Opara, Lovre. Nalaz termovizijskih mjerenja u pogonu tvornice Omial Novi d.o.o., 2014. (izvješće). 3. Krstulović-Opara, Lovre; Garma, Tonko. Izvješće o termografskom ispitivanju zgrade DV "Cvrčak" Kaštela, 2014. (izvješće). 4. Garma, Tonko; Perković, Toni. Izvješće o ispitivanju otpora izolacije i dielektrične čvrstoće uređaja za transkranijalnu stimulaciju, 2014. (izvješće). 5. Perković, Toni; Garma, Tonko. Izvješće o ispitivanju kabliranja LAN instalacije u laboratoriju Sveučilišnog odjela za stručne studije, 2014. (izvješće).
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. Bilušić, Ante; Garma, Tonko; Budimir, Marko. Building MEMS infrastructure in Croatia // Building MEMS infrastructure in Croatia. Blois : INSA-CVL, Blois, 2014. (poster,međunarodna recenzija,sažetak,znanstveni). 2. Colombo, Carlo; Dufouleur, Joseph; Garma, Tonko; Ketterer, Bernt; Uccelli, Emanuele; Fontcuberta i Morral, Anna. P-doping Mechanism in Catalyst-free MBE Grown GaAs Nanowires // . (predavanje,međunarodna recenzija,sažetak). 3. Hofmann, Martina; Garma, Tonko; Cattani-Scholz, Anna; Dalmau Mallorqui, Anna; Fontcuberta i Morral, Anna; Moreno i Codinachs, Lia. Development and characterization of EIS structures based on micro and nano SiO2 pores before and after its functionalization with silanes and phosphonate films // Engineering of functional interfaces. (predavanje,međunarodna recenzija,sažetak,znanstveni). URL link to work 4. Colombo, Carlo; Spirkoska, Danče; Garma, Tonko; Heiss, Martin; Vialla, Fabien; Dufouleur, Joseph; Abstreiter, Gerhard; Fontcuberta i Morral, Anna. 'Doping of catalyst-free MBE grown GaAs nanowires, transport properties and related devices // . (predavanje,međunarodna recenzija,sažetak). 5. Moreno i Codinachs, Lia; Birkenstock, Christopher; Garma, Tonko; Zierold, Robert; Bachmann, Julien; Nielsch, Kornelius; Schoening, Michael; Fontcuberta i Morral, Anna. A micron-sized nanoporous multifunction sensing device // .

	2008. (predavanje,međunarodna recenzija,sažetak,znanstveni).
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	**Ranko Goić, Ph.D., Full Professor**
The course he/she teaches in the proposed study programme	Basics of Energy engineering, Power System Analysis, Engineering Economy, Design of Electrical Networks and Substations
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	Full Professor, 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
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	**Damir Jakus, Ph.D. Assistant Professor**
The course he/she teaches in the proposed study programme	Distributed Generation
GENERAL INFORMATION ON COURSE TEACHER	
Address	Ruđera Boškovića 32, Split
Telephone number	021 305 807
E-mail address	damir.jakus@fesb.hr
Personal web page	-
Year of birth	1984.
Scientist ID	292324
Research or art rank, and date of last rank appointment	Research associate – 06/06/2013
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Assistant professor - 17/07/2013
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	15.01.2007.
Name of position (professor, researcher, associate teacher, etc.)	Assistant professor
Field of research	electric power systems, renewable energy, power system economics, power system optimization
Function	Assistant professor
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Place	Split
Date	09.11.2012.
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)	***Electrical networks -*** Undergraduate study programme in Electrical Engineering ***Electrical distribution networks*** – Professional study program in Electrical Engineering ***Electrical distribution networks*** – University Department of Professional Studies ***Renewable energy sources*** – Professional study program in Electrical Engineering
Authorship of university/faculty textbooks in the field of the course	Goić R., Jakus D., Penović, I., „Distribucija električne energije“ Goić R., Jakus D., Penović, I., „Električne mreže“ Goić R., Jakus D., „Osnove elektroenergetike“
Professional, scholarly and artistic articles published in the last five years	1. Jakus, D; Krstulović Opara, J; Vasilj, J. **,“Algorithm for optimal wind power plant capacity allocation in areas with limited transmission capacity**“,

in the field of the course (5 works at most)	International Transactions on Electrical Energy Systems, 24, 2013. 2. Jakus, D.; Goić, R.; Krstulović Opara, J., „**The impact of wind power plants on slow voltage variations in distribution networks**“, Electric power systems research, 81, 2011. 3. Goić, R.; Krstulović-Opara, J.; Jakus, D., „**Simulation of aggregate wind farm short-term production variations**“, Renewable Energy, 35, 2010. 4. Jakus, D.; Vasilj, J.; Goić, R.,“**Impact of PV Power Plants on the Voltage Conditions and Power System Losses in MV Distribution Network**“, Proceedings of the 4th International Workshop on Integration of Solar into Power Systems, Berlin, 2014. 5. Jakus, D.; Vasilj, J.; Tutavac, H.,“**Coordinated Control of Renewable Energy Sources in Distribution Networks**“, Proceedings of the 4th International Workshop on Integration of Solar into Power Systems, Berlin, 2014.
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. ***Razvoj i pogon elektroenergetskog sustava s visokim udjelom vjetroelektrana*** – MZOŠ (scientific project) 2. ***Tehničko-okolišna dubinska analiza vjetroelektrane Lukovac*** - HEP Obnovljivi izvori energije d.o.o. (expert project) 3. ***Tehničko-okolišna dubinska analiza vjetroelektrane Crno Brdo*** - HEP Obnovljivi izvori energije d.o.o. (expert project) 4. ***Preliminarna analiza mogućnosti priključka vjetroelektrane Otrić na elektroenergetsku mrežu*** - Vjetroelektrana Otrić d.o.o. (expert project) 5. ***Elaborat optimalnog tehničkog rješenja priključenja vjetroelektrane Ogorje na prijenosnu mrežu*** - Aiolos projekt d.o.o. (expert project)
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)	4.4/5

First and last name and title of teacher	**Ivica Jurić-Grgić, Ph.D., Associate Professor**
The course he/she teaches in the proposed study programme	Synchronous Machines and Excitation Systems
GENERAL INFORMATION ON COURSE TEACHER	
Address	Pujanke 59, 21000 Split, Croatia
Telephone number	+385 21 305-811
E-mail address	ijuricgr@fesb.hr
Personal web page	-
Year of birth	1977.
Scientist ID	248792
Research or art rank, and date of last rank appointment	Senior scientific associate, 12/7/2012
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Associate Professor, 20/9/2016
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	23/9/2001
Name of position (professor, researcher, associate teacher, etc.)	Associate Professor
Field of research	Power engineering
Function	-
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Place	Split
Date	10/3/2008
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)
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 Machines 1, Graduate study programme. Electrical Machines and Transformers, Vocational study programme. Electrical safety, Undergraduate study programme.
Authorship of university/faculty textbooks in the field of the course	-
Professional, scholarly and artistic articles published in the last five years	• Jurić-Grgić, I.; Lucić, R.; Dabro, M.: "A coupled nonuniform transmission line analysis using FEM", International Transactions on Electrical

in the field of the course (5 works at most)	Energy Systems, Vol.23 (8), 2013, pp. 1365–1372. • Lucić, R.; Jurić-Grgić, I.; Balaž, Z.: " Grounding grid transient analysis using the improved transmission line model based on the finite element method", ETEP: European Transactions on Electrical Power, Vol.23 (2), 2013, pp. 282–289. • Dabro, M.; Jurić-Grgić, I.; Martinović, M.: "Improvement of Synchronous Generator Power Stability Using Hydraulic Digital Governor", International Journal on Engineering Applications (IREA), Vol. 1 (5), 2013, pp. 263-267. • Dabro, M.; Jurić-Grgić, I.; Lucić, R.: "Optimization of Hydraulic Digital Governor parameters using EMTP-RV", International Journal on Engineering Applications (IREA), Vol. 1 (2), 2013, pp. 90-93. • Dabro, M.; Jurić-Grgić, I.; Lucić, R.: "EMTP-RV Model of Hydraulic Digital Governor", International Review on Modelling and Simulations (IREMOS), Vol. 4 (6), 2011, pp. 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)	• Study: Elaborat iznošenja potencijala i izračun napona dodira i koraka za EVP 110/25 kV Novska, Naručitelj: Projektni biro Split, 2010. • Project: 023 0231581-1610, "Numeričko modeliranje elektroenergetskog sustava tehnikom konačnih elemenata", br. 023 0231581-1610, Ministarstvo znanosti, obrazovanja i športa Republike Hrvatske, 2007.-2011. • Study: Izrada pravila i mjera sigurnosti za osiguranje mjesta rada na elektroenergetskim vodovima, Naručitelj: HEP OPS d.o.o., Prijenosno područje Split, 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	**Tomislav Kilić, Ph.D., Full Professor**
The course he/she teaches in the proposed study programme	Power Quality Monitoring
GENERAL INFORMATION ON COURSE TEACHER	
Address	Put borika 17, 21000 Split, HR
Telephone number	+385 21 305733
E-mail address	tkilic@fesb.hr
Personal web page	
Year of birth	1961.
Scientist ID	142496
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	1/10/1987
Name of position (professor, researcher, associate teacher, etc.)	Professor
Field of research	Electrical Measurement, Power Quality
Function	Head of Chair of Electrical Measurement
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Place	Split
Date	9/11/2001
INFORMATION ON ADDITIONAL TRAINING	
Year	1996
Place	Toronto, Canada
Institution	GEM Systems
Field of training	Research and development of instruments for magnetic field measurement
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	Fundamentals of Electrical Engineering, Undergraduate study programme,

title of course, study programme where it is/was offered, and level of study programme)	Electrical Measurements, Undergraduate study programme
Authorship of university/faculty textbooks in the field of the course	Kilić, Tomislav: Električna mjerenja - upute za laboratorijske vježbe, Skripta, FESB Split, ISBN 953-6114-62-3, Split, 2003.
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1. Petrović, Goran; Kilić, Tomislav; Garma, Tonko. Measurement and Estimation of the Extremely Low Frequency Magnetic Field of the Overhead Power Lines. // Journal Elektronika ir elektrotechnika. 19 (2013), 7; 33-36. 2. Kovač, Nikša; George, J. Anders; Tomislav Kilić. Sheath Loss Factors Taking Into Account the Proximity Effect for Cable Lineand Touching Flat Formation. // IEEE Transactions on Power Delivery, 30 (2015), 3, 1363-1371.
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	1. Marian-Silviu Poboroniuc, Gheorghe Livint, F. Maciel Barbosa, Wojciech Mysiński, Anna Friesel, Bahar Karaoglan, Yoana Ruseva, Dorin Popescu, Tomislav Kilic, Tony Ward, Noel Jackson, Ian Grout: *Developing New Electrical and Information Engineering Related Curricula to Respond to the Actual Global Challenges*, EAEEIE 2015, Denmark
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	1. HRZZ Istraživački projekt: Mjeriteljska infrastruktura za pametne mreže, 2015. - 2018. 2. LLP - ERASMUS: Strategic Alignment of Electrical and Information Engineering in European Higher Education Institutions, 2012. -2014. 3. TEMPUS: Creation of the third cycle studies-doctoral studies in metrology Trajanje projekta: 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?-	
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)	4,8/5

First and last name and title of teacher	**Nikša Kovač, Ph.D., Full Professor**
The course he/she teaches in the proposed study programme	Power Cables
GENERAL INFORMATION ON COURSE TEACHER	
Address	Put sv. Lovre 35, 21215 Kaštel Lukšić, HR
Telephone number	+385 21 305732
E-mail address	nkovac@fesb.hr
Personal web page	
Year of birth	1968.
Scientist ID	211370
Research or art rank, and date of last rank appointment	Scientific Adviser, 4/3/2010
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Senior Full Professor, 16/12/2015
Area and field of election into research or art rank	Technical Sciences, Field of Electrical engineering
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Date of employment	26/10/1994
Name of position (professor, researcher, associate teacher, etc.)	Professor
Field of research	Power Cables, Extremely Low Frequency Electromagnetic Fields
Function	Head of Chair of Fundamentals of Electrical Engineering
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Place	Split
Date	6/12/2002
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 (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	None

where it is/was offered, and level of study programme)	
Authorship of university/faculty textbooks in the field of the course	*Power Cables*, lectures, 2010, course: *Power Cables,* published on web pages: https://elearning.fesb.unist.hr/
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1. N. Kovač, G. J. Anders, T. Kilić, Sheath Loss Factors Taking Into Account the Proximity Effect for Cable Line in a Touching Flat Formation, *IEEE Transactions on Power Delivery*, vol. 30, no. 3, pp. 1363-1371, Jun. 2015. 2. N. Kovač, N. Grulović-Pavljanić, A. Kukavica, Generated heat within power cable sheaths per unit time and volume, *Applied Thermal Engineering*, vol. 52, pp. 90-96, Apr. 2013. 3. N. Kovač, M. Cvetković, Analiza zagrijavanja kabelskog raspleta 10(20) kV uz TS 110/10(20) kV Visoka, *Elaborat za HEP Operater distribucijskog sustava d.o.o., DP Elektrodalmacija – Split*, Split, 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)	Scientific project “Modeling and Environmental Aspects of ENF Electromagnetic Fields“
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)	4,7/5

First and last name and title of teacher	**Rino Lucić, Ph.D., Full Professor**
The course he/she teaches in the proposed study programme	Numerical Methods and Simulation Electrical installations testing Electric switching devices, Electromagnetic compatibility
GENERAL INFORMATION ON COURSE TEACHER	
Address	Split, Duplančića dvori 3
Telephone number	091/ 4 305 611
E-mail address	Rino.Lucic@fesb.hr
Personal web page	-
Year of birth	1957
Scientist ID	154916
Research or art rank, and date of last rank appointment	Scientific Adviser, 18/1/2010
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Senior Full Professor, 18/1/2016
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	25/9/1987
Name of position (professor, researcher, associate teacher, etc.)	Professor
Field of research	Numerical modeling of electromagnetic fields and transients
Function	-
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Place	Split
Date	16/09/1999.
INFORMATION ON ADDITIONAL TRAINING	
Year	1992
Place	Swansea (GB)
Institution	The University College of Swansea, University of Walles
Field of training	Numerical modeling of electromagnetic fields
Year	2001./ 2002.
Place	Amiens, San Quentin (France)
Institution	The University of P Picardie
Field of training	Numerical modeling of electrical machines by the finite element method and by permeance network method
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 safety (Undergraduate study programme),FESB Electrical installations (vocational study programme),FESB Electric switching devices (vocational study programme) OSS UNIST Marine electrical systems (vocational study programme MCAST-Malta) Electrical technology (vocational study programme MCAST-Malta)
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) R. Lucić, et al. ' A characteristics-based finite element method for transmission line problem', Electric power systems research (0378-7796) **84** (2012), 1; 152-1581) 2) R. Lucić, et al. ' Grounding grid transient analysis using the improved transmission line model based on the finite element method', Int. Trans. on El. Energy Systems, (1546-3109) **23** (2013), 2; 282-289. 3) R. Lucić, et al. ' Time domain finite element method analysis of multi-conductor transmission lines', European Transactions on Electrical Power (1430-144X) **20** (2010), 6; 822-832.
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)	Project MZOŠ 023-0000000-3271 Project MZOŠ 023-0231581-1610 IPA projekt 'Professional development programs for MCAST students and lecturers', Malta, 2011/2012.Project MZOŠ 023-0231581-1610
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	**Matislav Majstrović, Ph.D. Full Professor**
The course he/she teaches in the proposed study programme	Distribution Networks and Dispersed Generation
GENERAL INFORMATION ON COURSE TEACHER	
Address	Stepinčeva 9, 21000 Split, HR
Telephone number	+385 21 305728
E-mail address	matislav@fesb.hr
Personal web page	
Year of birth	1949
Scientist ID	27476
Research or art rank, and date of last rank appointment	Scientific Adviser, 01/11/1998
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Full Tenure Professor, 29/5/2006
Area and field of election into research or art rank	Technical Sciences, Field Electrical engineering
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Energy institute Hrvoje Požar, Zagreb
Date of employment	1/11/1998
Name of position (professor, researcher, associate teacher, etc.)	Scientific Adviser
Field of research	Electric transmission and distribution systems
Function	Scientific Adviser
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	University of Zagreb Faculty of Electrical Engineering and Computing
Place	Zagreb
Date	08/04/1986
INFORMATION ON ADDITIONAL TRAINING	
Year	1988
Place	Split, Croatia
Institution	United Nations
Field of training	United Nations Environment Program– Training Course on Long-Term Energy - Environment Alternatives Planning – LEAP
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	Electric power transmission systems Electric power distribution systems

title of course, study programme where it is/was offered, and level of study programme)	Electrical Installation Lights interior and exterior design Energy system analysis Renewable Energy Energy efficiency
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)	Majstrovic, M.; Sutlovic, E.; Ramljak, I.*: Critical diameter of particles produced in overhead line conductor clashing*, Applied Thermal Energy 114 (2017), pp. 713-718, Elsevier Ramljak, I.; Sutlović, E.; Majstrovic, M.: *Statistical analysis of conductor clashing particles in low-voltage distribution network*, XIV INFOTEH - JAHORINA, Vol. 14, March 18-20, 2015, Jahorina, BiH Majstrovic, M.; Sutlovic, E.; Ramljak, I.; Nizetic, S.: *The impact of conductor material on the critical diameter of particle produced in overhead line conductor clashing*, 9th International Energy and Environment Symposium (IEEES-9), May 14-17,2017, Split, Croatia
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	1. Granic, G., et al. (contributors: Jelavic, B.; Majstrovic, M.; Majstrovic, G.; Zeljko, M., Pesut, D.; Bosnjak, R.; Karan, M.): *What is security of supply in the open market and how to achieve it?*, Proceedings of the XXIst World Energy Congers, September 12-16, 2010, Montreal, Canada 2. Ramljak, I.; Majstrovic, M.; Sutlović, E.: *Statistical Analysis of Particles of Conductor Clashing*, IEEE International Energy Conference ENERGYCON 2014, May 13-16, 2014, Dubrovnik, Croatia 3. Majstrovic, M.; Majstrovic, G.: *Short circuit current distribution through the overhead line of 220 kV TS Brinje – TS VE Senj*, Energy institute Hrvoje POzar, Zagreb, 2016 4. Mikulic, S.; Majstrovic, G.; Majstrovic, M.: *Feasibility study of reactive power compensation in the 400 kV transmission network of Croatia – Book 1 – Reactive power assessment and voltage control with a static model*, Energy institute Hrvoje Pozar, Zagreb, 2015
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	1. HRZZ Istraživački projekt: *Neizvjesnosti i rizici u planiranju elektroenergetskih mreža*, 2010.-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?-pedagoške kompetencije?	
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	1. IEEE PES Chapter Outstanding Engineer Award, 2011 2. HED Zaklada Hrvoje Požar godišnja nagrada za stručni I znanstveni doprinos razvoju energetike, 2006 3. IEEE elected to the grade Senior Member, 2004
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)	4,8/5

First and last name and title of teacher	**Tonći Modrić, Ph.D., Assistant Professor**
The course he/she teaches in the proposed study programme	Electrical Power Switchyards and Substations
GENERAL INFORMATION ON COURSE TEACHER	
Address	Tijardovićeva 14, 21000 Split, Croatia
Telephone number	+385 21 305-630
E-mail address	tmodric@fesb.hr
Personal web page	-
Year of birth	1982.
Scientist ID	325646
Research or art rank, and date of last rank appointment	Research associate, 20.11.2014.
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Assistant Professor, 17.12.2014.
Area and field of election into research or art rank	Technical Sciences, Electrical Engineering
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	University of Split Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture (FESB)
Date of employment	1.12.2010.
Name of position (professor, researcher, associate teacher, etc.)	Assistant Professor
Field of research	Electric Power Engineering
Function	-
INFORMATION ON EDUCATION – Highest degree earned	
Degree	Ph. D.
Institution	FESB
Place	Split
Date	5.5.2014.
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)	-
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)	4. Lovrić, D.; Vujević, S.; Modrić, T.: "Comparison of different metal oxide surge arrester models", Proceedings of the International Conference on Applied Electromagnetics (PES 2011), Perić, Z. (ur.), Niš, Serbia: 2011, pp. (O1–2) 1–4. 5. Vujević, S.; Balaž, Z.; Modrić, T.; Sarajčev, P.: "Hybrid Model for Analysis of Ground Fault Current Distribution", International Review of Electrical Engineering, Vol. 7 (2), 2012, pp. 4035–4045. 6. Modrić, T.; Vujević, S.; Lovrić, D.: "Napredni algoritmi za analizu elektromagnetskih polja elektroenergetskih vodova i postrojenja", 11. savjetovanje HRO CIGRE / Filipović-Grčić, B. (ur.) - Zagreb: Hrvatski ogranak CIGRE, 2013. pp. (C4–18) 1–10. 7. Modrić, T.; Vujević, S.; Majić, T.: "Geometrical Approximation of the Overhead Power Line Conductors", International Review on Modelling and Simulations, Vol. 7(1), 2014, pp. 76–82. 8. Vujević, S.; Modrić, T.; Vukić, B.: "Internal Impedance of Two-Layer Cylindrical Conductors", International Review of Electrical Engineering, Vol. 9(1), 2014, pp. 235–243.
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. Vujević, S.; Lucić, R.; Jurić-Grgić, I.; Lovrić, D.; Modrić, T.; Balaž, Z.: "Izrada pravila i mjera sigurnosti za osiguranje mjesta rada na elektroenergetskim vodovima", 2013. 2. Vujević, S.; Lovrić, D.; Modrić, T.: "Mjerenje i analiza razine neionizirajućeg elektromagnetskog polja u okolišu TS 10/0,4 kV Brda 3", 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?	-
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)	4,75/5

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 Measurements of Process Quantities
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	**Petar Sarajčev, Ph.D., Associate Professor**
The course he/she teaches in the proposed study programme	High Voltage Engineering Protection at Substations
GENERAL INFORMATION ON COURSE TEACHER	
Address	R. Boškovića 32, HR-21000, Split
Telephone number	+385 21 305806
E-mail address	petar.sarajcev@fesb.hr
Personal web page	
Year of birth	1976.
Scientist ID	272943
Research or art rank, and date of last rank appointment	Scientific Adviser, 10/03/2016
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Associate Professor, 16/05/2012
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	01/03/2009
Name of position (professor, researcher, associate teacher, etc.)	Associate Professor
Field of research	Power system analysis
Function	
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Place	Split
Date	15/04/2008
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 (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	High voltage engineering, Graduate study

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. P. Sarajčev, J. Vasilj, R. Goić, Monte Carlo analysis of wind farm surge arresters risk of failure due to lightning surges, Renewable Energy, Vol. 57, pp. 626-634, 2013. 2. J. Vasilj, P. Sarajčev, R. Goić, Modeling of current-limiting air-core series reactor for transient recovery voltage studies, Electric power systems research, Vol. 117, pp. 185-191, 2014. 3. P. Sarajcev, J. Vasilj, D. Jakus, Monte–Carlo analysis of wind farm lightning- surge transients aided by LINET lightning-detection network data, Renewable Energy, Vol. 99, pp. 501-513, 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)	
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	**Elis Sutlović, Ph.D., Full Professor**
The course he/she teaches in the proposed study programme	Power Plants, Power System Planning, Power System Operation and Control, Computer Application in Electric Power System
GENERAL INFORMATION ON COURSE TEACHER	
Address	Kranjčevićeva 28, Split
Telephone number	091 630 5730
E-mail address	Elis.Sutlovic@fesb.hr
Personal web page	
Year of birth	1961.
Scientist ID	122652
Research or art rank, and date of last rank appointment	Scientific Adviser, 16.12.2010.
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Senior Full Professor, 25.02.2016.
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	24.10.1984.
Name of position (professor, researcher, associate teacher, etc.)	Professor
Field of research	Power system planning and analysis, Power system operation and control
Function	Head of Chair of Electrical facilities and power systems
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Place	Split
Date	2001.
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)	Power engineering, Graduate study programme, Power system control, Graduate study programme
Authorship of university/faculty textbooks in the field of the course	Ivan Medić, Elis Sutlović: Električna postrojenja, upute za laboratorijske vježbe, Skripta, FESB Split, ISBN 978-953-290-045-3, Split, 2014.
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1. Ivan Ramljak, Matislav Majstrović, Elis Sutlović: Statistical Analysis of Particles of Conductor Clashing, *Proceeding of IEEE EnergyCon 2014*, pp. 671-676, May 13-16, 2014, Dobrovnik, Croatia 2. Elis Sutlović, Snježana Čujić Čoko, Ivan Medić: Characteristics of basin inflows a statistical analysis for long-term/mid-term hydrothermal scheduling, Thermal Science Journal, Vol 18/3, pp. 9-809, 2014. 3. Ivan Ramljak, Elis Sutlović, Matislav Majstrović: Statistical analysis of conductor clashing particles in low-voltage distribution network, INFOTEH-JAHORINA Vol. 14, March 2015. 4. M. Majstrović, E. Sutlović, I. Ramljak, "Critical diameter of particles produced in overhead line conductor clashing", *Applied thermal engineering*, Vol 114, pp. 713-718, 2017.
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. MZOŠ Istraživački projekt: Power system expansion and operation with large scale integration of wind power, 2006-2012. 2. VIF FESB: Analiza energetskih tokova u kompleksnom energetskom sustavu, 2015-2017.
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)	4,8/5

First and last name and title of teacher	**Silvestar Šesnić, Ph.D., Assistant Professor**
The course he/she teaches in the proposed study programme	Application of Analytical Methods in Electromagnetic Compatibility
GENERAL INFORMATION ON COURSE TEACHER	
Address	Stepinčeva 65, 21000 Split
Telephone number	+385914305814
E-mail address	ssesnic@fesb.hr
Personal web page	-
Year of birth	1979.
Scientist ID	272965
Research or art rank, and date of last rank appointment	Research associate, 14.02.2013.
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Assistant Professor, 06.2014.
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	01.01.200.5
Name of position (professor, researcher, associate teacher, etc.)	Assistant Professor
Field of research	Research and higher education
Function	-
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Faculty of electrical Engineering, Mechanical Engineering and Naval Architecture, University of Split
Place	Split, Croatia
Date	04.11.2010.
INFORMATION ON ADDITIONAL TRAINING	
Year	2013.
Place	Clermont Ferrand, France
Institution	Polytech' Clermont Ferrand, Blaise Pascal University
Field of training	Electromagnetic compatibility
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
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)	Fundamentals of Electrical Engineering 2, Electrical engineering and information technology, Undergraduate 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)	• Poljak, Dragan; Šesnić, Silvestar; Drissi, Khalil El-Khamlichi; Kerroum, Kamal; Tkachenko, Sergey. Transient Electromagnetic Field Coupling to Buried Thin Wire Configurations: Antenna Model versus Transmission Line Approach in the Time Domain. // *International Journal of Antennas and Propagation*. 2016 (2016); 1-11 • Poljak, Dragan; Šesnić, Silvestar; Cavka, Damir; Drissi, Khalil El Khamlichi. On the use of the vertical straight wire model in electromagnetics and related boundary element solution. // Engineering analysis with boundary elements. 50 (2015); 19-28 • Šesnić, Silvestar; Garma, Tonko; Poljak, Dragan; Tkachenko, Sergey V. Comparison of the antenna model and experimental analysis of an impulse impedance of the horizontal grounding electrode. // Electric power systems research. 125 (2015); 159-163 • Šesnić, Silvestar; Poljak, Dragan. Antenna model of the horizontal grounding electrode for transient impedance calculation: Analytical versus Boundary Element Method. // Engineering analysis with boundary elements. 37 (2013), 6; 909-913 • Šesnić, Silvestar; Poljak, Dragan; Tkachenko, Sergey V. Analytical Modeling of a Transient Current Flowing Along the Horizontal Grounding Electrode. // IEEE transactions on electromagnetic compatibility. 55 (2013), 6; 1132-1139
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)	• ITER Physics Work Package – Code Development for Integrated Modelling, EURATOM, Horizon 2020 • Civil Engineering Applications of Ground Penetrating Radar, COST • EMI study of PLC services, Bilateral agreement Cogito, Croatia, France • Modelling and environmental aspects of ELF electromagnetic fields, 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)	University of Split, 4.3, Fundamentals of Electrical Engineering 2

First and last name and title of teacher	**Božo Terzić, Ph.D., Full Professor**
The course he/she teaches in the proposed study programme	Semiconductor Power Converters, Automated Electrical Drives, Electric Servo Drives, Design of Power Converters
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 years in the field of the course (5 works at most)	1. Terzić, Božo; Despalatović, Marin; Slutej, Alojz. *Magnetization Curve Identification of Vector-Controlled 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?-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)	From 4 to 4,8.

First and last name and title of teacher	**Slavko Vujević, Ph.D., Full Professor**
The course he/she teaches in the proposed study programme	Electromagnetics, Lightning Protection and Grounding, Analysis of Electromagnetic, Fields and Circuits
GENERAL INFORMATION ON COURSE TEACHER	
Address	Vijugasta 18, Hr-21000 Split, Croatia
Telephone number	+385 21 305-613
E-mail address	vujevic@fesb.hr
Personal web page	
Year of birth	1958
Scientist ID	122731
Research or art rank, and date of last rank appointment	Scientific Adviser; January 20, 2005
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Senior Full Professor, September 24, 2009
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	February 26, 1982
Name of position (professor, researcher, associate teacher, etc.)	Professor
Field of research	Electrical Measurement, Power Quality
Function	Head of the Subdepartment of Electromagnetics and Engineering Modeling
INFORMATION ON EDUCATION – Highest degree earned	
Degree	Ph.D.
Institution	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Place	Split
Date	July 14, 1994
INFORMATION ON ADDITIONAL TRAINING	
Year	2003
Place	Neumarkt, Germany
Institution	DEHN + Söhne
Field of training	Certificate in Red/Line-Seminar and Yellow/Line-Seminar on "Lightning and Surge Protection in Power Networks"
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)
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	• Electromagnetics, the university undergraduate study of Electrical Engineering, specialisation Electric Power Engineering, University of Split, FESB

is/was offered, and level of study programme)	• Lightning Protection and Grounding, the university undergraduate study of Electrical Engineering, specialisation Electric Power Engineering, University of Split, FESB • Computation of Electromagnetic and Thermal Fields, the university undergraduate study of Electrical Engineering, specialisation Electric Power Engineering, University of Split, FESB
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. Vujević, Slavko; Lovrić, Dino, On Continuous Numerical Fourier Transform for Transient Analysis of Lightning Current Related Phenomena, Electric Power Systems Research, Vol. 119, pp. 364-369, 2015. 2. Vujević, Slavko; Lovrić, Dino; Balaž, Zdenko, Self and Mutual Ground Impedances of Cylindrical Metal Plates Buried In Homogeneous Earth, International Journal of Numerical Modelling - Electronic Networks Devices and Fields; Vol. 28. No. 1, pp. 33-49, 2015. 3. Vujević, Slavko; Lovrić, Dino; Boras, Vedran, High-Accurate Numerical Computation of Internal Impedance of Cylindrical Conductors for Complex Arguments of Arbitrary Magnitude, IEEE Transactions on Electromagnetic Compatibility, Vol. 56, No. 6, pp. 1431-1438, 2014. 4. Lovrić, Dino; Vujević, Slavko; Modrić, Tonći, On the Estimation of Heidler Function Parameters for Reproduction of Various Standardized and Recorded Lightning Current Waveshapes, International Transactions on Electrical Energy Systems; Vol. 23, No. 2, pp. 290-300, 2013. 5. Vujević, Slavko; Sarajčev, Petar; Lovrić, Dino, Time-Harmonic Analysis of Grounding System in Horizontally Stratified Multilayer Medium, Electric Power Systems Research, Vol. 83, No. 1, pp. 28-34, 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)	Project of MZOS of Republic of Croatia no. 023-0000000-3271 - Development of Advanced Algorithms for Modelling of Electromagnetic Phenomena, 2008 - 2013 (project leader Professor Slavko Vujević)
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	**Dinko Vukadinović, Ph.D., Full Professor**
The course he/she teaches in the proposed study programme	Control of Electrical Machines Control of Electrical Machines Laboratory
GENERAL INFORMATION ON COURSE TEACHER	
Address	Pujanke 61, Split
Telephone number	021/376-715
E-mail address	dvukad@fesb.hr
Personal web page	
Year of birth	1973
Scientist ID	248950
Research or art rank, and date of last rank appointment	Senior research scientist, 15/7/2010
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Full Professor, 26/1/2013
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	9/2/1998
Name of position (professor, researcher, associate teacher, etc.)	Full Professor
Field of research	Power Engineering (Power Electronics, Control of Electrical Machines)
Function	Head of Group for Power Electronics and Control
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Place	Split
Date	27/10/2005
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, 3
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	Germany, 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. Bašić, M., Vukadinović, D. „Online Efficiency Optimization of a Vector Controlled Self-Excited Induction Generator“, IEEE Transactions on Energy Conversion. 31 (2016) , 1; 373-380 2. Vukadinović, D., Bašić, M., Nguyen, C.H., Vu, N.L., Nguyen, T.D., „Hedge-Algebra-Based Voltage Controller for a Self- Excited Induction Generator“, *Control engineering practice*, 30 (2014) ; 78-90 3. Bašić, M., Vukadinović, D., „Vector control system of a self-excited induction generator including iron losses and magnetic saturation“, *Control engineering practice*, 21 (2013) , 4; 395-406 4. Bašić, M., Vukadinović, D., Petrović, G., „Dynamic and Pole-Zero Analysis of Self-Excited Induction Generator Using a Novel Model with Iron Losses“, *International journal of electrical power & energy systems*, 42 (2012) , 1; 105-118 5. Bašić, M., Vukadinović, D., Polić, M., „Analysis of Power Converter Losses in Vector Control System of a Self–Excited Induction Generator“, *Journal of Electrical Engineering - Elektrotechnický časopis*, 65 (2014) , 2; 65-74
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?-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)	

3.4. Optimal number of students

The admission quote for the first year of studies is 60.

3.5. Estimate of costs per student

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

3.6. 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 Split 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 enhancement system of FESB</td></tr>
<tr><td colspan="2">• Quality Assurance Handbook of the constituent part</td></tr>
<tr><td colspan="2">Description of procedures for evaluation of the quality of study programme implementation:
• For 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</td></tr>
</table>

	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.
Monitoring of grading and harmonization of grading with anticipated learning outcomes	Committee for study programmes in Electrical Engineering and Computing 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 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