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

FACULTY OF ELECTRICAL ENGINEERING, MECHANICAL ENGINEERING AND NAVAL ARCHITECTURE

DETAILED PROPOSAL OF THE STUDY PROGRAMME

GRADUATE UNIVERSITY STUDY IN INFORMATION AND COMMUNICATION TECHNOLOGY

SPLIT, April 2024

CONTENTS

GENERAL INFORMATION OF HIGHER EDUCATION INSTITUTION

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

GENERAL INFORMATION OF THE STUDY PROGRAMME

Name of the study programme	Information and Communication Technology		
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 Information and Communication Technology (mag. ing. el.)		

1. INTRODUCTION

1.1. Reasons for starting the study programme

Information and Communication Technology (ICT) is one of the most dynamic sectors of world and European industry. The European Commission, together with the ICT industry, encourages the development of new educational programmes in the field of ICT as a prerequisite for the development of the information society (Digital Agenda for Europe, Grand Coalition for Digital Jobs http://ec.europa.eu/digital-agenda/en/grand-coalition-digital-jobs-0#Article). The development of this sector initiates fundamental changes in all areas of work and life. The area of information and communication technology has become exceptionally wide and interdisciplinary, and there is virtually no human activity in which information and communication technology do not contribute, significantly fostering their development. One of the main features of the field of information and communication technology is its rapid development. 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. Technologies like Internet, WWW, e-commerce, mobile communications, digital television and other are rapidly developing and keep integrating thus changing working and living environment.

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 development of information and communication technology requires professionals with knowledge in the field of engineering with particular emphasis on the broad systemic perspective.

The area of ICT has been identified as an area of strategic importance for the development of the information society. Strategy of development of Croatia “Croatia in the 21st century” puts emphasis on the need for increasing the number of trained professionals in this field. In the recommendations of the National Foundation for Science, Higher Education and Technological Development of the Republic of Croatia, the field of ICT was highlighted as a priority.

Study programme in Information and Communication Technology was developed in order to enable students to acquire basic theoretical knowledge and practical expertise, and to train them for permanent adoption of new knowledge and technologies. In addition, during the course of studies each student develops skills of creative thinking, independent and team work and ability to make business decisions at all levels of decision-making. The teaching process conforms with global and particularly with European trends in higher education and with the needs of the economy, and accordingly, appropriate curricula are created. Study programme in Information and Communication Technology is closely related to current scientific achievements in the scientific area of engineering and natural sciences, in the field of electrical engineering, computing and information technology. This programme conforms to the modern concept of interdisciplinary studies.

FESB scientists actively participate in the development of the mentioned scientific and professional fields. Scientific cooperation with renowned international scientific institutions is one of the fundamental commitments of FESB. FESB actively participates in the international scientific projects in the field of information and communication technology: COST 261, COST 286, COST 290, COST BM0704, COST BM1309, COST TD1301, COST IC1004, COST IC1002, COST TU1208, ALIS, CEEPUS, FP6 project PEM, Electromagnetic Pollution ECO-NET. For 23 years, FESB has been organizing International Scientific Conference on Software, Telecommunications and Computer Networks SoftCOM. Technical sponsor of the SoftCOM Conference is the most influential global association for promotion of scientific and expert work in the fields of electrical engineering and computing – IEEE (Institute of Electrical and Electronic Engineers), with the seat in the USA. The Conference gathered together scientists and experts from more than 40 countries. FESB scientists are actively involved in the organization and maintenance of a number of renowned international scientific conferences such as BEM, ELECTROCOMP, COST 286 Workshop, COST BM1309 and others. FESB scientists present their results at numerous academic conferences world-wide and in renowned journals.

The goal of the proposed graduate study programme in Information and Communication Technology is to educate professional staff able to perform the most complex tasks in the area of information and communication technology in the industry, in governmental and other public institutions.

Development of a major part of economy and public sector in the region striving towards information and communication technology is strongly dependent on professionals trained in this area. Dynamic development of the region will most certainly result in increased need for professionals in the field of information and communication technology.

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

Split is the economic and university hub of the major part of the Dalmatian region, as well as one part of the neighbouring region of Bosnia and Herzegovina. The Faculty of Electrical Engineering in Split was established in 1960, with the aim of educating skilled professionals for the sectors of economy based on electrical engineering. Field of study Information and Communication Technology titled Electro-communications was established in 1983.

Purpose of the study programme has been confirmed by the number of students who successfully completed their studies and are employed in practically all sectors of economy and public services especially in enterprises related to the field of information and communication technology. Demands of the labour market for this profile of experts significantly exceed current availability of experts. 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.

On completion of the study programme, students will have acquired knowledge necessary for development, design, production, monitoring and maintenance of complex systems in the field of Information and Communication Technology. The study programme has a crucial role in relation to the labour market as the final stage in the framework of two cycle system training broadly educated professional able to perform the most complex scientific-research and engineering tasks. The demand for experts with these competences considerably exceeds the available number of educated experts in the region, Croatia and the world.

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

Study programme in Information and Communication Technology has been recognized by a number of enterprises related to the field of electronics and computing, as well as by numerous public institutions.

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.

As far as the area of information and communication technology is concerned, FESB cooperates with Croatian Communications and Information Society (CCIS), which is a sister society of IEEE, the world's most influential technical professional organization. In addition, FESB cooperates with professional organization named ACM.

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

FESB is actively pursuing the process of development in higher education on global level, and especially in Europe. When developing the new curriculum of the study programme in Information and Communication Technology, 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 Information and Communication Technology differ a lot, both worldwide and in Europe. 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 information and communication technology.

The proposed programme of graduate study in Information and Communication Technology, together with the field of study Information and Communication Technology, represents a content unit of the undergraduate study programme in Electrical Engineering and Information Technology.

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/). There are two defined programme modules in the framework of the proposed programme (Telecommunications and Computer Information Systems module and Wireless Communications module) that conform to two specializations in the field of telecommunications as defined in project THEIERE. The structure of the programme is in line with the recommendations of the ASIIN (Accreditation Agency for Study Programs in Engineering, Informatics, Natural Sciences and Mathematics). The proposal of the programme complies with the recommendations of SEFI (European Society for Engineering Education) and CESAER (Conference of European Schools for Advanced Engineering Education and Research). When developing the curriculum of the study programme, special attention was given to the comparability with relevant study programmes at the Faculty of Electrical Engineering and Computing, University of Zagreb. The organisation of the proposed study programme is comparable with related study programmes at the following European institutions:

- Telekommunikation (Magisterstudium), Technische Univerzität Wien/ Engineering University Vienna, Austria, http://www.tuwien.ac.at/informationen_fuer/studierende
- Informations - und Kommunikationstechnik (Studiumrichtung), Elektrotechnik und Informationstechnik (Master studium), Technische Univerzität München, / Department of Electrical and Computer Engineering, Technical University of Munich, Germany, http://www.ei.tum.de/studienbetrieb/master/

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

Graduate university study programme in Information and Communication Technology enables vertical and horizontal mobility of students. In terms of vertical mobility, Graduate university study programme in Information and Communication Technology is open for mobility of students of related postgraduate study programmes at Universities in Croatia and in Europe. In terms of horizontal mobility, the graduate study programme in Information and Communication Technology is open for mobility of students of related study programmes 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.

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 Information and Communication Technology conforms with the Strategy of the University of Split 2015-2020 (Mission, vision and strategic guidelines). 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 Information and Communication Technology 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 to 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 proposed study programme 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. The Faculty has implemented professional studies (level VI in former qualifications system) since 1979 until today, with hiatus during the period 1998-2001.

In 1966, a Computer Centre was established at Faculty and a computer Iskra Zuse Z-23 / V was purchased with the financial support of the local enterprises. This was the first computer purchased in town and the first installed computer at a higher education institution in Croatia. Due to the above mentioned, IT education was offered to the experts from various fields of the economy and the Faculty became the central higher education institution in the field of computer information systems in the region. Continuous work at developing the curricula resulted in establishing a number of study programmes at undergraduate and postgraduate level.

The curriculum of study programme in Electrical Engineering, adopted in 2000, contained two fields of study: Power Engineering and Electronics. The first three semesters of the study programme were identical for both fields of study, and the following semesters provided specialist courses with elective disciplines of study. Study programme in Electro-communications comprised the area of information and communication technology, and was established in 1983.

Faculty delivered postgraduate study programme in Electrical Engineering awarding master and doctoral degrees. The programme provides specialisation in the areas of telecommunications and computer information systems, electronics, power engineering and electromechanical engineering, automation and computing.

Within the Bologna Process, the Faculty introduced new study programmes in 2005. In accordance with the recommendations of the Bologna Declaration and European accreditation agencies, graduate study programme in Information and Communication Technology was introduced, following the experience in delivering the final part of the earlier undergraduate study programme in the framework of the field of study Electro-communication (study programme Electrical Engineering, 5^{th}-9^{th} semester).

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

2. DESCRIPTION OF THE STUDY PROGRAMME

2.1. General information

Scientific/artistic area of the study programme	Engineering sciences
Duration of the study programme	2 years
The minimum number of ECTS required for completion of study	120
Enrolment requirements and admission procedure	Completed undergraduate study programme in Electrical Engineering and Information Technology, field of study Information and Communication Technology, 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 Information and Communication Technology. 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 problems in the field of information and communication technology.
2. To apply advanced engineering knowledge and engineering principles in presenting and solving highly complex and original problems in the field of information and communication technology
3. To apply acquired knowledge in identifying, formulating and solving highly complex problems in the field of information and communication technology
4. To develop innovative analytical methods and advanced modelling procedures in solving highly complex engineering problems in the field of information and communication technology
5. To critically review the features of new and upcoming products, processes and methods in the field of information and communication technology
6. By applying scientific principles, to design innovative experiments with the use of state-of-the-art technological solutions in the area of information and communication technology
7. To select optimal engineering and economic solutions in the design and construction of the most complex systems, networks and services in the field of information and communication technology
8. To critically assess and provide arguments for the possibilities of applied techniques and methods and their limitations.
9.

SKILLS

10. To apply advanced techniques of software development and software engineering in solving the most complex problems in the field of information and communication technology
11. To conduct complex experiments and measurements, analyse and interpret collected data and measurement results and give conclusions and proposals for solutions.
12. To manage multidisciplinary and international teams
13. To prepare design documents and technical reports, using modern technologies.
14. To use literature, databases and other sources of information.
15. To give public presentations, to prepare written reports and present project results in Croatian and English.

INDEPENDENCE

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

RESPONSIBILITY

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

ADDITIONAL LEARNING OUTCOMES FOR THE MODULE WIRELESS COMMUNICATION

1. To consolidate theoretical knowledge and practical skills in solving highly complex problems in the area of wireless communications, antenna systems and electromagnetic compatibility.
2. To propose new procedures and new solutions for modernisation in the area of wireless communications, antenna systems and electromagnetic compatibility.
3. To develop innovative programming solutions for simulation of components and systems in the area of wireless communications, antenna systems and electromagnetic compatibility
4. To design advanced hardware solutions in the area of wireless communications, antenna systems and electromagnetic compatibility
5. To analyse physical phenomena in devices in the field of wireless communications, antenna systems and electromagnetic compatibility.
6. To organise and manage the investigation of highly complex systems in the field of wireless communications, antenna systems and electromagnetic compatibility.
7. To design innovative solutions in the development, design, implementation and investigation of elements and devices in the field of wireless communications, antenna systems and electromagnetic compatibility

ADDITIONAL LEARNING OUTCOMES FOR THE MODULE TELECOMMUNICATIONS AND COMPUTER INFORMATION SYSTEMS

1. To consolidate theoretical knowledge and practical skills in solving highly complex problems in the area of telecommunications and computer information systems, wireless and optical networks and the development of telecommunication software.
2. To propose new procedures and new solutions for modernisation in the area of telecommunications and computer information systems, wireless and optical networks and the development of telecommunication software

3. To develop innovative programming solutions for simulation of systems and networks in the area of telecommunications and computer information systems, wireless and optical networks and the development of telecommunication software
4. To design advanced algorithmic solutions in the area of telecommunications and computer information systems, wireless and optical networks and the development of telecommunication software
5. To analyse complex systems and networks in the area of telecommunications and computer information systems, wireless and optical networks and the development of telecommunication software
6. To organise and manage the investigation of highly complex systems and networks in the area of telecommunications and computer information systems, wireless and optical networks and the development of telecommunication software
7. To design innovative solutions in the development, design, implementation and investigation of complex systems and networks in the area of telecommunications and computer information systems, wireless and optical networks and the development of telecommunication software

2.3. Employment possibilities

The goal of the graduate study in Information and Communication Technology is to educate professionals for the most demanding positions in the area of information and communication technology in the industry, higher education institutions, governmental and other public institutions.

After having completed the study programme, students can, due to their acquired knowledge, be employed in many companies related to the field of information and communication technology, public institutions and in the service sectors. There is virtually no working environment in which experts with completed graduate university study in Information and Communication Technology could not find employment and the labour market demands 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 Information and Communication Technology acquire the skills necessary for work in various areas: in companies that produce telecommunication equipment, telecommunication operators, in public institutions, in companies that develop telecommunication and network services, in companies that develop telecommunication software and in the other manufacturing and service industries. After having completed the study programme, the students are capable of testing, maintenance, designing, monitoring and controlling the most complex systems and networks in the field of information and communication technologies. 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.

In addition, there is also a support provided by economic and public sector of Split-Dalmatia County, by major part of the Dalmatian region and by state administration. FESB is a signatory to a number of cooperation agreements with the aim of promoting academic and educational activities, concluded with numerous enterprises and public organisations related to the Information and Communication Technology e.g.: Ericsson Nikola Tesla, Siemens, Croatian Telecom, Hrvatska elektroprivreda (national power company, VIPnet, Microsoft Croatia and Split-Dalmatia County. Professionals trained at FESB, at the field of study Electro-communications, represent a foundation of highly educated staff in numerous companies in the region related to the field of Information and Communication Technology including Ericsson Nikola Tesla, Croatian Telecom, Siemens and other.

Purpose of the study programme has been confirmed by the number of students who successfully completed their studies and are employed in practically all sectors of economy and public services, especially in enterprises related to the field of information and communication technology. Demands of the labour market for this profile of experts significantly exceed current availability of experts. 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.

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 study programme in Information and Communication Technology, 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. There are two programme modules:

- Wireless Communications
- Telecommunications and Computer information systems

In each semester, in addition to required courses, the students select elective courses as well. 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. As far as organisation of study programme in Information and Communication Technology is concerned, of particular importance are: Vice-dean for education, Committee for study programme in Electrical Engineering and Computing, Commission for study programme in Information and Communication Technology, student 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

Study programme module: WIRELESS COMMUNICATIONS - 241

List of courses								
Year of study: 1.								
Semester: I.								
STATUS	CODE	COURSE	HOURS IN SEMESTER*					ECTS
			L	S	AE	LE	DE	
Mandatory	FELJ01	Digital telecommunications	45	0	15	15	0	6
	FELH03	Electromagnetic waves	30	0	15	15	0	5
	FELJ02	Radio communications	30	0	15	15	0	5
	FELJ17	Numerical methods in communications	30	0	0	30	0	5
	FEMJ02	Information and technology physics	30	0	0	15	0	4
		Elective course 1**						
	Total		165	0	60	75	0	25
	* L = lectures, S = seminars, AE = auditory excercise, LE = laboratory excercise, DE = design excercise							
**** Elective courses are selected from the proposed list of this study programme module.**								
Elective**	FELJ03	Transmission systems	30	0	15	15	0	5
	FELH33	Digital television and video	30	0	0	30	0	5
	FELJ28	Radars	30	0	0	30	0	5
	FENj01	Application of analytical methods in electromagnetic compatibility	30	0	15	15	0	5
	FELH11	Artificial intelligence	30	0	0	30	0	5
	One elective course is selected.							
	* L = lectures, S = seminars, AE = auditory excercise, LE = laboratory excercise, DE = design excercise							

List of courses								
Year of study: 1.								
Semester: II.								
STATUS	CODE	COURSE	HOURS IN SEMESTER*					ECTS
			L	S	AE	LE	DE	
Mandatory	FELJ09	Wireless communication networks	30	0	15	15	0	5
	FELJ14	Mobile communications	30	0	0	30	0	5
	FELJ33	Antennas	30	0	0	30	0	6
	FELJ34	Microwave electronics	30	0	15	15	0	5
	FETJ01	Project management	30	0	0	15	0	4
		Elective course 1**						5
	Total		150	0	60	75	0	30
	* L = lectures, S = seminars, AE = auditory excercise, LE = laboratory excercise, DE = design excercise							
**** Elective courses are selected from the proposed list of this study programme module.**								
Elective**	FELJ10	Optical communication systems	30	0	15	15	0	5
	FELJ24	Bioelectromagnetics	30	0	0	30	0	5
	FELJ25	Satellite positioning systems	30	0	0	30	0	5
	FELH32	Electroacoustics	30	0	0	30	0	5
		Radiocommunications in maritime and aviation	30	0	0	30	0	5
	FELJ11	IP Communications	30	0	15	15	0	6
	FELJ37	Analysis methods in fusion technology	30	0	0	30	0	5
	One elective course is selected.							
	* L = lectures, S = seminars, AE = auditory excercise, LE = laboratory excercise, DE = design excercise							

List of courses								
Year of study: 2.								
Semester: III.								
STATUS	CODE	COURSE	HOURS IN SEMESTER*					ECTS
			L	S	AE	LE	DE	
Mandatory	FELH25	Electromagnetic compatibility	45	0	15	15	0	6
	FELJ21	Antenna systems and tehnologies	30	0	0	30	0	5
	FELJ26	Electromagnetic ecology and dosimetry	30	0	0	15	0	4
	FELJ22	Measurements in wireless systems	30	0	0	30	0	5
		Elective course 1**						
		Elective course 2**						
	Total		135	0	45	60	0	20
	* L = lectures, S = seminars, AE = auditory excercise, LE = laboratory excercise, DE = design excercise							
**** Elective courses are selected from the proposed list of this study programme module.**								
Elective**	FELJ07	Radiofrequency electronics	30	0	0	30	0	5
	FELJ20	Multimedia systems	30	0	0	30	0	5
	FELJ27	Microwave solid-state circuits	30	0	0	30	0	5
	FELK19	Wireless security	30	0	0	30	0	5
	FELJ29	Simulation and measurement of electromagnetic quantities	30	0	0	30	0	5
	FELJ38	Radio frequency identification technology	30	0	0	30	0	5
	FELJ36	Systems for wireless transmission of energy	30	0	0	30	0	5
		Medical devices	30	0	0	30	0	5
	FEXX06	Professional Training	0	0	0	0	0	5
	Two elective courses are selected.							
	* L = lectures, S = seminars, AE = auditory excercise, LE = laboratory excercise, DE = design excercise							

List of courses								
Year of study: 2								
Semester: IV.								
STATUS	CODE	COURSE	HOURS IN SEMESTER*					ECTS
			L	S	AE	LE	DE	
	FEXX02	Diploma thesis						30
	Total							30
* L = lectures, S = seminars, AE = auditory excercise, LE = laboratory excercise, DE = design excercise								

Study programme module:: TELECOMMUNICATIONS AND INFORMATICS - 242

List of courses								
Year of study: 1.								
Semester: I.								
STATUS	CODE	COURSE	HOURS IN SEMESTER*					ECTS
			L	S	AE	LE	DE	
Mandatory	FELJ01	Digital telecommunications	45	0	15	15	0	6
	FELJ03	Transmission systems	30	0	15	15	0	5
	FELJ02	Radio communications	30	0	15	15	0	5
	FELJ19	Information systems	30	0	0	30	0	5
	FEMJ02	Information and technology physics	30	0	0	15	0	4
		Elective course 1**						
	Total		165	0	45	90	0	25
	* L = lectures, S = seminars, AE = auditory excercise, LE = laboratory excercise, DE = design excercise							
**** Elective courses are selected from the proposed list of this study programme module.**								
Elective**	FELH03	Electromagnetic waves	30	0	15	15	0	5
	FELH33	Digital television and video	30	0	0	30	0	5
	FELK13	Data compression	30	0	0	30	0	5
	FELJ17	Numerical methods in communications	30	0	0	30	0	5
	FELH11	Artificial intelligence	30	0	0	30	0	5
	FELJ28	Radars	30	0	0	30	0	5
	One elective course is selected.							
	* L = lectures, S = seminars, AE = auditory excercise, LE = laboratory excercise, DE = design excercise							

List of courses								
Year of study: 1.								
Semester: II.								
STATUS	CODE	COURSE	HOURS IN SEMESTER*					ECTS
			L	S	AE	LE	DE	
Mandatory	FELJ09	Wireless communication networks	30	0	15	15	0	5
	FELJ10	Optical communication systems	30	0	15	15	0	5
	FELJ11	IP communications	30	0	15	15	0	6
	FELJ12	Algorithms	30	0	15	15	0	5
	FETJ01	Project management	30	0	0	15	0	4
		Elective course 1**						5
	Total		150	0	60	75	0	30
	* L = lectures, S = seminars, AE = auditory excercise, LE = laboratory excercise, DE = design excercise							
**** Elective courses are selected from the proposed list of this study programme module.**								
Elective**	FELJ13	Operating systems	30	0	0	30	0	5
	FELH32	Electroacoustics	30	0	0	30	0	5
	FELJ14	Mobile communications	30	0	0	30	0	5
	FELJ33	Antennas	30	0	0	30	0	6
	FELJ34	Microwave electronics	30	0	15	15	0	5
	FELK10	Cryptography and network security	30	0	0	30	0	5
	FELJ30	Radiocommunications in maritime and aviation	30	0	0	30	0	5
	FELK40	Computer forensics	30	0	0	30	0	5
	FELJ32	3D Renedering	30	0	0	30	0	5
	One elective course is selected.							
	* L = lectures, S = seminars, AE = auditory excercise, LE = laboratory excercise, DE = design excercise							

List of courses								
Year of study: 2.								
Semester: III.								
STATUS	CODE	COURSE	HOURS IN SEMESTER*					ECTS
			L	S	AE	LE	DE	
Mandatory	FELH30	Local and access networks	30	0	0	30	0	5
	FELJ18	Software engineering in telecommunications	30	0	0	30	0	5
	FELJ35	Network and mobile operating systems	30	0	0	30	0	5
	FELJ20	Multimedia systems	30	0	0	30	0	5
		Elective course 1**						
		Elective course 2**						
	Total		120	0	0	120	0	20
	* L = lectures, S = seminars, AE = auditory excercise, LE = laboratory excercise, DE = design excercise							
**** Elective courses are selected from the proposed list of this study programme module.**								
Elective**	FELJ07	Radiofrequency electronics	30	0	0	30	0	5
	FELH25	Electromagnetic compatibility	45	0	15	15	0	6
	FELJ21	Antenna systems and technologies	30	0	0	30	0	5
	FELJ22	Measurements in wireless systems	30	0	0	30	0	5
	FELK19	Wireless security	30	0	0	30	0	5
	FELJ38	Radio frequency identification technology	30	0	0	30	0	5
	FELJ36	Systems for wireless transmission of energy	30	0	0	30	0	5
		Medical devices	30	0	0	30	0	5
	FEXX06	Professional Training	0	0	0	0	0	5
	Two elective courses are selected.							
	* L = lectures, S = seminars, AE = auditory excercise, LE = laboratory excercise, DE = design excercise							

List of courses								
Year of study: 2.								
Semester: IV.								
STATUS	CODE	COURSE	HOURS IN SEMESTER*					ECTS
			L	S	AE	LE	DE	
	FEXX02	Diploma thesis						30
	Total							30
* L = lectures, S = seminars, AE = auditory excercise, LE = laboratory excercise, DE = design excercise								

2.13. Course description

<table>
<tr><td>NAME OF THE COURSE</td><td colspan="6">ALGORITHMS</td></tr>
<tr><td>Code</td><td>FELJ12</td><td>Year of study</td><td colspan="5">1.</td></tr>
<tr><td>Course teacher</td><td>Matko Šarić, Ph.D., Assistant Professor</td><td>Credits (ECTS)</td><td colspan="5">5</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2">Ante Topić, Teaching Assistant</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:
- Design of efficient algorithms and analysis of algorithms properties (speed and memory)
- Adopting the practical knowledge about sorting algorithms and graph-based algorithms</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="6">BsC degree.</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:
- Analyze the execution time of the algorithm
- explain and apply different sorting algorithms
- explain and apply graph-based algorithms
- apply dynamic programming</td></tr>
<tr><td rowspan="13">Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="3">Course content</td><td>L or S hours</td><td colspan="2">AE hours</td></tr>
<tr><td colspan="3">Introduction. What are algorithms. Analyzing algorithms in Example D-2 maximum</td><td>3</td><td colspan="2">0</td></tr>
<tr><td colspan="3">Analyzing of the loops. Solving of summations. Solving 2-D maximum - method of crossing the plane.</td><td>3</td><td colspan="2">0</td></tr>
<tr><td colspan="3">Asymptotic notation. Limited rule.</td><td>3</td><td colspan="2">0</td></tr>
<tr><td colspan="3">The technique of divide and rule. Mergesort (pseudocode, execution time analysis).</td><td>3</td><td colspan="2">0</td></tr>
<tr><td colspan="3">Recursion (search pattern, iteration, recursion tree method). Master theorem.</td><td>3</td><td colspan="2">0</td></tr>
<tr><td colspan="3">Heap data structure. Heapsort (pseudocode, execution time analysis).</td><td>3</td><td colspan="2">0</td></tr>
<tr><td colspan="3">Quicksort (pseudocode, execution time analysis)</td><td>3</td><td colspan="2">0</td></tr>
<tr><td colspan="3">The lower limit of sorting algorithms execution time. Sorting by linear time. (counting sort, radix sort).</td><td>3</td><td colspan="2">0</td></tr>
<tr><td colspan="3">The algorithms based on graphs (basic concepts and definitions).</td><td>3</td><td colspan="2">0</td></tr>
<tr><td colspan="3">Graph representation using the adjacency matrix and adjacency list. BFS algorithm.</td><td>3</td><td colspan="2">0</td></tr>
</table>

	All pairs shortest paths. Dynamic programming. Floyd-Warshall algorithm.	3	0
	Longest common subsequence. Matrix chain multiplication	3	0
	Decision problems. NP-problems and polynomial time verification. NP completeness. Reduction. Hamiltonian path and Hamiltonian cycle.	3	0
	List of laboratory or design exercises		LE hours
	Analysis of typical running times		2
	Solving of summations		2
	Recursions		2
	Merge sort I		2
	Merge sort II		2
	Heap sort		2
	Quicksort		2
	Linear time sorting algorithms		2
	Graph representation		2
	BFS algorithm		2
	Floyd-Warshall algorithm		2
	Longest common subsequence		2
	Matrix chain multiplication		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	2,0	Research		Practical training	
	Experimental work		Report		Individual work	2,2
	Essay		Seminar essay		Laboratory exercises	0,5
	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 midterms and final exams. The first midterm exam is after 7 weeks of lecturing and the second one is after the next 6 weeks. Midterm test and final test consist of theoretical questions and numerical problems. In the final exams students that did not pass the midterm exams take part. The midterm and final exams are carried out as written tests. The requirement for passing grade is the positive assessment of laboratory exercises and 50 % points on each midterm exam or the final exam. Grade (in percentage) is formed according to the formula: Grade(%) = 0,5 (M1 + M2) the activities in percentage: • M1, M2 – test results. The final grade is defined in the next way:

<table>
<tr><td></td><td colspan="3">50% do 63% sufficient (2)
64% do 77% good (3)
78% do 91% very good (4)
92% do 100% excellent (5)</td></tr>
<tr><td rowspan="6">Required literature (available in the library and via other media)</td><td>Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td>Individual work</td><td></td><td>e-learning portal</td></tr>
<tr><td>Laboratory exercises</td><td></td><td></td></tr>
<tr><td>Preparation for laboratory exercises</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">T.Cormen, C.Leiserson, R.Rivest, C.Stein: „Introduction to Algorithms“, second edition, third printing, McGraw-Hill, 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
- Feedback from students who have already obtained BsC degree</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="3"></td></tr>
</table>

NAME OF THE COURSE	ANALYSIS METHODS IN FUSION TECHNOLOGY						
Code	FELJ37	Year of study	3				
Course teacher	Dragan Poljak, Ph.D., Full Professor	Credits (ECTS)	5				
Associate teachers	Anna Šušnjara, Teaching Assistant	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	30	
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION			
Course objectives	Training students for: - Understanding and application of fundamental principles and laws of plasma physics and magnetohydrodynamics (MHD), - Solve MHD equations via analytical methods, - Solve MHD equations via numerical methods - Permanent adopting and fostering the knowledge in the area of fusion technology		
Course enrolment requirements and entry competences required for the course	Fundamental of Electrical Engineering 1 and 2, Electromagnetic Fields		
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - Analyze magnetic flux in plasma by analytically solving MHD equations - Analyze magnetic flux in plasma by numerically solving MHD equations - Use researchsoftware packages for the analysis of plasma systems - Use commercial software packages for the analysis of plasma systems		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	Energy problem in 21st century. Quest for 'clean' energy.	2	
	Fundamentals of plasma physics. Microscopic and macroscopic definition of plasma.	2	
	Termonuclear fusion and plasma confinement.	2	
	Fundamentals of magnetohydrodynamics.	2	
	MHD equations; induction equation, motion equation, energy equation.	2	
	MHD equilibrium.	2	
	Simple configuration of MHD equilibrium; cylindrical geometry.	2	
	Equilibrium in toroidal geometries; Grad-Shafranov equation. Current Diffusion Equation (CDE).	2	
	Analytical and numerical methods for solving MHD equations.	2	
	Application of the Finite Element Method (FEM).	2	
	Application of toroidal plasma; tokamak, nucelar reactor, controlled termonuclear fusion, basic parts of reactor.	2	
	Basics of fusion technology.	2	
	international termonuclear experimental reactor (ITER) research.	2	

	List of laboratory or design exercises	LE hours
	Modeling of a single particle plasma system.	4
	Analytical solution of motion equation.	4
	Analytical solution of linear cylindrical configuration (*pinch* plasma)	6
	Analytical solution of Grad-Shafranov equation	4
	Numerical solution of Grad-Shafranov equation by FEM	4
	Analytical solution of diffusion equation	4
	Numerical solution of diffusion equation by FEM	4

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

Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*						
	Class attendance	2	Research		Practical training	
	Experimental work		Report		(Other)	2,2
	Essay		Seminar essay		(Other)	0,2
	Tests	0,2	Oral exam		(Other)	0,2
	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 (120 min in duration) consists of 3 questions (each containing theoretical part and short numerical problem) and 2 longer numerical problems. The requirement for passing grade is the positive assessment of laboratory exercises and 50 % points on each midterm. Grade (in percentage) is formed according to the formula: Grade(%) = 0,5 (M1 + M2) where M1 and M2 are the midterm test results, and is determined through following percentage score: Percentage score: Grade: From 50% to 62% sufficient (2) From 63% to 75% good (3) From 76% to 88% very good (4) From 89% to 100% excellent (5) Students who do not pass midterm exams are obliged to pass final test (150 min in duration) in winter/fall examination period. Final test consists of 4 questions (each containing theoretical part and short numerical problem) and 2 longer numerical problems. The requirement for passing grade is 50 % points. Final grade is formed according to the described procedure.The midterm and final exams are carried out as written tests.

Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	D.Schnack: *Lectures in Magnetohydrodynamics*, Springer-Verlag, Berlin 2009.		5
	D.Poljak, *Teorija elektromagnetskih polja s*	5	

	primjenama u inženjerstvu, Šk. knjiga Zagreb, 2014.		
Optional literature (at the time of submission of study programme proposal)	1. H. Goedbloed, S. Poedts, *Principles of Magnetohydrodynamics*, Cambridge University Press, New York, 2004. 2. H. Goedbloed, S. Poedts, *Advanced Magnetohydrodynamics*, Cambridge University Press, New York, 2010. 3. D. Poljak, *Advanced Modeling in Computational Electromagnetic Compatibility*. New Jersey, USA: Wiley-Interscience, 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	ANTENNA SYSTEMS							
Code	FELJ21	Year of study	2.					
Course teacher	Antonio Šarolić, Ph.D., Full Professor	Credits (ECTS)	5					
Associate teachers	Niko Ištuk, Teaching Assistant	Type of instruction (number of hours)	L	S	AE	LE	DE	
			30		15	15		
Status of the course	Obligatory	Percentage of application of e-learning	0					

COURSE DESCRIPTION

Course objectives	Training students for: - analysis of complex antennas as radiating structures - application of antenna systems in wireless communication systems - design and engineering of antennas and antenna 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: - calculate the electromagnetic field in the surrounding of complex antenna structures - analyze planar antenna arrays - analyze wideband antennas and assess their characteristics - analyze surface antennas for microwave frequencies - elaborately assess the applicability of a certain antenna system for specific purpose - utilize the antenna parameters as the basis for antenna application in ICT - calculate electromagnetic field above ground - design the circuits for antenna matching to the transmission line - design the antenna system specific to application - assess the characteristics of an antenna system for a specific purpose		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L or S hours	AE hours
	Superdirective arrays. Planar arrays.	2	1
	Yagi antenna. Wideband antennas. Spiral antennas.	2	1
	Logperiodic antennas. Helix antennas.	2	1
	Aperture as a radiation source. Open waveguide. Horn antenna.	2	1
	Slot antenna. Duality principle. Babinet principle.	2	1
	Reflector antennas. Flat reflector. Angle reflector. Parabolic reflector.	2	1
	Symmetry matching. Balun. Dipole feed.	2	1
	Impedance matching.	2	1
	Vertical and horizontal dipole above perfectly conducting plane.	2	1
	Vertical and horizontal dipole above finite conducting plane.	2	1
	Patch antennas. Antenna systems for RFID.	2	1
	Antenna systems for various applications (mobile terminals,	2	1

	base stations, wireless sensors, biomedical applications)		
	Practical examples of antenna installations in use – field trip.	2	1
	List of laboratory or design exercises		LE or DE hours
	Superdirective arrays. Planar arrays. Yagi antenna. Wideband antennas. Spiral antennas.		2
	Logperiodic antennas. Helix antennas. Aperture as a radiation source. Open waveguide. Horn antenna.		2
	Slot antenna. Duality principle. Babinet principle. Reflector antennas. Flat reflector. Angle reflector. Parabolic reflector.		2
	Symmetry matching. Balun. Dipole feed. Impedance matching.		2
	Vertical and horizontal dipole above perfectly conducting plane. Vertical and horizontal dipole above finite conducting plane.		2
	Patch antennas. Antenna systems for RFID. Antenna systems for various applications (mobile terminals, base stations, wireless sensors, biomedical applications)		2
	Practical examples of antenna installations		1

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	Student is required to attend the lectures and auditory exercises in the amount of at least 70% of the schedule. Student is required to attend the laboratory exercises in the amount of 100% of the schedule and to complete all tasks associated with 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	0,5
	Experimental work	0,5	Report		Laboratory exercises	0,5
	Essay		Seminar essay		Individual work	0,5
	Mid-exam	0,5	Oral exam		(Other)	
	Written exam	0,5	Project	0,5	(Other)	

Grading and evaluating student work in class and at the final exam	During the semester, two mid-exams will be held. The first mid-exam will be held in the middles of the semester, while the second will be held after the lectures and exercises are completed, schedules to be agreed with the students. The first mid-exam is based on the first half of the course material. The second mid-exam is based on the first second half of the course material. To pass at each mid-exam, min. 50% of points must be earned from the part of the exam containing numerical problems (material from auditory exercises) and min. 50% of points must be earned from the part of the exam containing theory (material from the lectures). To earn the right to approach the second mid-exam, min. 30% of points must be earned from the part of the first mid-exam containing numerical problems (material from auditory exercises) and min. 30% of points must be earned from the part of the first mid-exam containing theory (material from the lectures).

<table>
<tr><td></td><td colspan="3">If a student earns the positive grades on both mid-exams, he/she is considered to have passed the whole exam with the grade calculated as average from both mid-exams.
At the first exam term, students may choose to take the exam containing only that half of the material that they haven't passed at mid-exams.
At all other exam terms, students must take the whole exam, containing all the course material.
Approaching the exams is subject to fulfilling the requirements on student responsibilities.
The overall point percentage defining the overall grade is calculated as the average of points earned in all exam questions, corrected by the result of oral verification:
Percentage -> Grade
50% - 62,4% -> sufficient (2)
62,5% - 74,9% -> good (3)
75% - 87,4% -> very good (4)
87,5% - 100% -> excellent (5)

Final grade can be supplemented by performing practical project work involving individual and experimental work, in agreement with the teacher.
Exam terms: according to the academic year calendar</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>• E. Zentner: Antene i radiosustavi, Graphis, Zagreb 2001.</td><td></td><td></td></tr>
<tr><td>• Constantine A. Balanis: Antenna Theory: Analysis and Design, Wiley, 1997.</td><td></td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">• V. Roje: Antene I dio, skripta, Sveučilište u Splitu 1981.
• Handbook of antennas in wireless communications, CRC Press, 2002.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">Surveys providing student feedback</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="3"></td></tr>
</table>

NAME OF THE COURSE	ANTENNAS						
Code	FELJ33	Year of study	1.				
Course teacher	Antonio Šarolić, Ph.D., Full Professor	Credits (ECTS)	6				
Associate teachers	Niko Ištuk, Teaching Assistant	Type of instruction (number of hours)	L	S	AE	LE	DE
			30		15	15	
Status of the course	Obligatory	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - understanding the phenomena of radiation - analysis of antennas as radiating structures - application of antennas in wireless communication systems		
Course enrolment requirements and entry competences required for the course	None.		
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - utilize the antenna parameters as the basis for antenna application in ICT - elaborately assess the applicability of a certain antenna for specific purpose - calculate the electromagnetic field in the surrounding of simple antenna structures - analyze the parameters of linear antennas - analyze simple uniform antenna arrays		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L or S hours	AE hours
	Introduction. Antenna parameters. Polarization. Radiation pattern.	2	1
	Directivity. Gain. Antenna impedance. Effective area.	2	1
	Effective length. Antenna factor. Relations linking the antenna parameters. Friis equation.	2	1
	Elementary electrical dipole (EED). Field around the EED.	2	1
	Radiated power and radiation resistance of EED. Efficiency of EED.	2	1
	Zones surrounding the antenna – near and far field.	2	1
	Resonant dipoles. Halfwave dipoles. Fullwave dipoles.	2	1
	Electrically short dipole and unipole.	2	1
	Mutual impedance of dipoles.	2	1
	Antenna array. Uniform linear antenna array.	2	1
	Array with uniform amplitude distribution.	2	1
	Arrays with non-uniform amplitude distribution.	2	1
	Practical examples of antenna installations in use – field trip.	2	1
	List of laboratory or design exercises		LE hours
	Introduction. Antenna parameters. Polarization. Radiation pattern. Directivity. Gain. Antenna impedance. Effective area.		2

	Effective length. Antenna factor. Relations linking the antenna parameters. Friis equation. Elementary electrical dipole (EED). Field around the EED.	2
	Radiated power and radiation resistance of EED. Efficiency of EED. Zones surrounding the antenna – near and far field.	2
	Resonant dipoles. Halfwave dipoles. Fullwave dipoles. Electrically short dipole and unipole.	2
	Mutual impedance of dipoles. Antenna array. Uniform linear antenna array.	2
	Array with uniform amplitude distribution. Arrays with non-uniform amplitude distribution.	2
	Practical examples of antenna installations	1

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	Student is required to attend the lectures and auditory exercises in the amount of at least 70% of the schedule. Student is required to attend the laboratory exercises in the amount of 100% of the schedule and to complete all tasks associated with laboratory exercises.	

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

Grading and evaluating student work in class and at the final exam	During the semester, two mid-exams will be held. The first mid-exam will be held in the middles of the semester, while the second will be held after the lectures and exercises are completed, schedules to be agreed with the students. The first mid-exam is based on the first half of the course material. The second mid-exam is based on the first second half of the course material. To pass at each mid-exam, min. 50% of points must be earned from the part of the exam containing numerical problems (material from auditory exercises) and min. 50% of points must be earned from the part of the exam containing theory (material from the lectures). To earn the right to approach the second mid-exam, min. 30% of points must be earned from the part of the first mid-exam containing numerical problems (material from auditory exercises) and min. 30% of points must be earned from the part of the first mid-exam containing theory (material from the lectures). If a student earns the positive grades on both mid-exams, he/she is considered to have passed the whole exam with the grade calculated as average from both mid-exams. At the first exam term, students may choose to take the exam containing only that half of the material that they haven't passed at mid-exams. At all other exam terms, students must take the whole exam, containing all the course material. Approaching the exams is subject to fulfilling the requirements on student

<table>
<tr><td></td><td colspan="3">responsibilities.
The overall point percentage defining the overall grade is calculated as the average of points earned in all exam questions, corrected by the result of oral verification:
Percentage -> Grade
50% - 62,4% -> sufficient (2)
62,5% - 74,9% -> good (3)
75% - 87,4% -> very good (4)
87,5% - 100% -> excellent (5)
Final grade can be supplemented by performing practical project work involving individual and experimental work, in agreement with the teacher.
Exam terms: according to the academic year calendar</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>• E. Zentner: Antene i radiosustavi, Graphis, Zagreb 2001.</td><td></td><td></td></tr>
<tr><td>• Constantine A. Balanis: Antenna Theory: Analysis and Design, Wiley, 1997.</td><td></td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">• V. Roje: Antene I dio, skripta, Sveučilište u Splitu 1981.
• Handbook of antennas in wireless communications, CRC Press, 2002.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">Surveys providing student feedback</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	FENj01	Year of study	1.				
Course teacher	Silvestar Šesnić, Ph.D., Assistant Professor	Credits (ECTS)	5				
Associate teachers	-	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	15	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	AE hours
	Mathematical modelling in electromagnetism.	2	1
	Mathematical modelling in electromagnetic compatibility.	2	1
	Overview of methods for the solution of differential equations in electromagnetic compatibility.	2	1
	Overview of methods for the solution of integral equations in electromagnetic compatibility.	2	1
	Approximation procedures.	2	1
	Analytical methods in frequency domain.	4	2
	Analytical methods in time domain.	4	2
	Comparison of analytical and numerical methods.	2	1
	Application of analytical methods to antenna systems.	2	1
	Application of analytical methods to grounding systems.	2	1
	Application of analytical methods to transmission lines.	2	1
	Application of analytical methods in bio-electromagnetism.	2	1
	Application of analytical methods in magneto-hydrodynamics.	2	1
	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 ☒ 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	-	Individual work	2
	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	- evaluation of results in accordance with the learning outcomes; - feedback from students survey;

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

<table>
<tr><td rowspan="10">Course content broken down in detail by weekly class schedule (syllabus)</td><td>Course content</td><td>L or S hours</td><td>LE hours</td></tr>
<tr><td>Introduction to Artificial Intelligence - the name, history, related disciplines. Biological intelligence, the theory of multiple intelligences. The research area of artificial intelligence. The techniques of artificial intelligence and success criteria.</td><td>4</td><td>0</td></tr>
<tr><td>Complex tasks and their preparation for solving using AI methods. Problem solving techniques using search (undirected and directed search)</td><td>4</td><td>0</td></tr>
<tr><td>Knowledge and storage of knowledge – I part introduction, data, information, knowledge. Knowledge-based systems. Knowledge and storage of knowledge - II part mathematical logic (standard and non-standard logic).</td><td>4</td><td>0</td></tr>
<tr><td>Logical reasoning. Probabilistic reasoning (probability, conditional probability, Bays networks, hidden Markov models). Fuzzy (fuzzy) reasoning.</td><td>6</td><td>0</td></tr>
<tr><td>Knowledge and storage of knowledge - Part III structure storage knowledge (semantic networks, stereotypes, the script, frames, production systems).</td><td>2</td><td>0</td></tr>
<tr><td>Machine learning (unsupervised and supervised)</td><td>4</td><td>0</td></tr>
<tr><td>Examples of applications of artificial intelligence. Expert systems. Processing and understanding speech. Computer vision.</td><td>2</td><td>8</td></tr>
<tr><td>The programming language LISP</td><td>0</td><td>15</td></tr>
<tr><td>The programming language Prolog and expert system shell</td><td>0</td><td>15</td></tr>
<tr><td></td><td></td><td></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
☐ independent assignments
☒ multimedia
☒ ☒ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="3">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 colspan="3"><table>
<tr><td>Class attendance</td><td>1,5</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Individual work</td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>Laboratory exercises</td><td>1,5</td></tr>
<tr><td>Tests</td><td></td><td>Oral exam</td><td></td><td>Preparation for laboratory exercises</td><td></td></tr>
<tr><td>Written exam</td><td>2</td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
</table></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="3">The exam consists of a written part and if necessary additional oral exam. During the semester will be two tests. The first colloquium in 8 weeks of classes, the second at 18 weeks. A student can pass the course by these tests. In the two final exams in June and July, students who have not collected inadequate number of points through colloquia take the whole subject covered by the two tests. The condition for taking the final exam is successfully finished practical lab exercises.

The exam is comprehensive and includes the theoretical part of the material and tasks with auditory exercises. The condition for positive assessment is that the</td></tr>
</table>

<table>
<tr><td></td><td colspan="3">student has a total of at least 50% on the exam or when it must have a minimum 25% passing the theoretical part of the material and 25% of the deposited duties. If a student has less than 25% of the points on the tasks and / or less than 25% points from the theoretical part of the material again taken the entire exam. Students who did not pass the exam after two final exams can pass the exam in autumn periods. All test questions students will be known before the exam.

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

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

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

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

NAME OF THE COURSE	BIOELECTROMAGNETICS							
Code	FELJ24	Year of study	1.					
Course teacher	Antonio Šarolić, Ph.D., Full Professor	Credits (ECTS)	5					
Associate teachers	Niko Ištuk, Teaching Assistant	Type of instruction (number of hours)	L	S	AE	LE	DE	
			30			30		
Status of the course	Elective	Percentage of application of e-learning	0					

COURSE DESCRIPTION

Course objectives	Training students for: - understanding the human electrophysiology - acquiring knowledge on therapeutic and diagnostic methods - application of specialized interdisciplinary knowledge in biomedical 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: - describe the cell structure - describe the electrophysiology of excitable cells and tissues - apply the electrophysiology knowledge for understanding the brain and heart function - analyze the electric activity of heart and brain with applications in diagnostics - link the electrophysiology principles to the function of other bodily organs and to potential biomedical applications

Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	Introduction and history.	2	0
	Structure of neuron and muscle cells.	2	0
	Membrane potential.	2	0
	Axon as transmission line (cable).	2	0
	Membrane activation.	2	0
	Synapses, receptors and brain.	2	0
	Heart.	2	0
	Volume source. Volume conductor.	2	0
	Electrocardiography (ECG).	2	0
	Electroencephalograhpy (EEG).	2	0
	Electrophysiology of the eye. Electrodermal reaction.	2	0
	Other diagnostic and therapeutic methods based on applied electromagnetics. Magnetic resonance imaging (MRI).	2	0
	Visit to Medical School of the University of Split. Visit to companies related to the course topics.	2	0

	List of laboratory or design exercises	LE hours
	Membrane potential.	4

	Axon as transmission line (cable).	2
	Membrane activation.	4
	Synapses, receptors and brain.	2
	Electrocardiography (ECG).	2
	Electroencephalograhpy (EEG).	2
	Electrodermal reaction.	2
	Other diagnostic and therapeutic methods based on applied electromagnetics. Magnetic resonance imaging (MRI).	2
	Visit to Medical School of the University of Split. Visit to companies related to the course topics.	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	Student is required to attend the lectures and auditory exercises in the amount of at least 70% of the schedule. Student is required to attend the laboratory exercises in the amount of 100% of the schedule and to complete all tasks associated with 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	0,5	Report		Laboratory exercises	0,5
	Essay		Seminar essay	1	Individual work	1
	Mid-exam	0,5	Oral exam		(Other)	
	Written exam	0,5	Project		(Other)	

Grading and evaluating student work in class and at the final exam	During the semester, two mid-exams will be held. The first mid-exam will be held in the middles of the semester, while the second will be held after the lectures and exercises are completed, schedules to be agreed with the students. The first mid-exam is based on the first half of the course material. The second mid-exam is based on the first second half of the course material. To pass at each mid-exam, min. 50% of points must be earned from the part of the exam containing numerical problems (material from auditory exercises) and min. 50% of points must be earned from the part of the exam containing theory (material from the lectures). To earn the right to approach the second mid-exam, min. 30% of points must be earned from the part of the first mid-exam containing numerical problems (material from auditory exercises) and min. 30% of points must be earned from the part of the first mid-exam containing theory (material from the lectures). If a student earns the positive grades on both mid-exams, he/she is considered to have passed the whole exam with the grade calculated as average from both mid-exams. At the first exam term, students may choose to take the exam containing only that half of the material that they haven't passed at mid-exams. At all other exam terms, students must take the whole exam, containing all the course material. Approaching the exams is subject to fulfilling the requirements on student responsibilities. The overall point percentage defining the overall grade is calculated as the average of points earned in all exam questions, corrected by the result of oral verification:

	Percentage -> Grade 50% - 62,4% -> sufficient (2) 62,5% - 74,9% -> good (3) 75% - 87,4% -> very good (4) 87,5% - 100% -> excellent (5) Final grade can be supplemented by performing practical project work involving individual and experimental work, in agreement with the teacher. Exam terms: according to the academic year calendar

	Title	Number of copies in the library	Availability via other media
Required literature (available in the library and via other media)	• Jaakko Malmivuo & Robert Plonsey: Bioelectromagnetism - Principles and Applications of Bioelectric and Biomagnetic Fields, Oxford University Press, New York, 1995.		
	• Handbook of biological effects of electromagnetic fields (third edition): Bioengineering and Biophysical Aspects of Electromagnetic Fields, Ed. Frank S. Barnes and Ben Greenebaum, CRC Press, 2007.		
	• Handbook of biological effects of electromagnetic fields (third edition): Biological and Medical Aspects of Electromagnetic Fields, Ed. Frank S. Barnes and Ben Greenebaum, CRC Press, 2007.		
Optional literature (at the time of submission of study programme proposal)	• Šantić, A: Biomedicinska elektronika, Školska knjiga, Zagreb, 1995. • The Biomedical Engineering Handbook (Second Edition), Ed. Joseph D. Bronzino, CRC Press, 2000.		
Quality assurance methods that ensure the acquisition of exit competences	Surveys providing student feedback		
Other (as the proposer wishes to add)			

<table>
<tr><td>NAME OF THE COURSE</td><td colspan="6">CRYPTOGRAPHY AND NETWORK SECURITY</td></tr>
<tr><td>Code</td><td>FELK10</td><td>Year of study</td><td colspan="5">1.</td></tr>
<tr><td>Course teacher</td><td>Mario Čagalj, Ph.D., Full Professor</td><td>Credits (ECTS)</td><td colspan="5">5</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2">Toni Perković, Ph.D., Assistant Professor</td><td rowspan="2">Type of instruction (number of hours)</td><td>L</td><td>S</td><td>AE</td><td>LE</td><td>DE</td></tr>
<tr><td>30</td><td>0</td><td>0</td><td>30</td><td></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">The main objectives of the course are:
• provide students with insight into basic features and aspects of digital information protection by using cryptographic mechanisms
• present students with proven tools and mechanisms for the protection of digital information
• enable students to apply cryptographic mechanisms in real-world communication-information systems</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">After successfully mastering the course, students will be able to:
• Explain key concepts of information security (confidentiality, integrity and availability)
• Explain the essential difference between ensuring integrity and confidentiality of messages
• Select appropriate / secure mechanisms to protect digital information
• Characterize the level of protection provided by IPsec and TLS protocols for the given configuration
• Establish a virtual private network (VPN) by using cryptographic protection at the network and transport level
• Recommend cryptographic mechanisms to protect confidentiality and integrity at the application level
• Integrate and use cryptographic libraries in their own software solutions
• Generate and manage digital certificates
• Design systems for authentication of users based on digital certificates
• Critically evaluate the security of information systems based on basic cryptographic primitives (AES, HMAC, CBC-MAC, DH, RSA etc.)</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">Introduction to Information Security (Security Threats, Basic Security Aims)</td><td>2</td><td></td></tr>
<tr><td colspan="4">Cryptography based on the symmetric secret key (secret-key cryptography)</td><td>2</td><td></td></tr>
<tr><td colspan="4">Basic Modes of Modern Codes (ECB, CBC, CFB, OFB, CTR mode)</td><td>2</td><td></td></tr>
<tr><td colspan="4">Cryptography based on an asymmetric public key (public-key cryptography)</td><td>4</td><td></td></tr>
<tr><td colspan="4">Authentication Functions (hash and MAC algorithms, digital signatures and digital public key certificates)</td><td>4</td><td></td></tr>
</table>

	First midterm exam		
	Internet Security Protocol (IPsec)	2	
	IPsec: Internet Key Exchange (IKE) protocol	2	
	Web Security: Secure Socket Layer (SSL) and Transport Layer Security (TLS)	4	
	Network firewalls	2	
	Second midterm exam		

List of laboratory exercises	LE hours
Vulnerabilities in Computer Networks (MitM, DoS, ARP spoofing attacks)	4
Symmetric cryptography (DES, 3DES, AES, CBC, CTR)	4
Asymmetric cryptography (RSA, Diffie-Hellman)	4
Authentication Functions (hash and MAC algorithms, digital signatures and digital public key certificates)	6
IPsec and IKE protocols	5
Web Security: Secure Socket Layer (SSL) and Transport Layer Security (TLS)	4
Network firewalls	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	0,7	Research		Practical training	
	Experimental work		Report		Individual work	2
	Essay		Seminar essay		Laboratory exercises	2
	Tests	0,2	Oral exam			
	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. Students are also required to submit a written report on their work on the laboratory assignments. The final grade is formed as follows: Grade = Round[0,05 P + 0,10 LV + 0,35 M1 + 0,50 M2] where: • P – is a grade based on attendance at lectures, • LV – a grade earned during laboratory exercises, • M1, M2 – test results. NOTE: If a student fails a given task (P, LV, M1, M2), the corresponding grade is set to 0 in the above formula.

<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>Lecture notes and presentations</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">• Menezes J., van Oorschot P. C., Vanstone S. A.: Handbook of AppliedCryptography, CRC Press, 1996.
• Stallings W.: Cryptography and Network Security, Principles and Practice, Prentice Hall, 2005.</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	DATA COMPRESSION						
Code	FELK13	Year of study	1.				
Course teacher	Matko Šarić, Ph.D., Assistant Professor	Credits (ECTS)	5				
Associate teachers	dipl. ing. Ante Topić	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	30	0
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - Designing of efficient algorithms in order to minimize running time and memory requirements - Adopting theoretical an practical knowledge about data compression methods - Implementation of selected data compression methods		
Course enrolment requirements and entry competences required for the course	BsC degree		
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - describe the basics of data compression theory - explain data compression methods - apply appropriate compression methods depending on kind of signal - implement selected data compression methods		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L or S hours	AE hours
	Basics of data compression theory (source model, the source encoding, entropy)	2	0
	Basics of data compression theory (Shannon limits, distortion-speed ratio)	2	0
	Quality measures for data compression algorithms Lossless compression, lossy compression	2	0
	Vector and scalar quantization (optimality criteria, algorithm LBG)	2	0
	Transform coding (DFT, DCT)	2	0
	Transform coding (DWT, Karhunen-Loeve transform)	2	0
	Predictive coding	2	0
	Probability based coding (Huffman, Shannon-Fano)	2	0
	Arithmetic coding, dictionary coding, adaptive coding	2	0
	Run length coding, Lempel-Ziv-Welch (LZW) algorithm	2	0
	Estimation movement algorithms	2	0
	Data reduction standards	2	0
	List of laboratory or design exercises		LE hours
	Compression quality measures		2
	Vector and scalar quantization		2

	Transform coding	2
	Huffman and Shannon Fano coding	2
	Arithmetic coding	2
	Movement estimation algorithms	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		Individual work	2,2
	Essay		Seminar essay		Laboratory exercises	1
	Tests	0,2	Oral exam		Preparation for laboratory exercises	0
	Written exam	0,1	Project			

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

There are two midterms and final exams. The first midterm exam is after 7 weeks of lecturing and the second one is after the next 6 weeks. Midterm test and final test consist of theoretical questions and numerical problems. In the final exams students that did not pass the midterm exams take part. The midterm and final exams are carried out as written tests. The requirement for passing grade is the positive assessment of laboratory exercises and 50 % points on each midterm exam or the final exam. Grade (in percentage) is formed according to the formula:

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

the activities in percentage:

- M1, M2 – test results.

The final grade is defined in the next way:

50% do 63% sufficient (2)
64% do 77% good (3)
78% do 91% very good (4)
92% do 100% excellent (5)

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

Title	Number of copies in the library	Availability via other media
Khalid Sayood: "Introduction to Data compression", Morgan Kaufmann Publishers, 2000		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 - Feedback from students who have already obtained BsC degree
Other (as the proposer wishes to add)	

NAME OF THE COURSE	DIGITAL TELECOMMUNICATIONS						
Code	FELJ01	Year of study	1.				
Course teacher	Joško Radić, Ph.D., Associate Professor	Credits (ECTS)	6				
Associate teachers	Petar Šolić, Ph.D., Assistant Professor	Type of instruction (number of hours)	L	S	AE	LE	DE
			45	0	15	15	0
Status of the course	Obligatory	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - Understanding the structure of a digital communication system - Application of analytical models necessary to understand the effects and the design of digital communication systems - Implement and analyse a simple communication system - Acquiring knowledge about the ways of realization of communication networks
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. Compare different systems with redundant coding 2. Analyze the properties of communication systems with redundant coding applied 3. Design transceiver filters for transmission without ISI 4. Explanation of the role of synchronization in a digital communication system 5. Select the corresponding ARQ system with respect to the parameters of the communication channel 6. Identify the topology of the communication network and describe ways of switching in the network 7. Multistage switch design

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

Course content	L hours	AE hours
Real channels Equalisation	3	2
Nyquist filters, correlation filters,	3	2
Linear and non-linear equalization, Nyquist signaling filters,	3	2
Echo cancellation, scrambling,	3	2
Parallel and serial, synchronous and asynchronous, simplex and duplex transmission,	3	2
Synchronization of digital signals (clock, the frame and carrier)	3	2
Redundant coding, block, convolutions and trellis codes,	3	2
First midterm exam		
BCH and Reed-Solomon codes, turbo coding		
ARQ system, FEC systems, encryption and protocols,	3	2
The topology of the network. networking groups and signaling	3	2
Routing and numbering plan, types of switching systems	3	2
Circuit switching, multistage switching	3	2
Spatial and temporal switching	3	2
Second midterm exam		

	List of laboratory exercises	LE hours
	Eye pattern	2
	Equalisation	2
	Scrembling	2
	Channel coding: Block codes	2
	Channel coding: Convolutional codes	2
	Optimum receiver	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	1,8	Research		Practical training	
	Experimental work		Report		Individual work	3
	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	During the semester there are two mid-term exams and the final exam. Mid-term and final exams consist of questions and tasks. 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 (%) = 0,8 * (0.5 * M1 + 0,5 * M2) + 0,2 * L; M1, M2 - points at the mid-term expressed as a percentage, and L - points from the laboratory (with completed all lab. Exercises) expressed as a percentage. The final evaluation is determined as follows: percentage Rating 50% to 61% is sufficient (2) 62% to 74% good (3) 75% to 87% of very good (4) 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**
	• J. Proakis: Digital Communication, IV. Ed.		
	• S. Benedetto: Principles of digital transmission: with wireless application		
	• L. W. Couch II: Digital and Analog Communication Systems		

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	DIGITAL TELEVISION AND VIDEO						
Code	FELH33	Year of study	1.				
Course teacher	Mladen Russo, Ph.D., Assistant Professor Nikola Rožić, Ph.D., Professor Emeritus	Credits (ECTS)	5				
Associate teachers		Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	30	0
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - understanding of stochastic model of video (TV) signal and the principles of classic television technology, - understanding and knowledge of the basics of colorimetry and transformation of different color systems (RGB, CMY, HSL, YUV, YCbCr) - understanding transmission systems PAL, NTSC, SECAM, CATV and television systems MAC, MUSE - understanding of digital coding and compression, H.261 and MPEG standards, formats for tapes (R-DAT) and disk drives (CD-ROM, DVD) - understanding of digital HDTV system, - understanding of basic principles of television transmitters, transponders and receiving systems for cable or satellite television		
Course enrolment requirements and entry competences required for the course	Passed exams in Information theory and Communications systems.		
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - explain stochastic model of video (TV) signal - explain the basic principles of colorimetry and transformation of different color system and transmission system PAL, NTSC, SECAM - define the most important algorithms for digital coding and compression - describe HDTV digital systems - explain the operation of television transmitters, transponders and receiving systems for cable or satellite television		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L or S hours	AE hours
	Analog television systems, scanning television signal and its analysis.	2	0
	Color television, colorimetry and color transformation.	2	0
	Component and composite color systems	2	0
	RGB systems and color mixing	2	0
	PAL and NTSC television standards, teletext services, multiplexing and MAC standard	2	0
	MPEG encoding	2	0
	Cable television (CATV), satellite television (DBS systems), modulation and encryption, receiving equipment for satellite TV	2	0

	Video signal processing and coding, systems with composite and component colors, conversion between PAL and NTSC standard	2	0
	The basic structure of transmitters, transponders and TV receivers	2	0
	Coding standards for digital video tapes, magnetic and optical discs (R-DAT, CD-ROM, DVD), redundant coding for commercial systems	2	0
	Processing of digital audio and video signals in digital TV	2	0
	HDTV digital systems, home theater	2	0
	Stereoscopy, holography and 3-D systems	2	0
	List of laboratory exercises		LE hours
	Analog television systems, scanning television signal and its analysis.		2
	Color television, colorimetry and color transformation.		2
	Component and composite color systems		2
	RGB systems and color mixing		2
	PAL and NTSC television standards, teletext services, multiplexing and MAC standard		2
	MPEG encoding		2
	Cable television (CATV), satellite television (DBS systems), modulation and encryption, receiving equipment for satellite TV		2
	Video signal processing and coding, systems with composite and component colors, conversion between PAL and NTSC standard		2
	The basic structure of transmitters, transponders and TV receivers		2
	Coding standards for digital video tapes, magnetic and optical discs (R-DAT, CD-ROM, DVD), redundant coding for commercial systems		2
	Processing of digital audio and video signals in digital TV		2
	HDTV digital systems, home theater		2
	Stereoscopy, holography and 3-D 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	3	Research		Practical training	
	Experimental work		Report		Individual work	1,7
	Essay		Seminar essay		(Other)	
	Tests	0,2	Oral exam		(Other)	
	Written exam	0,1	Project		(Other)	

<table>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="3">During a semester there are two midterms and final exam. Final exam and midterms are held according to the calendar of classes. At the final exam students take the test from the complete course if they do not have a positive grade on the midterms or take the midterm that they did not pass. At the make-up and commission exam students take the test from the complete course.

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(%) = 0,25*M1+0,25*M2 + 0,5*M3; M1, M2 – midterm test results, M3 – laboratory test results.

The final grade is determined as follows:
Percentage Grade
50% to 61% sufficient (2)
62% to 74% good (3)
75% to 87% very good (4)
88% to 100% excellent (5)</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>• N.Rožić: Digitalna televizija i video, internal script</td><td></td><td>e-learning portal</td></tr>
<tr><td>• H.Benoit: Digital Television, MPEG1,2 and DVB Systems</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">• K.G. Jackson, G.B. Townsend: TV&Video Engineer’s Reference Book, B/H Ltd. 1994.
• A.C. Luther: Digital Audio and Video, Artech House, 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	ELECTROACOUSTICS						
Code	FELH32	Year of study	1.				
Course teacher	Ivo Mateljan, Ph.D., Full Professor	Credits (ECTS)	5				
Associate teachers		Type of instruction (number of hours)	L	S	AE	LE	DE
			30			30	
Status of the course	Elective	Percentage of application of e-learning					

COURSE DESCRIPTION

Course objectives	Training students for: - Understandind basic law of acoustics , - Understanding principles of electroacoustic transducers, - Understanding basic of psychoacoustics - Rooom acoustics evaluation
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. Define equations for propagation of sound 2. Define characteristics of sound emiters and receivers 3. Define characteristisc od electroacoustic transducers 4. Define basic psychoacoustical quantities and units: loudness, SPL, fon and son 5. Define basic characteristics of loudspeakers and microphones 6. Make project of sound system in open and closed space.

Course content broken down in detail by weekly class schedule (syllabus)	Course content	L or S hours	AE hours
	Acoustic wave equation and wave phenomena	2	0
	Sound emitters in open space	2	0
	Sound field in closed space – reverberation	2	0
	Hearing system	2	0
	Psychoacoustics	2	0
	Measurement od acoustical signals	2	0
	Transducers	2	0
	Electrodynamic driver and Thiel Small parameters	2	0
	Loudspeaker boxes	2	0
	Microphones types	2	0
	Design of microphones	2	0
	PA systems	2	0
	Architectural acoustics	2	0
	List of laboratory or design exercises		LE hours
	Spectral analysis of acoustical signals		2
	Hearing characteristics – SPL and loudness		2
	Loudspeaker frequemcy response		2

	Detection of resonances	2
	Room acoustics measurements	2
	Design od loudspeaker boxes and crossovers	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	2	Research		Practical training	
	Experimental work		Report		Individual work	2
	Essay		Seminar essay	0.5	**Lab. Exercise**	0.5
	Tests		Oral exam		Lab. Exercise test	
	Written exam		Project			

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

There are seminar work and final exams. There are learning check out on every laboratory exercise. The requirement for passing grade is the positive assessment of laboratory exercises and 50 % points on each seminar work or the final exam. Grade (in percentage) is formed according to the formula:

Grade(%) = 0,1 SR + 0,1 LV + 0,8 UI

the activities in percentage:

- SR – seminar,
- LV – laboratory assessment,
- UI – final exam.

Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	• Ivo Mateljan: Elektroakustika– skripta, FESB, 2008		Internet
	• Ivo Mateljan: ARTA software - manual, ARTALABS, FESB, 2008.		Internet

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	ELECTROMAGNETIC COMPATIBILITY						
Code	FELH25	Year of study	2.				
Course teacher	Dragan Poljak, Ph.D., Full Professor Antonio Šarolić, Ph.D., Full Professor	Credits (ECTS)	6				
Associate teachers	Niko Ištuk, Teaching Assistant	Type of instruction (number of hours)	L	S	AE	LE	DE
			45		15	15	
Status of the course	Obligatory	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - understanding the electromagnetic phenomena in circuits, devices and systems - application of acquired knowledge to prevent electromagnetic interference from circuits, devices and systems - application of acquired knowledge to improve immunity of circuits, devices and systems to electromagnetic disturbances
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 electronic components and circuits from the aspect of electromagnetic compatibility - calculate electromagnetic field around parasitic antenna structures, as well as disturbance voltages induced in such structures - analyze the conducted emissions and susceptibility of electrical devices - design filters for rejection of disturbances - analyze shielding and grounding of electrical devices and circuits - test the electromagnetic compatibility by measurements in accordance with standards and regulations - analyze electromagnetic compatibility of devices and systems using models with concentrated parameters, distributed parameters and transmission lines - analyze wire antennas with the application in electromagnetic compatibility

Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	Introduction to electromagnetic compatibility.	3	1
	Electronic components and their equivalent circuits.	3	1
	Radiated emissions and susceptibility.	3	1
	Conducted emissions and susceptibility	3	1
	Filtering.	3	1
	Shielding.	3	1
	Grounding.	3	1
	Measurements in electromagnetic compatibility.	3	1
	Electromagnetic compatibility requirements, standards and regu- lations. Electromagnetic compatibility in	3	1

	radiocommunication systems.		
	Historical overview of EMC modelling. Low-frequency models with concentrated parameters.	3	1
	High-frequency models with distributed parameters.	3	1
	Analysis of wire antennas in EMC applications.	3	1
	Transmission line models.	3	1

	List of laboratory or design exercises	LE hours
	Introduction to electromagnetic compatibility.	1
	Electronic components and their equivalent circuits.	1
	Radiated emissions and susceptibility.	1
	Conducted emissions and susceptibility	1
	Filtering.	1
	Shielding.	1
	Grounding.	1
	Measurements in electromagnetic compatibility.	1
	Electromagnetic compatibility requirements, standards and regulations. Electromagnetic compatibility in radiocommunication systems.	1
	Historical overview of EMC modelling. Low-frequency models with concentrated parameters.	1
	High-frequency models with distributed parameters.	1
	Analysis of wire antennas in EMC applications.	1
	Transmission line models.	1

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	Student is required to attend the lectures and auditory exercises in the amount of at least 70% of the schedule. Student is required to attend the laboratory exercises in the amount of 100% of the schedule and to complete all tasks associated with laboratory exercises.	

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

Grading and evaluating student work in class and at the final exam	During the semester, two mid-exams will be held. The first mid-exam will be held in the middles of the semester, while the second will be held after the lectures and exercises are completed, schedules to be agreed with the students. The first mid-exam is based on the first half of the course material. The second mid-exam is based on the first second half of the course material. To pass at each mid-exam, min. 50% of points must be earned from the part of the exam containing numerical problems (material from auditory exercises) and min. 50% of points must be earned from the part of the exam containing theory (material

<table>
<tr><td></td><td colspan="3">from the lectures).
To earn the right to approach the second mid-exam, min. 30% of points must be earned from the part of the first mid-exam containing numerical problems (material from auditory exercises) and min. 30% of points must be earned from the part of the first mid-exam containing theory (material from the lectures).
If a student earns the positive grades on both mid-exams, he/she is considered to have passed the whole exam with the grade calculated as average from both mid-exams.
At the first exam term, students may choose to take the exam containing only that half of the material that they haven't passed at mid-exams.
At all other exam terms, students must take the whole exam, containing all the course material.
Approaching the exams is subject to fulfilling the requirements on student responsibilities.
The overall point percentage defining the overall grade is calculated as the average of points earned in all exam questions, corrected by the result of oral verification:
Percentage -> Grade
50% - 62,4% -> sufficient (2)
62,5% - 74,9% -> good (3)
75% - 87,4% -> very good (4)
87,5% - 100% -> excellent (5)
Final grade can be supplemented by performing practical project work involving individual and experimental work, in agreement with the teacher.
Exam terms: according to the academic year calendar</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>• Clayton R. Paul: Introduction to Electromagnetic Compatibility, Wiley, 2006.</td><td></td><td></td></tr>
<tr><td>• Dragan Poljak: "Advanced modeling in computational electromagnetic compatibility", Wiley Interscience, 2007.</td><td></td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">• Handbook of Electromagnetic Compatibility, ed. R. Perez, Academic Press, 1995.
• Tesche, F.M.: Ianoz, M.V., Karslsson, T.: EMC Analysis Methods and Computational Models, John Wiley & Sons, 1997.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">Surveys providing student feedback</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">ELECTROMAGNETIC ECOLOGY AND DOSIMETRY</td></tr>
<tr><td>Code</td><td>FELJ26</td><td>Year of study</td><td colspan="4">2</td></tr>
<tr><td>Course teacher</td><td>Dragan Poljak, Ph.D., Full Professor</td><td>Credits (ECTS)</td><td colspan="4">4</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2">Anna Šušnjara, Teaching Assistant</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></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 and apply fundamental principles of electromagnetic and thermal dosimetry,
- Assessment of human exposure to low frequency and high frequency electromagnetic fields
- Permanent adopting and deepening knowledge in the area of bioelectromagnetism
- Application of national and international regulations for the assessment of human exposure to non-ionising radiation</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="6">- Electromagnetic fields, Electromagnetic waves</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 fundamental notions in bioelectromagnetics,
- Apply methods for the measurement of external LF and HF fields
- Apply methods for the calculation of external LF and HF fields
- Analyze the level of the human body exposure to non-ionizing radiation using national and international regulations
- Mathematically formulate simple cases of electromagnetic wave and radiation from thin wire structures.
- Analyze simple transmission lines, grounding systems and antennas
- Compute fundamental parameters of internal dosimetry by means of simple body models.
- Use commercial software packages for application of realistic dosimetry models of the human body.</td></tr>
<tr><td rowspan="5">Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="3">Course content</td><td>L hours</td><td colspan="2">AE hours</td></tr>
<tr><td colspan="3">Electrosmog: electromagnetic pollution of the environment. Ionising and non-ionising radiation.</td><td>2</td><td colspan="2"></td></tr>
<tr><td colspan="3">Coupling mechanisms of electromagnetic field and the human body. Biological effects of electromagnetic fields. Low frequency and high frequency effects. Epidemiological and statistical studies.</td><td>2</td><td colspan="2"></td></tr>
<tr><td colspan="3">Fundamental quantities of electromagnetic dosimetry, current density, induced electric field, specific absorption rate (SAR), specific absorption(SA), external fields, power density.</td><td>2</td><td colspan="2"></td></tr>
<tr><td colspan="3">Guidelines for protection of non-ionising radiation. National and international regulations. Basic restrictions and referent</td><td>2</td><td colspan="2"></td></tr>
</table>

	leves. Protection measures.	
	Methods of theoretical and experimental dosimetry. Incident and internal field dosimetry.	2
	Incident field dosimetry; Radiation source characterization. Calculation and measurement of LF electric field. Exposure to power lines and substation transformers.	2
	Incident field dosimetry; Calculation an dmeasurement of HF electromagnetic field. Exposure to RFID antennas, mobile phones, base stations.	2
	Classification of models for internal dosimetry. Simplified and anatomical body models.	2
	LF Electromagnetic modeling. LF Electromagnetic modeling of the body. Whole body exposure to low frequencies.	2
	HF Electromagnetic modeling. The eye and brain exposure to non-ionising radiation.	2
	The human body exposure to transient radiation.	2
	Thermal response of the human body exposed to HF electromagnetic radiation visokih frekvencija. Thermal response to the eye and brain due to plane wave exposure.	2
	Biomedical applications of electromagnetic fields. Electrical stimulation of nerves. Laser radiation of the eye. Methods of the human brain stimulation. Transcranial magnetic stimulation.	2

	List of laboratory or design exercises	LE hours
	Human exposure to non-ionising EM radiation (frequencies up to 10 MHz) – simulation models	2
	Human exposure to non-ionising EM radiation (frequencies above 10 MHz) – simulation models	2
	Measure equipment and methods for the assessment of human exposure to EM fields	3
	Measurement of LF electric fields	2
	Measurement of LF magnetic fields	2
	Measurement of HF EM fields	2
	EM field calculation in the vicinity of base stations	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	1,8	Research		Practical training	
	Experimental work		Report		(Other)	1,8
	Essay		Seminar essay		(Other)	0,1
	Tests	0,1	Oral exam		(Other)	0,1
	Written exam	0,1	Project		(Other)	

<table>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="3">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 (120 min in duration) consists of 3 questions (each containing theoretical part and short numerical problem) and 2 longer numerical problems. The requirement for passing grade is the positive assessment of laboratory exercises and 50 % points on each midterm. Grade (in percentage) is formed according to the formula:

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

where M1 and M2 are the midterm test results, and is determined through following percentage score:

Percentage score: Grade:

From 50% to 62% sufficient (2)
From 63% to 75% good (3)
From 76% to 88% very good (4)
From 89% to 100% excellent (5)

Students who do not pass midterm exams are obliged to pass final test (150 min in duration) in winter/fall examination period. Final test consists of 4 questions (each containing theoretical part and short numerical problem) and 2 longer numerical problems. The requirement for passing grade is 50 % points. Final grade is formed according to the described procedure.The midterm and final exams are carried out as written tests.</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>D.Poljak, Teorija elektromagnetskih polja s primjenama u inženjerstvu, Šk. knjiga Zagreb, 2014.</td><td></td><td></td></tr>
<tr><td>D. Poljak: Izloženost ljudi elektromagnetskom zračenju, Kigen, Zagreb, 2007.</td><td></td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">4. D. Poljak, Advanced Modeling in Computational Electromagnetic compatibility, Wiley Interscience, New York 2007.
5. D. Poljak: Human Exposure to Electromagnetic Fields, WIT Press, Southampton- Boston, 2003
6. R.W.Y. Habash, Electromagnetic Fields and Radiation, Marcel Dekker, 2002.
7. D. Poljak: Exposure of Humans to Electromagnetic Radiation, SoftCOM Library 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>

<table>
<tr><td>NAME OF THE COURSE</td><td colspan="6">ELECTROMAGNETIC WAVES</td></tr>
<tr><td>Code</td><td>FELH03</td><td>Year of study</td><td colspan="5">1</td></tr>
<tr><td>Course teacher</td><td>Dragan Poljak, Ph.D., Full Professor</td><td>Credits (ECTS)</td><td colspan="5">5</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2">Anna Šušnjara, Teaching assistant</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></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 and apply fundamental principles and laws of of electromagnetic wave propagation,
- Formulating and solve simple problems in electromagnetic wave propagation and radiation of antenna systems,
- Permanent adopting and fostering the knowledge in the area of electromagnetic wave propagation,
- Applying of analytical and numerical methods to solve problems in electromagnetic wave propagation an dradiation of wire antennas</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="6">- Electromagnetic Fields</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 fundamental phenomena, quantities and laws of electromagnetic wave propagation,
- Apply fundamental laws of electromagnetic theory to calculate basic parameters of electromagnetic waves
- Apply methods and techniques to solve problems of electromagnetic wave propagation and radiation of thin wire antenna arrays
- Mathematically formulate propagation, reflection and difraction of plane waves for the case of interface between two dielectric media and radiation of wire antennas.
- Analyze electromagnetic wave coupling to aboveground and belowground lines, grounding systems and antennas
- Compute quantities of simpler lines, lightning rods, grounding electrodes, antennas, radar cross section
- Develop simple codes and use commercial software packages for solving problems in propagation, electromagnetic compatibility and and for the analysis of realistic antenna systems.</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 or S hours</td><td>AE hours</td></tr>
<tr><td colspan="4">Introduction. Maxwell's equations. Wave equations. Continuity conditions. Potentials. Poynting theorem</td><td>2</td><td>1</td></tr>
<tr><td colspan="4">Hamilton principle in electromagnetism. Symmetrical form of Maxwell's equations. Introducing magnetic charge density and current. Principle of duality an dequivalence principle. Equivalent sources.</td><td>2</td><td>1</td></tr>
<tr><td colspan="4">Plane wave. Propagation in different media.</td><td>2</td><td>1</td></tr>
<tr><td colspan="4">Difraction, reflection and transmission of plane wave for</td><td>2</td><td>1</td></tr>
</table>

	different polarizations. Plane wave at interface of two dielectrice media, dielectric – perfect conductor and dielectric – lossy medium. Normal and oblique incidence.		
	Type of wave guidance. Zero and total reflection. Surface waves. Fundamentals of waveguide theory. Rectangular metallic waveguide and dielectric waveguide.	2	1
	Analytical methods for solving waveguide fields. Method of separation of variables.	2	1
	Numerical methods for the solution of electromagnetic wave phenomena. Finite Element Method. Boundary Element method.	2	1
	Short antenna. Near and far field. Dipole antenna. Thin wire antenna arrays.	2	1
	Electromagnetic wave coupling to transmission lines. Telegrapher's equations in frequency domain and time domain.	2	1
	Electromagnetic scattering. Determination of radar cross section (RCS).	2	1
	Fundamentals of grounding system analysis.	2	1
	Fundamentals of electromagnetic compatibility. Electromagnetic interference on aboveground and belowground lines.	2	1
	Lightning channel modeling. Modeling of direct and indirect lightning strike.	2	1
	List of laboratory or design exercises		LE hours
	Propagation of EM wave in a dielectric and a lossy medium.		2
	Normal incidence of EM wave on perfect ground and interface between two dielectric media.		3
	Oblique EM incidence on perfect ground.		2
	Oblique EM incidence on two dielectric media		2
	Total reflection and zero reflection.		2
	Oblique EM incidence on imperfect ground.		2
	Radiated EM field of a short dipole.		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	2	Research		Practical training	
	Experimental work		Report		(Other)	2,2
	Essay		Seminar essay		(Other)	0,2
	Tests	0,2	Oral exam		(Other)	0,2
	Written exam	0,2	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. Each midterm test (120 min

<table>
<tr><td>work in class and at the final exam</td><td colspan="3">in duration) consists of 3 questions (each containing theoretical part and short numerical problem) and 2 longer numerical problems. The requirement for passing grade is the positive assessment of laboratory exercises and 50 % points on each midterm. Grade (in percentage) is formed according to the formula:

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

where M1 and M2 are the midterm test results, and is determined through following percentage score:

Percentage score: Grade:

From 50% to 62% sufficient (2)
From 63% to 75% good (3)
From 76% to 88% very good (4)
From 89% to 100% excellent (5)

Students who do not pass midterm exams are obliged to pass final test (150 min in duration) in winter/fall examination period. Final test consists of 4 questions (each containing theoretical part and short numerical problem) and 2 longer numerical problems. The requirement for passing grade is 50 % points. Final grade is formed according to the described procedure.The midterm and final exams are carried out as written tests.</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. D.Poljak, Teorija elektromagnetskih polja s primjenama u inženjerstvu, Šk. knjiga Zagreb, 2014.</td><td></td><td></td></tr>
<tr><td>2. D.Poljak, V.Dorić, S.Antonijević,: Modeliranje žičanih antena primjenom računala . Zagreb, Kigen d.o.o., 2009.</td><td></td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">1. D. Poljak, Advanced Modeling in Computational Electromagnetic compatibility, Wiley Interscience, New York 2007.
2. S. Ratnajeevan, H. Hoole, P. Ratnamahilan, P. Hoole: A Modern Short Course in Engineering Electromagnetics, Oxford University Press, 1996.
3. S.M.Wentworth: Fundamentals of Electromagnetics with Engineering Applications, Wiley, 2005
4. E. Yamashita: Analysis Methods for Electromagnetic Wave Problems, Vol 2, Artech House 1996
5. A.F.Peterson, S.L.Ray, R.Mittra: Computational Methods for Electromagnetics, IEEE Press, 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	INFORMATION AND TECHNOLOGY PHYSICS						
Code	FEMJ02	Year of study	1.				
Course teacher	Nikola Godinović, Ph.D., Associate Professor	Credits (ECTS)	4				
Associate teachers	Dunja Polić, Darko Zarić, Toni Vrdoljak	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0		15	0
Status of the course	Obligatory	Percentage of application of e-learning	0				

COURSE DESCRIPTION

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

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

	List of laboratory or design exercises	LE hours
	Measuring Planck's constant	1
	Measuring the temperature dependence of semiconductor resistance (measuring band gap in silicon)	2
	Hall effect	2
	Measuring the properties of semiconductor photodetectors	1
	Demonstration of superconductivity – Meissner effect	1
	Demonstration of uncertainty principle	1
	Measuring the attenuation of gamma radiation	2
	Measuring the properties of solar cell	1

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

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

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

<table>
<tr><td rowspan="6">Required literature (available in the library and via other media)</td><td>Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td>Knapp, V.; Colić, P.: Uvod u električna i magnetska svojstva materijala, Školska knjiga, Zagreb, 1997</td><td></td><td></td></tr>
<tr><td>I. Supek, M. Furić: Počela fizike, Školska knjiga, Zagreb, 1994.</td><td></td><td></td></tr>
<tr><td>A. Beiser: Concepts of Modern Physics, sixth edition, McGraw-Hill 2003</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">E.V. Wichmann: Kvantna Fizika, udžbenik fizike Sveučilišta u Berkeley, svezak 4., Tehnička knjiga, Zagreb, 1988.

D. Halliday, R. Resnick, J. Walker: Fundamentals of Physics 10th edition, John Wiley & Sons, Inc., 2013.

Vladimir Šips, Uvod u fiziku čvrstog stanja, Školska knjiga 2000.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">- Student evaluation surveys Teacher self-evaluation
- 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	INFORMATION SYSTEMS						
Code	FELJ19	Year of study	1.				
Course teacher	Mladen Russo; Ph.D., Assistant Professor	Credits (ECTS)	5				
Associate teachers		Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	30	0
Status of the course	Obligatory/elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - understanding and knowledge of the model of storage systems, information use and processing, the role of hardware, software and administrator - understanding the relation between information systems (IS) and company's business, the role of IS in conducting business and decision-making - knowledge of data organization model based on relational and semantic models - knowledge of the basic components of software engineering, development, testing, maintenance and management of IS - data processing, forecasting methods, decision models - application of "soft computing" methods, fuzzy logic models - understanding artificial intelligence methods and expert 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: - classify information systems - define the DBMS system - make an ER diagram - create a relational database - apply methods for data forecasting and processing

Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	Information and information systems, hardware, software and staff	2	0
	Basics of information systems planning, business organization model, functional areas and business processes, activities and organizations	2	0
	Relational database, grouping of IS subsystems, databases and database management systems (DBMS)	2	0
	Relational and semantic databases, object modeling	2	0
	Distributed data processing, middleware server systems	2	0
	Multimedia and hypermedia systems, Web systems	2	0
	Information systems and GSM	2	0
	Languages and tools for IS development, CASE tools	2	0
	Administration, maintenance and management of IS	2	0
	Collecting and basics of data processing, statistical analysis	2	0
	Estimation of statistical parameters, time series averaging methods, technological forecasting	2	0

	Natural language processing, voice control of applications and databases	2	0
	Integration of information and expert systems	2	0

		LE hours
	Company model	2
	Databases 1	2
	Databases 2	2
	Mean values of a discrete data set	2
	Positional mean values of a discrete data set	2
	Calculated mean values of a continuous data set	2
	Positional mean values of a continuous data set	2
	Moments and measures of dispersion, symmetry and kurtosis	2
	Chain indices and growth rates	2
	Bayesian estimation method of arithmetic mean	2
	Moving average method	2
	Exponential moving average method	2
	Linear regression model	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	3	Research		Practical training	
	Experimental work		Report		Individual work	1,7
	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	During a semester there are two midterms and final exam. Final exam and midterms are held according to the calendar of classes. At the final exam students take the test from the complete course if they do not have a positive grade on the midterms or take the midterm that they did not pass. At the make-up and commission exam students take the test from the complete course. The requirement for passing grade is 50% points on each midterm exam or the final exam. Grade (in percentage) is formed according to the formula: Grade(%) = 0,5*M1+0,5*M2; M1, M2 – midterm test results. The final grade is determined as follows: Percentage Grade 50% to 61% sufficient (2) 62% to 74% good (3) 75% to 87% very good (4) 88% to 100% excellent (5)

Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	• N. Rožić, M. Russo: Informacijski sustavi, internal script		e-learning portal
Optional literature (at the time of submission of study programme proposal)	• P. Beynon-Davies: Information Systems Development, MacMillan J. Martin: “Baze podataka za krajnjeg korisnika”		
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	IP COMMUNICATIONS						
Code	FELJ11	Year of study	1.				
Course teacher	Mladen Russo, Ph.D., Assistant Professor	Credits (ECTS)	6				
Associate teachers		Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	15	15	0
Status of the course	Obligatory/elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - understanding network architecture and protocols based on the ISO-OSI reference model and packet commutation - knowledge of TCP/IP protocol stack, layer specific protocols and functions - understanding addressing methods in IPv4 and IPv6 networks - understanding routing protocol mechanisms, protocols for multimedia traffic and quality of service (QoS) - knowledge of the most important applications of TCP/IP networks, e-mail, www and http communication, file transfer protocol (FTP), remote operation (telnet), voice over IP (VoIP) and IP television (IPTV)		
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: - compare the ISO-OSI model and the TCP/IP protocol stack - describe the mechanisms of packet routing - compare IPv4 and IPv6 protocols - create a computer network - set up VoIP communication		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	Network architectures, technologies and services, ISO OSI model and TCP/IP networks and protocols	2	1
	IP protocol, addressing and routing	2	1
	Managing subnets, ARP, Internet control messages (ICMP)	2	1
	IPv6 protocol	2	1
	Transport layer (TCP), unreliable and reliable packet delivery	2	1
	Traffic management and congestion control	2	1
	Static and dynamic routing, RIP and OSPF routing protocols	2	1
	Dial-up access, SLIP and PPP protocols	2	1
	Multimedia protocols in IP networks, routing in real-time applications (RIP), resources reservation in real-time applications (RSVP)	2	1
	Network management (SNMP)	2	1
	WWW, HTTP, HTML, e-mail, FTP, Telnet	2	1
	Voice over IP (VoIP), H.323 and SIP protocols, mobile IP communications	2	1
	IP television and video	2	1

		LE hours
	Computer networking	2
	ARP protocol	2
	IP protocol – header analysis, subnetting	2
	TCP three way handshake procedure	2
	ICMP protocol	2
	VoIP communications	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	3	Research		Practical training	
	Experimental work		Report		Individual work	2,7
	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	During a semester there are two midterms and final exam. Final exam and midterms are held according to the calendar of classes. At the final exam students take the test from the complete course if they do not have a positive grade on the midterms or take the midterm that they did not pass. At the make-up and commission exam students take the test from the complete course. The requirement for passing grade is 50% points on each midterm exam or the final exam. Grade (in percentage) is formed according to the formula: Grade(%) = 0,5*M1+0,5*M2; M1, M2 – midterm test results. The final grade is determined as follows: Percentage Grade 50% to 61% sufficient (2) 62% to 74% good (3) 75% to 87% very good (4) 88% to 100% excellent (5)

Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	• Casad, J.: TCP/IP in 24 hours, Sams Publ. 2012	1	e-learning portal

Optional literature (at the time of submission of study programme proposal)	• W. Stallings: High Speed Networks: TCP/IP Design Principles, Prentice Hall • B. Khasnabish: Implementing Voice over IP, Wiley Interscience, 2003.
Quality assurance methods that ensure the acquisition of exit competences	- Evaluation of results in accordance with the above learning outcomes - Feedback from students via surveys - Self-evaluation of teachers - Institutional and non-institutional evaluations
Other (as the proposer wishes to add)	

NAME OF THE COURSE	LOCAL AND ACCESS NETWORKS						
Code	FELH30	Year of study	2.				
Course teacher	Josip Lörincz, Ph.D., Assistant Professor	Credits (ECTS)	5				
Associate teachers	Dinko Begušić, Ph.D., Full Professor	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	30	
Status of the course	- Obligatory (university graduate programme, 242)	Percentage of application of e-learning	10%				

COURSE DESCRIPTION

Course objectives	Training students for: - knowledge and understanding of the fundamental concepts of local and access networks, - knowledge of the characteristics of the medium for the transmission of information in local and access network (metal wires, optical fibre and wireless transmission), - capability to configure local and access networks and network devices, - qualification for participation in the design and maintenance of local and access networks, - permanent acquisition of knowledge in the field of new technologies used in local access networks.		
Course enrolment requirements and entry competences required for the course	Knowledge of basic concepts and technology in the area of data information transfer and communication protocols. Knowledge of basic computer skills. Knowledge of English language.		
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - define basic terms and concepts of local and access networks, - evaluate and implement protocols, systems and techniques for transmission of information in local and access networks based on different transmission medias including metal wires, optical fibre and wireless transmission, - configure local and access networks and network devices, - participate in the design and maintenance of local and access networks, - permanently acquire knowledge about new technologies in the area of local access networks.		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	Introduction. Standards.		2
	The division of the LAN network according to different criteria.		2
	Local area networks of type Ethernet.		2
	Local area networks of type: Token ring, Token bus, FDDI, DQDB		2
	Gigabit Ethernet, switched LAN		2
	Networks: ATM, ATM LAN		2
	Virtual Private Networks-VPN		2
	Wireless Communication Systems-general, cellular (mobile) systems		2
	Wireless LAN (WLAN) networks		2
	Broadband access networks-general		2

	xDSL technology: HDSL, ADSL, VDSL		2
	Fiber optical networks: FTTx technology		2
	HFC technology, WiMAX technology		2

	List of laboratory or design exercises	LE hours
	Exercise 1.: Introduction - basics Riverbed Modeler simulator	2
	Exercise 2.: Local Area Network - The role of Switch in LAN Ethernet network	2
	Exercise 3.: Local Area Network - a network design (planning network with different users, terminals and services)	2
	Exercise 4.: ATM (cell switching technology based on connection oriented connections)	2
	Exercise 5.: RIP protocol (Routing protocol based on an link algorithm state)	2
	Exercise 6.: TCP Transmission Control Protocol (Trusted protocol based on pre-established links)	2
	Exercise 7.: The methods of sorting (queuing, waiting to transmit or discard packets)	2
	Exercise 8.: The wireless local area network (media access control for mobile station)	2
	Exercise 9.: Mobile wireless networks (wireless cellular networks with mobile devices)	2
	Exercise 10.: OSPF routing protocol based on an link-state algorithm	2
	Exercise 11.: Border Gateway Protocol (BGP) - (Routing data traffic between different administrative domains)	2
	Compensation exercises	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 conditions for overall positive assessment are: • positive assessment of laboratory exercises (above 50 %) • minimum presence during 70% of overall class teaching time in a semester, • presence on laboratory exercises during 100% of overall laboratory exercise time in a semester, • minimum 50% points at each mid-term or final exam (or correctional or commission exam).	

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

<table>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="3">During the semester there will be two mid-term exams (tests). The 1st mid-term exam will be after 8 weeks of classes, and the 2nd after 15 weeks of classes. On the 1st and 2nd of the final exams, students take exam of those parts of the curricula which they did not pass on some of the mid-term exams. On the 3rd and 4th of the final (correctional) exam, students take exam of complete course curricula.

Rating (%) = 0.1PL + 0,2LA + 0.35 (M1 + M2)
PL – presence on the lectures (expressed in percentage),
LA- grades from laboratory assessment (expressed in percentage),
M1, M2- the 1st and 2nd mid-term exam grades or final exam grades (expressed in percentage),

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

Independently on results obtained during the 1st or 2nd mid-term exams, on the 3rd and 4th final (correctional) exams students take exam of entire curricula content. In the case of organization of commission exam, students also take exam of entire curricula content. Requirements related to the admission on final and correctional (commission) exam is a positive assessment of laboratory exercises.

Examinations:
1st Final exam
2nd Final exam
3rd Final (correctional) exam
4th Final (correctional) exam
5th Final (commission) exam (organized only based on decision of Faculty council in specific academic year)</td></tr>
<tr><td rowspan="6">Required literature (available in the library and via other media)</td><td>Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td>• Milutin Kapov, Josip Lorincz, "Local and Access Networks", FESB-Split, 2015, (2009), internal script</td><td></td><td>e-learning portal</td></tr>
<tr><td>• Josip Lorincz, “Instructions for performing laboratory exercises in local and access networks”, FESB Split, internal script, 2015.</td><td></td><td>e-learning portal</td></tr>
<tr><td>• Alen Bažant and others: "The basic architecture of the network", ELEMENT, Zagreb, 2004.</td><td>5</td><td></td></tr>
<tr><td>• M. Vrdoljak and others: "New Communication Technologies", FESB Split, HT TKC Split, softcore library Split in 1999.</td><td>5</td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">• M. Jose ., M. Caballero and others, "SDH / SONET, ATM, xDSL and Synchronization Networks", Artech House, Boston, London, 2003.
• Alex Gillespie: "Broadband Access Technology Interfaces and Management, Artech House, Boston, London, 2000.
• Annabel Z. Dodd, "Telecommunications", Algorithm, Zagreb 2002.</td></tr>
</table>

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

NAME OF THE COURSE	MARITIME RADIOCOMMUNICATIONS						
Code	FELJ30	Year of study	1.				
Course teacher	Antonio Šarolić, Ph.D., Full Professor	Credits (ECTS)	5				
Associate teachers	Niko Ištuk, Teaching Assistant	Type of instruction (number of hours)	L	S	AE	LE	DE
			30			30	
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - understanding the specificities of maritime radiocommunications - acquiring knowledge on maritime radiocommunication 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: - describe the specificities of maritime radiocommunications - apply the knowledge of radiocommunications to maritime applications - identify the maritime radiocommunication devices and systems in use - use the maritime radiocommunication systems - connect the maritime radiocommunication systems into a GMDSS system

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

Course content	L hours	AE hours
Introduction to maritime radiocommunications.	2	0
Basics of maritime telecommunications.	2	0
Basics of maritime radiocommunications.	4	0
Terrestrial radio links.	2	0
Satellite radio links.	2	0
Terrestrial radiocommunication systems.	2	0
Satellite radiocommunication systems.	2	0
GMDSS system.	2	0
Shipboard navigational radar.	2	0
GPS.	2	0
Visit to systems in use (field trip).	4	0

List of laboratory or design exercises	LE hours
Introduction to maritime radiocommunications.	2
Basics of maritime telecommunications.	2
Basics of maritime radiocommunications.	4
Terrestrial radio links.	2
Satellite radio links.	2
Terrestrial radiocommunication systems.	2
Satellite radiocommunication systems.	2
GMDSS system.	2
Shipboard navigational radar.	2
GPS.	2

<table>
<tr><td></td><td colspan="5">Visit to systems in use (field trip).</td><td>4</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">Student is required to attend the lectures and auditory exercises in the amount of at least 70% of the schedule. Student is required to attend the laboratory exercises in the amount of 100% of the schedule and to complete all tasks associated with 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>0,5</td><td>Report</td><td></td><td>Laboratory exercises</td><td>0,5</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>1</td><td>Individual work</td><td>1</td></tr>
<tr><td>Mid-exam</td><td>0,5</td><td>Oral exam</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>0,5</td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">During the semester, two mid-exams will be held. The first mid-exam will be held in the middles of the semester, while the second will be held after the lectures and exercises are completed, schedules to be agreed with the students.
The first mid-exam is based on the first half of the course material. The second mid-exam is based on the first second half of the course material.
To pass at each mid-exam, min. 50% of points must be earned from the part of the exam containing numerical problems (material from auditory exercises) and min. 50% of points must be earned from the part of the exam containing theory (material from the lectures).
To earn the right to approach the second mid-exam, min. 30% of points must be earned from the part of the first mid-exam containing numerical problems (material from auditory exercises) and min. 30% of points must be earned from the part of the first mid-exam containing theory (material from the lectures).
If a student earns the positive grades on both mid-exams, he/she is considered to have passed the whole exam with the grade calculated as average from both mid-exams.
At the first exam term, students may choose to take the exam containing only that half of the material that they haven't passed at mid-exams.
At all other exam terms, students must take the whole exam, containing all the course material.
Approaching the exams is subject to fulfilling the requirements on student responsibilities.
The overall point percentage defining the overall grade is calculated as the average of points earned in all exam questions, corrected by the result of oral verification:
Percentage -> Grade
50% - 62,4% -> sufficient (2)
62,5% - 74,9% -> good (3)
75% - 87,4% -> very good (4)
87,5% - 100% -> excellent (5)
Final grade can be supplemented by performing practical project work involving individual and experimental work, in agreement with the teacher.
Exam terms: according to the academic year calendar.</td></tr>
</table>

	Title	Number of copies in the library	Availability via other media
Required literature (available in the library and via other media)	• Kim, J.C., Muehldorf, E.I., Naval Shipboard Communication Systems, Prentice Hall, 1995.		
	• Lees, G.D., Williamson, W.G., Handbook for Marine Communications, Lloyds of London Press, London, 1999.		
	• Law, Preston E. Jr, Shipboard Antennas, Artech House, Boston, 1986.		
Optional literature (at the time of submission of study programme proposal)	• Zentner, E,. Antene i radiosustavi, Graphis, Zagreb, 2001. • Law, Preston E. Jr, Shipboard Electromagnetics, Artech House, Boston, 1987. • Šarolić, A., Elektromagnetska kompatibilnost brodskih RF uređaja, (magistarska disertacija), FER, 2000.		
Quality assurance methods that ensure the acquisition of exit competences	Surveys providing student feedback		
Other (as the proposer wishes to add)			

NAME OF THE COURSE	MEASUREMENTS IN WIRELESS SYSTEMS						
Code	FELJ22	Year of study	2				
Course teacher	Zoran Blažević, Ph.D., Full Professor	Credits (ECTS)	5				
Associate teachers	Maja Škiljo, Ph.D.	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	15	15	0
Status of the course	Obligatory: 241 Elective: 242	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - radio-channel measurements and analysis, - statistical modelling of radio propagation in different environments and for various radio systems, - applying empirical and statistical models for radio-channel characterization.
Course enrolment requirements and entry competences required for the course	Finished the undergraduate study of Communications and Information Technology
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - calculate radio-channel parameters, - perform measurements and analysis of fixed and mobile radio systems parameters - statistically characterize radio propagation of arbitrary radio-systems on the base of measurements, - Apply various channel models

Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	Introduction to Measurements in Wireless Systems.	1	1
	Fixed radio-links channel parameters. Fading	2	1
	Ground radio links planning and measurements	2	2
	Fading in mobile radio channels.	2	1
	Mobile radio channel parameters.	2	1
	Propagation path-loss models. Hata-Okumura model.	3	1
	First midterm exam		
	Statistical channel models of ground networks comparison with Maxwell theory based model.	2	1
	Satellite radio-channels. Statistical models based on measurements (Loo model, Suzuki model).	4	1
	Wide-band channel parameters. Wide-band measurements.	4	3
	Wide-band channel models based on measurements.	2	1
	Wide-band indoor radio channel modelling.	3	1
	Second midterm exam		
	List of laboratory exercises		LE hours
	Antenna measurements by Vector Network Analyser measurements. Measurements calibration.		3

	Narrow-band channel measurements at various frequencies.	3
	Wide-band channel measurements	3
	Wide-band indoor channel measurements	3
	Radio-links planning by using measured data and software.	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 required.	

Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*						
	Class attendance	2,0	Research		Practical training	
	Experimental work		Report		Individual work	1.5
	Essay		Seminar essay		Laboratory exercises	0,8
	Tests	0,5	Oral exam		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. Each midterm test and final tests consists of theoretical questions and numerical. The students that did not pass the midterm exams take part In the final exams. The midterm and final exams are carried out as written tests. The requirement for passing grade is the positive assessment of laboratory exercises and 40 % points on each midterm exam or the final exam. Grade (in percentage) is formed according to the formula: Grade(%) = 0,1 NP + 0,1 LV + 0,4 (M1 + M2) the activities in percentage: • NP - attendance at lectures, • LV – laboratory assessment, • M1, M2 – test results.

	Title	**Number of copies in the library**	**Availability via other media**
Required literature (available in the library and via other media)	• Z. Blažević; Mjerenja u bežičnim sustavima, predavanja		e-learning portal
	• M. Patzold: "Mobile Fading Channels", Wiley, 2002.	1	
	• Doble, J.: "Introduction to Radio Propagation for Fixed and Mobile Communications", Artech House Boston - London, GB, 1996.	1	

Optional literature (at the time of submission of study programme proposal)	• G. H. Bryant: ''Principles of Microwave Measurements'', IEE Publishing, 1993. • Zentner, E.: Antene i radiosustavi, Graphis Zagreb, 2001.
Quality assurance methods that ensure	- Evaluation of results in accordance with the above learning outcomes - Feedback from students via surveys

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

NAME OF THE COURSE	MICROWAVE ELECTRONICS						
Code	FELJ34	Year of study	1.				
Course teacher	Ivan Marinović, Ph.D., Full Professor	Credits (ECTS)	5				
Associate teachers		Type of instruction (number of hours)	L	S	AE	LE	DE
			30		15	15	
Status of the course	Obligatory: 241 Elective: 242	Percentage of application of e-learning					

COURSE DESCRIPTION

Course objectives	Training students for: - understanding basics of microwave components and circuits - application of scattering matrices (S-matrices) analysis - microwave measurements applying SG, SA and VNA
Course enrolment requirements and entry competences required for the course	Finished course *Electronic components and circuits*
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - understand basics of microwave electronics (transmission line, waveguide) - calculate stubs matching parameters applying Smith-chart - analyze microwave components and circuits applying S-matrices - understand behavior of simple passive microwave components - understand characteristics of basic active microwave components (vacuum tubes and solid-state ones)

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

Course content	L hours	AE hours
Transmission lines	5	2
Impedance matching, Smith chart	6	5
Waveguides	4	3
S-matrices	1	1
Microwave passive components	6	4
Klystron, reflex klystron, magnetron, TWT	4	0
GUNN diode, IMPATT diode	2	0
Microwave oscillators	1	0
Microwave amplifiers	1	0

List of laboratory or design exercises	LE hours
Slotted line, impedance matching	3
Directional coupler	2
Sweep generator and spectrum analyzer	3
Vector network analzer	3
Cable power loss measurements	2
Microwave amplifier	2

<table>
<tr><td>Format of instruction</td><td colspan="6">☒ lectures
☐ seminars and workshops
☒ exercises
☐ on line in entirety
☐ partial e-learning
☐ field work</td><td colspan="2">☐ independent assignments
☐ multimedia
☒ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="8">The presence on lectures and exercises in the amount of at least 70% of the times scheduled. Performed all required laboratory exercises.</td></tr>
<tr><td rowspan="5">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>2</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Exercises</td><td>1</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>Individual work</td><td>2</td></tr>
<tr><td>Tests</td><td></td><td>Oral exam</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="8">There are two midterms and final exams. The first midterm exam is after 7 weeks of lecturing and the second one is after next 6 weeks. Each midterm test consists of theoretical questions and numerical problems as well as the final test. In the final exams students that did not pass the midterm exams take part. The midterms are carried out as written tests while the final exams are written and oral. The absolute grading is applied.</td></tr>
<tr><td rowspan="3">Required literature (available in the library and via other media)</td><td colspan="5">Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td colspan="5">Z. Smrkić, Mikrovalna elektronika, Školska knjiga, Zagreb.</td><td>5</td><td></td></tr>
<tr><td colspan="5">J. Bartolić, Mikrovalna elektronika, Graphis, Zagreb</td><td>5</td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="8">-</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="8">- Evidence of students attendance
- Annual analysis of grades achieved
- Teachers self-evaluation
- Students feedback via questionnaires and surveys</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="8"></td></tr>
</table>

NAME OF THE COURSE	MICROWAVE SOLID-STATE CIRCUITS						
Code	FELJ27	Year of study	2.				
Course teacher	Ivan Marinović, Ph.D., Full Professor	Credits (ECTS)	5				
Associate teachers		Type of instruction (number of hours)	L	S	AE	LE	DE
			30			30	
Status of the course	Elective	Percentage of application of e-learning					

COURSE DESCRIPTION

Course objectives	Training students for: - analysis of complex microwave solid-state components and circuits
Course enrolment requirements and entry competences required for the course	Finished course *Microwave electronics*
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - understand principles of different microwave components - make analysis of solid-state microwave circuits

Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	1. Microwave solid-state diodes: PIN, GUNN, IMPATT...	8	
	2. Microwave oscillators with negative resistance	4	
	3. Microwave solid-state transistors: MESFET, HEMT...	10	
	4. Microwave mixers and amplifiers	8	
	List of laboratory or design exercises		LE hours
	1. Measurements on microwave oscillator 1GHz		10
	2. Measurements on microwave amplifiers 1-2GHz, 2-4GHz, 4-8GHz i 0.04-3GHz		20

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

Student responsibilities	The presence on lectures and exercises in the amount of at least 70% of the times scheduled. Performed all required laboratory exercises.

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

<table>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="3">There are two midterms and final exams. The first midterm exam is after 7 weeks of lecturing and the second one is after next 6 weeks. Each midterm test consists of theoretical questions and numerical problems as well as the final test. In the final exams students that did not pass the midterm exams take part. The midterms are carried out as written tests while the final exams are written and oral. The absolute grading is applied.</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>Z. Smrkić, Mikrovalna elektronika, Školska knjiga, Zagreb.</td><td>5</td><td></td></tr>
<tr><td>J. Bartolić, Mikrovalna elektronika, Graphis, Zagreb</td><td>5</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">- Evidence of students attendance
- Annual analysis of grades achieved
- Teachers self-evaluation
- Students feedback via questionnaires and surveys</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="3"></td></tr>
</table>

NAME OF THE COURSE	MOBILE COMMUNICATIONS						
Code	FELJ14	Year of study	1.				
Course teacher	Zoran Blažević, Ph.D., Full Professor	Credits (ECTS)	5				
Associate teachers	Maja Škiljo, Ph.D.	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	15	15	0
Status of the course	Obligatory: 241 Elective: 242	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - understanding and application of basic principles of radio-networks, - physical OSI layer of cellular radio-networks calculation and analysis, - mobile radio networks analysis.
Course enrolment requirements and entry competences required for the course	Finished the undergraduate study of Communications and Information Technology
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - Calculate optimal radio system configuration in sense of selecting digital modulation and coding, - model and perform basic calculation of cellular networks: base stations power and interference budget - calculate and analyse (narrow- and wide-band) radio-channel parameters, - conduct and analyse radio-channel measurements

Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	Introduction to Mobile Communications.	1	1
	Classification of digital radio-channels.	2	1
	Digital radio system performances.	2	2
	Systems with bandwidth limitation.	2	1
	Power limited systems.	2	1
	Power limited and bandwidth limited systems. Channel coding.	2	1
	Direct Sequence-Spread Spectrum Systems	2	1
	Cellular radio systems. Cochannel and adjacent channel interference.	2	1
	Path-loss law. Base station ling budget. Multipath reception.	2	2
	First midterm exam		
	Cell radio-coverage calculation.	2	1
	Mobile propagation channel analysis.	2	1
	Radio channel measurements.	2	1
	Propagation channel classification. Delay-spread and channel coherence bandwidth.	2	1
	Second midterm exam		

	List of laboratory exercises	LE hours
	Radio channel characterization by Vector Network Analyser measurements.	5
	Communication systems testing and simulating by Matlab and Simulink	2
	Analog and digital modulation simulations	2
	Multipath fading channels simulations	2
	Adjacent and co-channel interference in cellular systems simulations by Simulink	2
	COST 207 and GSM/EDGE channel models by Matlab	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 required.	

Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*	Class attendance	2,0	Research		Practical training	
	Experimental work		Report		Individual work	1.5
	Essay		Seminar essay		Laboratory exercises	0,8
	Tests	0,5	Oral exam		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. Each midterm test and final tests consist of theoretical questions and numerical. The students that did not pass the midterm exams take part In the final exams. The midterm and final exams are carried out as written tests. The requirement for passing grade is the positive assessment of laboratory exercises and 40 % points on each midterm exam or the final exam. Grade (in percentage) is formed according to the formula: Grade(%) = 0,1 NP + 0,1 LV + 0,4 (M1 + M2) the activities in percentage: • NP - attendance at lectures, • LV – laboratory assessment, • M1, M2 – test results.

	Title	**Number of copies in the library**	**Availability via other media**
Required literature (available in the library and via other media)	• Z. Blažević: Mobilne komunikacije, predavanja, FESB		e-learning portal
	• I. Zanchi, Z. Blažević: Radiokomunikacije, predavanja, FESB		e-learning portal
	• David Parson.: The Mobile Radio Propagation Channel, Pentech Press Pub. London, 1992.	2	

Optional literature (at the time of submission of study programme proposal)	• R. Steele: "Mobile Radio Communications", Pentech Press, London, GB and IEEE Press, Piscataway, USA, 1992. • Vijag, K. Garg, Joseph, E. Wilkes: Wireless and Personal Communications Systems, Prentice Hall PTR, NY 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	MULTIMEDIA SYSTEMS						
Code	FELJ20	Year of study	2.				
Course teacher	Mladen Russo, Ph.D., Assistant Professor	Credits (ECTS)	5				
Associate teachers	Jelena Čulić, Teaching Assistant Martina Bašić, Teaching Assistant	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	30	0
Status of the course	Obligatory: 242 Elective: 241	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - understanding of multimedia systems and virtual reality - knowledge of the properties and methods for generating speech, audio, image and video signals (including 3D images and video) - understanding of the most important algorithms for compressing speech, audio, image and video signals		
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 principles of human speech, hearing and vision - explain the basic principles of psychoacoustics and their application in compression of audio signals - demonstrate the frequency masking effect - define the most important algorithms for compression of speech, audio, image and video signals - demonstrate the basic mechanisms of JPEG compression		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	Introduction. History of multimedia systems. Basic terms. Overview of multimedia software tools. Design of multimedia applications.	2	0
	Audio signal. How humans hear and speak. Speech modelling.	2	0
	Generic compression techniques for audio signals. Audio specific algorithms (mp3).	2	0
	Speech specific algorithms (LPC, CELP, RELP, MPE, RPE) and applications in mobile telephony. Review of standards for encoding speech and audio signals.	2	0
	Color in images and video signal. The perception of color (how people perceive electromagnetic radiation). Theory of mixing colors.	2	0
	Color models for image signal (RGB, CMY, CMYK). Color models for video signal (YUV, YIQ, YCbCr). Software-oriented color models (HSB, HLS, HSV). Gamma correction. Image signal (resolution, depth, memory requirements). Image formats (gif, tiff, jfif, ps, bmp).	2	0
	Basics of video and television. Analog television and video.	2	0

	Digital television and video. Video formats and memory requirements.		
	Image compression. JPEG modes.	2	0
	Video compression: H.261. H.263.	2	0
	Video compression: MPEG-1. MPEG -2.	2	0
	Video compression: MPEG-4.	2	0
	Video compression: H.264.	2	0
	Fundamentals of virtual reality. History. Stereoscopic (3D) vision. Software and hardware for virtual reality.	2	0
			LE hours
	Sound recording. Searching of voiced and unvoiced speech. Pitch period.		2
	Speech specific algorithms (LPC)		2
	Frequency masking		2
	3D sound		2
	Image compression (JPEG)		2
	Image compression (JPEG)		2
	Image compression (JPEG)		2
	MPEG – influence of I, P, B frames on video quality		2
	Multimedia systems on mobile devices (Android programming)		2
	Multimedia systems on mobile devices (Android programming)		2
	Multimedia systems on mobile devices (Android programming)		2
	3D images		2
	CAVE system		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	3	Research		Practical training	
	Experimental work		Report		Individual work	1,7
	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	During a semester there are two midterms and final exam. Final exam and midterms are held according to the calendar of classes. At the final exam students take the test from the complete course if they do not have a positive grade on the midterms or take the midterm that they did not pass. At the make-up and commission exam students take the test from the complete course. The requirement for passing grade is 50% points on each midterm exam or the final exam. Grade (in percentage) is formed according to the formula: Grade(%) = 0,5*M1+0,5*M2; M1, M2 – midterm test results.

<table>
<tr><td></td><td colspan="3">The final grade is determined as follows:
Percentage Grade
50% to 61% sufficient (2)
62% to 74% good (3)
75% to 87% very good (4)
88% to 100% excellent (5)</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>• H. Dujmić: Multimedijski sustavi, internal script</td><td>1</td><td>e-learning portal</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">• Steinmetz, Nahrstedt: "Multimedia Fundamentals: Media Coding and Content Processing", Prentice Hall, 2002
• Rao, Bojkovic, Milovanovic: "Multimedia Communication Systems: Techniques, Standards and Networks", Prentice Hall, 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	NETWORK AND MOBILE OPERATING SYSTEMS						
Code	FELJ35	Year of study	2.				
Course teacher	Josip Lörincz, Ph. D., Assistant Professor	Credits (ECTS)	5				
Associate teachers	Dinko Begušić, Ph. D., Full Professor Ante Dagelć, mag. ing. comp.	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	30	
Status of the course	Obligatory	Percentage of application of e-learning	10%				

COURSE DESCRIPTION

Course objectives	Training students for: • knowledge of the structure and working mode of network and mobile operating systems, • knowledge of the application possibilities of network and mobile operating systems and cloud computing, • ability to configure networks and network devices, • knowledge of application development techniques for network and mobile platforms, • knowledge of basic techniques of virtualization.
Course enrolment requirements and entry competences required for the course	Basic computer skills. Basic knowledge of English. Knowledge of basic principles of programming. Knowledge of basic protocols in telecommunications.
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - define basic terms and concepts of network and mobile operating systems, - express the basic terms and concepts of cloud computing, - distinguish between different types of wireless communication networks and protocols, - apply the concept of virtualization of computer systems, - configure the network and mobile devices, - analyse the possibilities of mobile applications and apply the network and mobile operating systems as well as tools for application development on mobile platforms, - develop applications for network and mobile platforms, - continuously monitor the progress in the development of network and mobile operating systems and their applications.

Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	General characteristics and classification of operating systems	2	
	Android operating system	2	
	Mobility in communications systems (GSM, UMTS, LTE systems)	2	
	Communication networks and protocols (multiplexing, OSI model, TCP / IP protocol)	2	
	Computer languages and hierarchical structures of network and mobile operating systems	2	
	Software middleware and basic characteristics of network and mobile operating systems (multiprocessing)	2	

	Process management of network and mobile operating systems (table of processes, routines-subprograms)	2	
	Network and Distributed Operating Systems (clustered and Network Computing)	2	
	Systems on a chip	2	
	Basic concepts of cloud computing	2	
	Basic concepts in mobile cloud computing	2	
	Operating systems for the cloud computing environment	2	
	The structures of operating systems and virtualization of operating systems	2	
	System calls and process threads for network and mobile operating systems	2	
	Communication between processes and algorithms for the allocation of processors	2	
	List of laboratory or design exercises		LE hours
	Exercise 1: Operating System Cisco IOS, back up the OS with the router and restore the OS to the router, the configuration level, the basic configuration of the router and switch		2
	Exercise 2: Setup DHCP on the router		2
	Exercise 3: Setup NAT / PAT translation, access lists (ACLs) on the router		2
	Exercise 4: configuration of static and dynamic data traffic routing		2
	Exercise 5: Virtualization of computer systems		2
	Exercise 6: Introduction - programming environment for developing applications for the operating system Android		2
	Exercise 7: Use of the following tools to create applications: GenyMotion, LogCat, Toast, Activity lifecycle, Intent		2
	Exercise 8: The application of next tools to create applications: Configuration change, ListView, BaseAdapter		2
	Exercise 9: Application of advanced functionality such as ListView and BaseAdapter tools for creating applications		2
	Exercise 10: The implementation of HTTP requests - communication of applications with the server		2
	Exercise 11: Define application local settings and work with Android libraries (LIB's) and Spinner System		2
	Exercise 12: Configuration of simple applications on a mobile device uder the operating system Android with the help of tools: GSON and AsyncHttpClient		2
	Compensation laboratory exercises		2
	Presentation of developed application in the form of seminar work		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)	

<table>
<tr><td>Student responsibilities</td><td colspan="6">The conditions for overall positive assessment are:
• positive assessment of laboratory exercises (above 50 %)
• minimum presence during 70% of overall class teaching time in a semester,
• presence on laboratory exercises during 100% of overall laboratory exercise time in a semester,
• Submitted and presented seminar work,
• minimum 50% points at each mid-term or final exam (or correctional or commission exam).</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>0,8</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>0,8</td><td>Laboratory exercises</td><td>0,8</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>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 mid-term exams (tests). The 1st mid-term exam will be after 8 weeks of classes, and the 2nd after 15 weeks of classes. On the 1st and 2nd of the final exams, students take exam of those parts of the curricula which they did not pass on some of the mid-term exams. On the 3rd and 4th of the final (correctional) exam, students take exam of complete course curricula.

Rating (%) = 0.1PL + 0.2SW + 0,2LA + 0.25 (M1 + M2)
PL – presence on the lectures (expressed in percentage),
LA- grades from laboratory assessment (expressed in percentage),
SW - seminar work grades (expressed in percentage),
M1, M2- the 1st and 2nd mid-term exam grades or final exam grades (expressed in percentage),

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

Independently on results obtained during the 1st or 2nd mid-term exams, on the 3rd and 4th final (correctional) exams students take exam of entire curricula content. In the case of organization of commission exam, students also take exam of entire curricula content. Requirements related to the admission on final and correctional (commission) exam is a positive assessment of laboratory exercises.

Examinations:
1st Final exam
2nd Final exam
3rd Final (correctional) exam
4th Final (correctional) exam
5th Final (commission) exam (organized only based on decision of Faculty council in specific academic year)</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">• Josip Lorincz, Network and mobile operating systems, FESB Split, internal teaching text, 2016.</td><td></td><td>e-learning portal</td></tr>
</table>

	• Josip Lorincz, Ante Dagelić: Laboratory Exercises for course network and mobile operating systems, FESB Split, internal teaching text, 2015.		e-learning portal
Optional literature (at the time of submission of study programme proposal)	1. Operating Systems Concepts Essentials, A. Silberschatz, P.B. Galvin, G. Gagne, John Wiley and Sons, Inc., 2011 2. Operacijski sustavi, L. Budin, Element d.o.o., 2011 3. Internet		
Quality assurance methods that ensure the acquisition of exit competences	- Evaluation of results in accordance with the above learning outcomes - Feedback from students via surveys - Self-evaluation of teachers - Institutional and non-institutional evaluations - Feedback from graduated students about the relevance of the course content		
Other (as the proposer wishes to add)	/		

NAME OF THE COURSE	NUMERICAL METHODS IN COMMUNICATIONS						
Code	FELJ17	Year of study	1				
Course teacher	Dragan Poljak, Ph.D., Full Professor Vicko Dorić, Ph.D., Associate Professor	Credits (ECTS)	5				
Associate teachers	Anna Šušnjara, Teaching Assistant	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	15	15	
Status of the course	Obligatory	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - Understanding and apply fundamental principles of engineering numerical modeling, - Formulating and solve simple problems in electrical engineering by means of modern numerical methods, - Permanent adopting and fostering the knowledge in the area of numjerical modeling, - Applyingof numerical methods to solve problems in electronics and communications involving elektromagnetic waves and electromagnetic radiation		
Course enrolment requirements and entry competences required for the course	- Mathematics 2 and 3, Physics 1 and 2		
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - Define fundamental principles of engineering modeling, - Apply numerical methods to determine transient response of electric circuits - Apply numerical methods to solve one-dimensional static engineering problems - Apply numerical methods to solve two-dimensional static engineering problems - Compute frequeny response of transmission lines by means of Finite Difference Method (FDM) and Finite Element Method (FEM) - Compute frequeny response of wire antennas by means of Boundary Element Method (BEM) - Develop simple codes and use commercial software packages based on numerical methods for solving problems in electronics and communications		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	Introduction to numerical modeling. Source and field concepts. Differential and integral approach to solve problems in science and etechnology.	2	1
	Classification of numerical methods. Analysis in the ferquency and time domain. Domain discretisation methods.Boundary discretisation methods.	2	1
	Overview of numerical methods; Finite Difference Method (FDM).Finite Element Method (FEM). Boundary Element Method (BEM).	2	1
	Introduction to Finite Difference Method (FDM).	2	1
	Finite Difference Method (FDM): One-dimensional static	2	1

	problems.		
	Finite Difference Method (FDM): Two-dimensional static problems.	2	1
	Finite Difference Time Domain (FDTD) method: one-dimensional problems.	2	1
	Introduction to Finite Element method (FEM)	2	1
	Finite Element Method: One-dimensional static problems.	2	1
	Finite Element Method: Two-dimensional static problems.	2	1
	Finite Element Method in the time domain: One-dimensional problems.	2	1
	Introduction to Boundary Element Method (BEM).	2	1
	Application of numerical methods to transmission lines, waveguides, electric circuits, antennas, human exposure to electromagnetic radiation.	2	1
	List of laboratory or design exercises		LE hours
	Numerical integration – trapesoidal rule		2
	Numerical integration- Simpson and Gauss quadrature		2
	Adaptive integration		2
	Collocation method		2
	Least Square Method		2
	Finite Difference Method		2
	Finite Element Method		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	2	Research		Practical training	
	Experimental work		Report		(Other)	2,2
	Essay		Seminar essay		(Other)	0,2
	Tests	0,2	Oral exam		(Other)	0,2
	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 (120 min in duration) consists of 3 questions (each containing theoretical part and short numerical problem) and 2 longer numerical problems. The requirement for passing grade is the positive assessment of laboratory exercises and 50 % points on each midterm. Grade (in percentage) is formed according to the formula: Grade(%) = 0,5 (M1 + M2) where M1 and M2 are the midterm test results, and is determined through following percentage score:

<table>
<tr><td></td><td colspan="3">Percentage score: Grade:

From 50% to 62% sufficient (2)
From 63% to 75% good (3)
From 76% to 88% very good (4)
From 89% to 100% excellent (5)

Students who do not pass midterm exams are obliged to pass final test (150 min in duration) in winter/fall examination period. Final test consists of 4 questions (each containing theoretical part and short numerical problem) and 2 longer numerical problems. The requirement for passing grade is 50 % points. Final grade is formed according to the described procedure.The midterm and final exams are carried out as written tests.</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>• D.Poljak, Teorija elektromagnetskih polja s primjenama u inženjerstvu, Šk. knjiga Zagreb, 2014.</td><td></td><td></td></tr>
<tr><td>• D.Poljak i dr., Numeričke metode u elektrotehnici – interna skripta, FESB-Split 2006.</td><td></td><td></td></tr>
<tr><td>• D.Poljak, V.Dorić, S.Antonijević,: Modeliranje žičanih antena primjenom računala . Zagreb, Kigen d.o.o., 2009.</td><td></td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">• D. Poljak, Advanced Modeling in Computational Electromagnetic compatibility, Wiley Interscience, New York 2007.
• Jović, V.: Uvod u inženjersko numeričko modeliranje, Aquarius Engineering, Split, 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>

OPERATING SYSTEMS - FELJ13 - Sven Gotovac, Ph.D., Full Professor

NAME OF THE COURSE	OPTICAL COMMUNICATION SYSTEMS						
Code	FELJ10	Year of study	1.				
Course teacher	Dinko Begušić, Ph.D., Full Professor	Credits (ECTS)	5				
Associate teachers	Maja Stella, Ph.D., Assistant Professor Ivica Meštrović, dipl. ing. Marko Banović, dipl. ing. Josip Babić, mag. ing,.	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	15	15	0
Status of the course	Obligatory: 242 Elective: 241	Percentage of application of e-learning					

COURSE DESCRIPTION			
Course objectives	Training students for: - understanding and application of basic concepts and technologies of optical communication systems and networks, - application of passive and active components of optical systems and networks, - collaborate in design, development and maintenance of optical communication systems and networks, - permanent adoption and deepening of the knowledge in the area of optical communication systems and networks.		
Course enrolment requirements and entry competences required for the course	None		
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - define the basic concepts and methods for signal processing and communication using optical communication systems, - identify the characteristics and apply passive and active components of optical systems and networks, - identify the characteristics and apply the technologies of optical communication networks, - collaborate in design, development and maintenance of optical communication systems and networks, - permanently adopti and deepen the knowledge in the area of optical communication systems and networks.		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	Signal transmission and processing using photonic systems. Optical fibre characteristics.	2	1
	Analysis of linear time invariant systems.	2	1
	Splicing of the optical fibers. Optical connectors. Optical cables.	2	1
	Linear and nonlinear effects . Soliton systems.	2	1
	Passive element sin optical communication systems. Directional couplers, isolators, circulators, optical filters, multiplexers.	2	1
	Bragg grating, Mach-Zender interferometer, Fabry-Perot filter.	2	1

	Active components in optical communication networks. Optical amplifiers. EDFA amplifiers.	2	1
	Light sources. Light emittin diodes (LED). Laser diodes (LD).	2	1
	Photonic detectors. Pin photodiodes. Avalanche photodiodes (APD).	2	1
	Photonic switches. Modulators and demodulators.	2	1
	Characteristics of optical receivers. Design of the physical layer of the optical transmission system.	2	1
	Systems with time domain multiplexing. Wavelength domain multiplexing (WDM, DWDM).	2	1
	Optical networks SDH/SONET. Optical layer. Access networks based on optical technologies: FTTx systems. Passive optical networks (PON).	2	1
	List of laboratory or design exercises		LE hours
	Fiber optic and cables.		2
	Power measurements in fiber optic systems.		2
	Optical splicing.		2
	Optical connectors and splitters.		2
	Measurements on WDM systems.		2
	Measurements by optical reflectometer.		2
	Measurements on PON networks.		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	1,0	Research	-	Practical training	-
	Experimental work	-	Report	-	Individual work	2,2
	Essay	-	Seminar essay	0,5	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 and final test consists of 10 theoretical questions and numerical problems. The duration of each test is 2 school hour. 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, the seminar exercise and 50 % points on each midterm exam or the final exam. The continuous knowledge assessment 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,

<table>
<tr><td></td><td colspan="3">

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

The final grade is based on the grade of the continuous knowledge assesment grade and the oral part of the final exam. The students whose grade may be formed without the need for the oral part of the final exam may not be obliged to attend tthe oral part of the exam.
There are two terms for the final exam and one additional term for the make up exam.
The requirement for attendance of the final exam or the make up exam is the passing grade for all laboratory excercises and submitted seminar excercis work. At the final exam the student writes the test from the area of the miterm exam(s) which has/have not been succesfully passed before. At the make up exam the student writes the test from the complete course.
</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>• D.Begušić: Optical communication networks, handouts, FESB, 2016.</td><td></td><td>e-learning portal</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">- Rajiv Ramaswami, Kumar Sivarajan: „Optical Networks: A Practical Perspective“, (Second edition), Academic Press, 2002.
- Peter Tomsu, Christian Schmutzer: “Next Generation Optical Networks,
- The Convergence of IP Intelligence and Optical technologies”, Prentice Hall, 2002
- IEEE Communications Magazine,
- Documents of standardization institutions ITU, ETSI, IEEE and others,
- Scientific papers in the area of optical communication networks.</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	3							
Course teacher	Head of the professional training from the Faculty	Credits (ECTS)	5							
Associate teachers	Head of the professional training from the private institution	Type of instruction (number of hours)	L	S	AE	LE	DE			
Status of the course	Elective	Percentage of application of e-learning								
COURSE DESCRIPTION										
Course objectives	Training students for: - consolidating theoretical knowledge and practical skills in solving highly complex engineering problems - acquaintance with the organization, work and business of the receiving institution, - solving practical problems, - inclusion in the labour market, - writing technical reports									
Course enrolment requirements and entry competences required for the course	Acquired 120 ECTS credits									
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - consolidate theoretical knowledge and practical skills in solving problems - use literature, databases and other sources of information - select appropriate methods and procedures for solving practical problems - apply technical knowledge and skills to effectively solve engineering problems - prepare a written report on the work results									
Course content broken down in detail by weekly class schedule (syllabus)	Professional training is the independent work of the student performed in the receiving institution in accordance with the plan and programme agreed between the head of the professional training from the receiving institution and the head of professional training from the Faculty.									
Format of instruction	☐ lectures ☐ seminars and workshops ☐ exercises ☐ *on line* in entirety ☐ partial e-learning ☒ field work		☒ independent assignments ☐ multimedia ☐ laboratory ☒ work with mentor ☐ (other)							
Student responsibilities	Independent work									
Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*	Class attendance		Research		Practical training	4				
	Experimental work		Report		Independent work					
	Essay		Seminar essay		Report writing	1				
	Tests		Oral exam		(Other)					
	Written exam		Project		(Other)					

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

NAME OF THE COURSE	PROJECT MANAGEMENT							
Code	FETJ01	Year of study	2.					
Course teacher	Ivica Veža, Ph.D., Full Professor	Credits (ECTS)	4					
Associate teachers	Marko Mladineo, Ph.D.	Type of instruction (number of hours)	L	S	AE	LE	DE	
			30	0	0	15		
Status of the course	Obligatory	Percentage of application of e-learning	0					

COURSE DESCRIPTION

Course objectives	Training students for: - planning and managing projects - calculating profitability of the project and return of investment (ROI)
Course enrolment requirements and entry competences required for the course	None
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - analyze customer requirements (VOC) - formulate the main goals of the project and rank them - develop the main project activities and the structure of distribution of work – (Work Breakdown Structure) - plan the time (to determine the critical path) - plan capacity (determine bottlenecks and balance activities) - plan costs and risks - apply adopted knowledge and skills from contents of completed course to solve a specific task - combine and apply adopted knowledge and skills in teamwork

Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	Introduction and basic concepts	2	0
	The concept and definition of project and project management	2	0
	Projects - vision, strategy, goals (examples - automotive and shipbuilding industries)	2	0
	The strategy and project management. Multi-project management.	2	0
	Basics of organization. The project organizational structure.	2	0
	The phases of the project (initiation of project, project selection, project planning, project management and end of project)	2	0
	Methods for project planning.	2	0
	Quality management (planning of improvement and quality control)	2	0
	Cost management. Continuous Improvement - Kaizen.	2	0
	Risk management.	2	0
	Psychological and social component of project management. Project manager.	2	0

	Teamwork.	2	0
	Communication and motivation in the team. Methods for stimulating creativity.	2	0

	List of laboratory or design exercises	LE hours
	Introduction to the technique of network planning.	1
	Basic concepts of network planning technique	1
	Analysis of time	1
	CPM method	1
	PERT method	1
	PRECEDENCE method	1
	Cost analysis	1
	Resource analysis	1
	Introduction to the software - Microsoft Project	1
	Introduction to business process management	1
	Basics of process diagrams	1
	Mapping processes	1
	Comparison of different process diagrams	1

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	1,0	Research		Practical training	
	Experimental work		Report		Individual work	1,0
	Essay		Seminar essay		laboratory exercises	0,5
	Tests	0	Oral exam		Preparation for laboratory exercises	
	Written exam		Project	1,5	(Other)	

Grading and evaluating student work in class and at the final exam	During the semester the stages of project management are introduced to students, parallel they attend lectures and laboratory exercises to develop their project. There is project work team and the minimum number of students is two, maximum number is three. During the course they determine the content of their project and main targets. Students develop the main activities of project and the structure of distribution of work (WBS). They plan the time for each activity and determine the critical path. Students also plan capacities and determine bottlenecks and balance capacities. At the end they determine the costs, calculate project profitability (ROI) and analyze risks. On test students present their work which is evaluated (grade M). On the other side students have one test in the field of Network planning techniques (LV) at the end of the semester. • LV - grade of laboratory exercises, • M - points achieved from the project. The final grade (in percentage) is formed according to the formula: Grade (%) = 0,30 LV + 0,70 M

<table>
<tr><td rowspan="6">Required literature (available in the library and via other media)</td><th>Title</th><th>Number of copies in the library</th><th>Availability via other media</th></tr>
<tr><td>Veža, I., Bilić, B., Gjeldum, N., Mladineo, M., “Upravljanje projektima”, Fakultet elektrotehnike, strojarstva i brodogradnje, Split, 2011.</td><td></td><td>e-learning portal</td></tr>
<tr><td>Majstorović, V. Projektni menadžment, Sveučilište u Mostaru, Mostar, 2010.</td><td>5</td><td></td></tr>
<tr><td>Omazić, M.A. Projektni menadžment, Sinergija, Zagreb, 2005.</td><td>5</td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">“A Guide to the Project Management Body of Knowledge, PMBOK Guide”, Project Management Institute, Newtown Square, 2004.
Wysocki, R. K., McGary, R., “Effective Project Management: Traditional, Adaptive, Extreme”, John Wiley & Sons, 2003.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">• Evidence about class attendance
• The annual analysis of performance of the examinations
• Student survey in order to evaluate teachers
• Self-evaluation of teachers
• Feedback from students who have already graduated about the relevance of the course content</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="3"></td></tr>
</table>

NAME OF THE COURSE	RADARS							
Code	FELJ28	Year of study	1					
Course teacher	Zoran Blažević, Ph.D., Full Professor	Credits (ECTS)	5					
Associate teachers	Maja Škiljo, Ph.D.	Type of instruction (number of hours)	L	S	AE	LE	DE	
			30	0	0	30	0	
Status of the course	Elective	Percentage of application of e-learning	0					

COURSE DESCRIPTION

Course objectives	– explaining and increasing the knowledge about radiolocation principles, radar operation principle, and the role of all main radar subsystems. – calculating and estimating the basic radar signal parameters – differentiating between specific radar types and perceiving their advantages and disadvantages – visualization of possibilities and characteristics of surveillance and targeting radar operation – considering and investigating modern solutions in radar technology
Course enrolment requirements and entry competences required for the course	Finished the undergraduate study of Communications and Information Technology
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: – develop competencies in individual and team work in analyzing and designing certain radar subsystems – estimate and calculate radar target parameters – recognize the relation between certain tactical and technical radar requirements – evaluate and perceive advantages and disadvantages of certain radar types – consider and analyze characteristics of surveillance and targeting radars

Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours
	Introduction to radar systems.	1
	Basic principles of radar systems.	2
	Parameters of radar signal.	2
	Radio wave propagation, radar equation and maximum range.	3
	Radar cross section.	3
	Estimation of target position parameters by radar signal.	2
	Basic radar hardware.	2
	Moving target indication (MTI) radar.	3
	Doppler impulse radar.	3
	Synthetic aperture radar (SAR).	2
	Meteorological radar.	2
	Ultra wideband (UWB) radar.	2
	Target tracking.	2
	Clutter cancelation in radar systems.	1

	List of laboratory exercises	LE hours
	Transmission and reflection measurements of devices using vector network analyzer.	2
	Radar principles- the measurement of target distance.	6
	Numerical simulation of target radar cross section.	2
	The measurement of bistatic radar cross section.	2
	SAR radar concept- simulation and measurements.	4
	MTI radar concept- simulation and measurements.	2
	UWB radar concept- simulation and measurements.	2
	Group visit to HRM (Croatian Navy) in Lora.	5
	Group visit to Naval centre of electronics (PCE) Split.	5

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 required.	

Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*						
	Class attendance	1.5	Research		Practical training	
	Experimental work		Report		Individual work	
	Essay		Seminar essay	2	Laboratory exercises	1
	Tests	0,5	Oral exam		Preparation for laboratory exercises	
	Written exam		Project		(Other)	

Grading and evaluating student work in class and at the final exam	There is one midterm test and seminar essay. The midterm test is after 7 weeks of lecturing and the seminar essays are presented during the next part of the semester. The midterm test consists of theoretical questions and numerical. Seminar essay includes individual work and work in groups, and the presentation of the results. The students that did not pass the test take part In the final exams and the presentation of the seminar essay is obligatory. The midterm test is carried out as written test. Grade (in percentage) is formed according to the formula: Grade(%) = 0,1 NP + 0,1 LV + 0,4 (M + S) the activities in percentage: • NP - attendance at lectures, • LV – laboratory assessment, • M - test results, • S- seminar essay

Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	• M. Škiljo:: Radari, predavanja		e-learning portal
	• Skolnik, M: Introduction to Radar Systems, McGraw-Hill, 1990.	1	
	• Peebles, P. Z: "Radar Principles", John Wiley & Sons, 1998.	1	

Optional literature (at the time of submission of study programme proposal)	• Tait, P: "Introduction to Radar Target Recognition", IEE, 2005. • Zentner, E.: Antene i radiosustavi, Graphis Zagreb, 2001.
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	RADIO COMMUNICATIONS						
Code	FELJ02	Year of study	1.				
Course teacher	Zoran Blažević, Ph.D., Full Professor	Credits (ECTS)	5				
Associate teachers	Maja Škiljo, Ph.D.	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	15	15	0
Status of the course	Obligatory	Percentage of application of e-learning	0				

COURSE DESCRIPTION			
Course objectives	Training students for: - understanding and application of basic principles and mechanisms of Earth radio-propagation, - radio-channel physical phenomena modelling, - permanent adoption and deepening of knowledge in the field of radio engineering.		
Course enrolment requirements and entry competences required for the course	Finished the undergraduate study of Communications and Information Technology		
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - define the fundamental phenomena, the quantities and the laws of Earth radio-propagation, - apply fundamental laws of radio-propagation and model basic radio-channels, - calculate and estimate basic radio-channel parameters, - apply channel models for radio-signal quality estimation - apply basic methods of radio-channel measurements		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	Introduction to Radio Communications. History perspective of radio engineering. SI units.	1	-
	Radiowave propagation. Surface Waves. Division of Atmosphere.	2	1
	Radio-antenna parameters and effective isotropic radiated power.	2	2
	Free space radiowave propagation. Radio-gain.	2	1
	Propagation by Troposphere	1	1
	Effective Earth Radius Model and Flat Earth Model. Ducting.	3	1
	Radio-horizon by refraction. Influence of Earth curvature	2	1
	Tropospheric loss by hydrometeors and gasses	1	1
	Propagation by Ionosphere	3	1
	First midterm exam		
	Propagation by diffraction. Fresnel wave theory on diffraction. Knife-Edge Model.	4	1
	Approximate methods for multiple diffraction loss estimation	2	2
	Geometrical Theory of Diffraction. Keller's law of diffraction.	1	1
	Propagation by reflection. Fresnel reflection coefficients.	4	1

	Ground roughness influence. Divergence factor.		
	Interference by direct and ground reflected wave. Power law.	2	1
	Second midterm exam		
	List of laboratory exercises		LE hours
	Introduction to laboratory instruments, devices and other equipment		2
	Reflection parameters measurements		4
	Transmission parameters measurements		4
	Measurements of radio-channels by spectrum analyser		3
	Software estimations of diffraction loss		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 required.	

Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*						
	Class attendance	2,0	Research		Practical training	
	Experimental work		Report		Individual work	1.5
	Essay		Seminar essay		Laboratory exercises	0,8
	Tests	0,5	Oral exam		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. Each midterm test and final tests consist of theoretical questions and numerical. The students that did not pass the midterm exams take part In the final exams. The midterm and final exams are carried out as written tests. The requirement for passing grade is the positive assessment of laboratory exercises and 40 % points on each midterm exam or the final exam. Grade (in percentage) is formed according to the formula: Grade(%) = 0,1 NP + 0,1 LV + 0,4 (M1 + M2) the activities in percentage: • NP - attendance at lectures, • LV – laboratory assessment, • M1, M2 – test results.

Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	• I. Zanchi, Z. Blažević: Radiokomunikacije, predavanja, FESB		e-learning portal
	• Boithias, L.: Radio Wave Propagation, North Oxford Academic 1987.	1	
	• Zentner, E.: Radiokomunikacije, Školska knjiga - Zagreb, 1980.	2	

Optional literature (at the time of submission of study programme	• Zentner, E.: Antene i radiosustavi, Graphis Zagreb, 2001. • Parsons, J. D.: "The Mobile Radio Propagation Channel", Pentech Press Publishers - London, GB, 1992.

proposal)	• Doble, J.: "Introduction to Radio Propagation for Fixed and Mobile Communications", Artech House Boston - London, GB, 1996.
Quality assurance methods that ensure the acquisition of exit competences	- 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	RADIO FREQUENCY IDENTIFICATION TECHNOLOGY						
Code	FELJ38	Year of study	3.				
Course teacher	Joško Radić, Ph.D., Associate Professor Petar Šolić, Ph.D., Assistant Professor	Credits (ECTS)	5				
Associate teachers		Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	30	0
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - Acquire elemental knowledge in the field of RFID technologies - Introduction with RFID systems with multiple readers - Understanding mobility and energy efficiency in RFID systems - Implement simple RFID system - Applying appropriate technology for identification and localization		
Course enrolment requirements and entry competences required for the course	None		
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: 1. Describe architecture and types of RFID systems 2. Explain protocols used in RFID systems 3. Explain reasons of introducing RFID systems with multiple readers 4. Choose appropriate RFID system regarding to its application 5. Choose appropriate RFID system regarding to its demands on the application 6. Project simple solution to control the access by using RFID system		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	LE hours
	RFID system architecture	3	2
	Types of RFID systems	2	2
	Networking protocols in communication of one reader and multiple tags, decision trees and ALOHA	4	4
	CDMA and CSMA systems	2	2
	Mobility and energy efficiency of RFID systems	2	2
	Systems with large number of readers and tags	3	3
	Problems in RFID systems implementation	2	2
	Enviroments appropriate for the usage of RFID systems	2	2
	RFID systems applications, access control and identification	2	2
	Competitive technologies for identification and localization, bar-codes, wireless sensor networs	2	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 colspan="2">☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="8">The presence on lectures in the amount of at least 70 % of the times scheduled. Performed all required laboratory exercises.</td></tr>
<tr><td rowspan="6">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>0,8</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</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>0,1</td><td>Oral exam</td><td></td><td>Preparation for laboratory exercises</td><td>0,5</td></tr>
<tr><td>Written exam</td><td>0,1</td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td colspan="6"></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="8">During the semester there are two mid-term exams and the final exam. Mid-term and final exams consist of questions and tasks. 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 (%) = 0,75 * (0.5 * M1 + 0,5 * M2) + 0,25 * L;
M1, M2 - points at the mid-term expressed as a percentage, and L - points from the laboratory (with completed all lab. Exercises) expressed as a percentage.
The final evaluation is determined as follows:
percentage Rating
50% to 61% is sufficient (2)
62% to 74% good (3)
75% to 87% of very good (4)
88% 100% Excellent (5)</td></tr>
<tr><td rowspan="2">Required literature (available in the library and via other media)</td><td colspan="5">Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td colspan="5">Nastavni materijali za kolegij Tehnologija radiofrekvencije identifikacije</td><td></td><td>e-learning</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="8">M. Bolic, D. Simplot-Ryl, I. Stojmenovic, RFID Systems: Research trends and challenges, edited book, Wiley Series in Wireless Communications and Mobile Computing, 2010.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="8">- 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="8"></td></tr>
</table>

NAME OF THE COURSE	RADIOFREQUENCY ELECTRONICS							
Code	FELJ07	Year of study	2.					
Course teacher	Ivan Marinović, Ph.D., Full Professor	Credits (ECTS)	5					
Associate teachers		Type of instruction (number of hours)	L	S	AE	LE	DE	
			30			30		
Status of the course	Elective: 241, 242	Percentage of application of e-learning						

COURSE DESCRIPTION

Course objectives	Training students for: - analysis of simple RF circuits - doing measurements on the circuits		
Course enrolment requirements and entry competences required for the course	Finished course *Electronic components and circuits*		
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - understand principles of basic RF circuits - do DC analysis of electronic circuits - do AC analysis of electronic circuits - do analysis in frequency domain - make measurements of the basic RF parameters		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	Impedance matching, RF filters	6	
	Oscillators	6	
	C-class power amplifiers	6	
	Modulation	6	
	Superheterodyne receiver, PLL-loop	6	
	List of laboratory or design exercises		LE hours
	LP and HP filters		6
	Oscillator		6
	C-class power amplifier		6
	AM and FM modulators		6
	PLL-loop		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 and exercises in the amount of at least 70% of the times scheduled. Performed all required laboratory exercises.		

Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*	Class attendance	2	Research		Practical training	
	Experimental work		Report		Exercises	1
	Essay		Seminar essay		Individual work	2
	Tests		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 next 6 weeks. Each midterm test consists of theoretical questions and numerical problems as well as the final test. In the final exams students that did not pass the midterm exams take part. The midterms are carried out as written tests while the final exams are written and oral. The absolute grading is applied.		
Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	• I. Modlic, B. Modlic, Visokofrekvencijska elektronika, modulacija, modulatori, sintezatori frekvencije, Školska knjiga	5	
	• I. Modlic, B. Modlic, Visokofrekvencijska elektronika, oscilatori, pojačala snage, Školska knjiga	5	
	• M. Vujnović, Oscilatori, Školska knjiga	5	
Optional literature (at the time of submission of study programme proposal)	- P. Vizmuller, RF design guide, Systems, Circuits and Equations, Artech House		
	- Jon B. Hagen, Radio-Frequency Electronics, Circuits and Applications, Cambridge University Press		
Quality assurance methods that ensure the acquisition of exit competences	- Evidence of students attendance - Annual analysis of grades achieved - Teachers self-evaluation - Students feedback via questionnaires and surveys		
Other (as the proposer wishes to add)			

NAME OF THE COURSE	SATELLITE POSITIONING SYSTEMS						
Code	FELJ25	Year of study	1.				
Course teacher	Zoran Blažević, Ph.D., Full Professor	Credits (ECTS)	5				
Associate teachers	Maja Škiljo, Ph.D.,	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	30	0
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - understanding of basic principles of and problemacy of radio-positioning systems, - applying and operating receiving radio-positioning equipment - calculation and analysis of satellite positioning systems parameters
Course enrolment requirements and entry competences required for the course	Finished the undergraduate study of Communications and Information Technology
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - define and explain radio-positioning techniques, - calculate and estimate basic radio-positioning system parameters, - apply channel models to radio-propagation in satellite positioning systems - apply standards to radio-positioning network design

Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	Introduction. GPS, GLONASS, GALILEO.	1	
	Position fix by using satellites. GPS coordinate systems.	2	
	GPS measurements: pseudo-range and delta-pseudorange.	3	
	GPS equations. Analytic solution.	4	
	GPS equation solution applying iterative techniques based on linearization.	2	
	Kalman filter.	2	
	Performances of standalone GPS. Pseudo-range errors.	3	
	Delusion of precision. DOP parameters.	5	
	Vertical accuracy for fixed satellite-user geometry.	1	
	Horzontal accuracy for fixed satellite-user geometry.	1	
	Differential GPS. LAD-GPS.	2	
	Error sources in DGPS system.	2	
	WADGPS.	2	
	Midterm exam		

	List of laboratory exercises	LE hours
	Introduction to GPS receivers, handling and applications	10
	Application of GPS software (Trimble and Visual GPS) for GPS planning and data analysis. Application of Internet for DGPS corrections download.	5
	GPS signal quality and GPS parameters measurements	10
	Measurements by GPS. Routes measurements and saving.	5

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 required.	

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
	Essay		Seminar essay		Laboratory exercises	0,8
	Tests	0,5	Oral exam		Preparation for laboratory exercises	0,2
	Written exam		Project		(Other)	

Grading and evaluating student work in class and at the final exam	There are one midterm and one final exam. Both midterm test and final test consist of theoretical questions and numerical problems. The students that did not pass the midterm exams take part In the final exams. The midterm and final exams are carried out as written tests. The requirement for passing grade is the positive assessment of laboratory exercises, 40 % points on the midterm exam or the final exam, and the rest of the grade depends on the seminary work presented by the student. Grade (in percentage) is formed according to the formula: Grade(%) = 0,1 NP + 0,1 LV + 0,4 (M + S) the activities in percentage: • NP - attendance at lectures, • LV – laboratory assessment, • M – test results., • S – seminary work results and presentation

Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	• Z. Blažević: Sustavi satelitskog pozicioniranja, predavanja		e-learning portal
	• Kaplan, E. D.:"Understanding GPS Principles and Applications", Artech House, Boston London, 1996	1	
	• B. W. Parkinson, J. J. Spliker Jr., "Global Positioning System: Theory and Applications Volume I", American Institute of Aeronautic and Astronautics, 1996.	1	

Optional literature (at the time of submission of study programme proposal)	* ICD-GPS-200, NAVSTAR GPS Space Segment/Navigation User Interfaces, ARINC Research Corporation
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	SIMULATION AND MEASUREMENT OF ELECTROMAGNETIC QUANTITIES						
Code	FELJ29	Year of study	2.				
Course teacher	Dragan Poljak, Ph.D., Full Professor Antonio Šarolić, Ph.D., Full Professor	Credits (ECTS)	5				
Associate teachers	Niko Ištuk, Teaching Assistant	Type of instruction (number of hours)	L	S	AE	LE	DE
			30			30	
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - solving of electromagnetic problems by modelling and using numerical methods - solving of electromagnetic problems using instrumentation for electromagnetic measurements		
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: - use the measurement instrumentation for electromagnetic measurements - use the numerical methods for simulation of electromagnetic problems - use the measurement methods for measuring important parameters of radio systems		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	Overview of numerical methods in electromagnetics.	2	0
	Theory of transmission lines. Analysis in time and frequency domain.	2	0
	Application of finite difference methods in frequency and time domain.	2	0
	Theory of antennas. Analysis in frequency and time domain.	2	0
	Application of analytic and numerical procedures in antenna models.	2	0
	Application of finite element method in frequency and time domain.	2	0
	Application of boundary element method in frequency and time domain.	2	0
	Instrumentation and environment for electromagnetic measurements.	2	0
	Measurements in controlled environment: Components of the measurement setup. Chambers for electromagnetic measurements.	2	0
	Measurements in controlled environment: Measurement procedures.	2	0
	Measurements in uncontrolled environment: Components of the measurement setup.	2	0
	Measurements in uncontrolled environment: Measurement procedures.	2	0
	Measurement errors, measurement uncertainty.	2	0

	List of laboratory or design exercises	LE hours
	Overview of numerical methods in electromagnetics.	2
	Theory of transmission lines. Analysis in time and frequency domain.	2
	Application of finite difference methods in frequency and time domain.	2
	Theory of antennas. Analysis in frequency and time domain.	2
	Application of analytic and numerical procedures in antenna models.	2
	Application of finite element method in frequency and time domain.	2
	Application of boundary element method in frequency and time domain.	2
	Instrumentation and environment for electromagnetic measurements.	2
	Measurements in controlled environment: Components of the measurement setup. Chambers for electromagnetic measurements.	2
	Measurements in controlled environment: Measurement procedures.	2
	Measurements in uncontrolled environment: Components of the measurement setup.	2
	Measurements in uncontrolled environment: Measurement procedures.	2
	Measurement errors, measurement uncertainty.	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	Student is required to attend the lectures and auditory exercises in the amount of at least 70% of the schedule. Student is required to attend the laboratory exercises in the amount of 100% of the schedule and to complete all tasks associated with 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	0,5
	Experimental work	0,5	Report		Laboratory exercises	0,5
	Essay		Seminar essay	1	Individual work	1
	Mid-exam		Oral exam		(Other)	
	Written exam	0,5	Project		(Other)	

Grading and evaluating student work in class and at the final exam	Seminar presentation or exam consisting of written and practical examination

Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	• Dragan Poljak: "Advanced modeling in computational electromagnetic compatibility", Wiley Interscience, 2007.		
	• Handbook of microwave measurements, Vol.I-III, Polytechnic Press, 1963.		

Optional literature (at the time of submission of study programme proposal)	- Handbook of Electromagnetic Compatibility, ed. R. Perez, Academic Press, 1995. - Poljak, D.: Electromagnetic Modelling of Wire Antenna Structures, WIT Press, Southampton-Boston, 2002.
Quality assurance methods that ensure the acquisition of exit competences	Surveys providing student feedback
Other (as the proposer wishes to add)	

NAME OF THE COURSE	SOFTWARE ENGINEERING IN TELECOMMUNICATIONS						
Code	FELJ18	Year of study	2.				
Course teacher	Dinko Begušić, Ph.D., Full Professor	Credits (ECTS)	5				
Associate teachers	Goran Škugor, dipl. ing. Jelena Mihovilović, dipl.ing.	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	30	0
Status of the course	Obligatory: 242 Elective: 250	Percentage of application of e-learning					

COURSE DESCRIPTION

Course objectives	Training students for: - evaluation and application of basic concepts and methods of software engineering in telecommunications, - collaboration in design, development and maintenance of software systems and products in telecommunications, - permanent adoption and deepening of the knowledge in the area of software engineering methods and software products in communication systems and networks.
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 apply basic concepts and methods of software engineering in telecommunications, - evaluate characteristics of software engineering processes in telecommunications, - collaborate in design, development and maintenance of software systems and products in telecommunications, - evaluate and apply methods and tools for development of telecommunications software, - collaborate in telecommunications software development process and apply adequite methods of software engineering - permanently adopt and deepen of the knowledge in the area of software engineering methods and software products in communication systems and networks.

Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	Software product. Software engineering body of knowledge.	2	-
	Software product life cycle models. Waterfall model. COTS.	2	-
	Basic process activities.	2	-
	RUP process model. Graphical modelling language UML. Model driven engineering.	2	-
	Agile methods. Application of agile techniques in telecommunications.	2	-
	Agile methods: SCRUM, KANBAN. 3	2	-
	Characteristics of software products for telecommunications.	2	-
	Telecommunications software testing techniques.	2	-

	Information systems for telecommunication systems management. TMN, eTOM, ITIL.	2	-
	Software metrics and software quality.	2	-
	Maintenance of the software products in telecommunications.	2	-
	Techniques for robust telecommunications software development.	2	-
	Software projects management in telecommunications.	2	-
	List of laboratory or design exercises		LE hours
	Introduction in laboratory excercises.		2
	Project definition.		2
	Requirements specification.		2
	Project development cycles 1-9.		18
	Project presentations.		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	1,0	Research	-	Practical training	-
	Experimental work	-	Report	-	Individual work	2,2
	Essay	-	Seminar essay	-	Laboratory exercises	1,0
	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 and final test consists of 10 theoretical questions and numerical problems. The duration of each test is 2 school hour. 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, the seminar exercise and 50 % points on each midterm exam or the final exam. The continuous knowledge assessment grade (in percentage) is formed according to the formula:

$$\text{Grade}(\%) = 0{,}05\ NP + 0{,}35\ LV + 0{,}3\ (M1 + M2)$$

the activities in percentage:

- NP - attendance at lectures,
- LV – laboratory assessment,
- M1, M2 – test results.

The final grade is based on the grade of the continuous knowledge assesment grade and the oral part of the final exam. The students whose grade may be formed without the need for the oral part of the final exam may not be obliged to attend tthe oral part of the exam.

<table>
<tr><td></td><td colspan="3">There are two terms for the final exam and one additional term for the make up exam.
The requirement for attendance of the final exam or the make up exam is the passing grade for all laboratory excercises and submitted seminar excercis work. At the final exam the student writes the test from the area of the miterm exam(s) which has/have not been succesfully passed before. At the make up exam the student writes the test from the complete course.</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>• D.Begušić: Software engineering in tele communications, handouts, FESB, 2016.</td><td></td><td>e-learning portal</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">- G. Utas: Robust Communications Software, John Wiley & Sons, 2005 I. - Sommerville: Software Engineering, Addison Wesley, UK, 2006. DIEEE - Communications Magazine.
- Documents of standardization institutions ITU, ETSI, IEEE and others.
- Scientific papers in the area of software engineering in telecommunications
- Antun Carić: Design of Telecommunications Software, 2003.
- L. Rising: Design Patterns in Communications Software, Cambridge University Press, 2001
- Robert S. Pressman: Software Engineering: A Practitioner's Approach, McGraw-Hill Inc., 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	SYSTEMS FOR WIRELESS TRANSMISSION OF ENERGY						
Code	FELJ36	Year of study	2				
Course teacher	Zoran Blažević, Ph.D., Full Professor	Credits (ECTS)	5				
Associate teachers	Maja Škiljo, Ph.D.	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	30	0
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - understanding of basic principles of and problemacy of systems for wireless transmission of energy, - designing of radio system for near-field transmission of energy - design of radio system for far-field power transmission - calculation and analysis of wireless energy systems parameters		
Course enrolment requirements and entry competences required for the course	Finished the undergraduate study of Communications and Information Technology.		
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - analyse power and energy transmission techniques, - calculate and estimate wireless energy transmission system parameters, - designing basic transmission system schemes for given service		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	Introduction. Historical perspective of radio and wireless transmission.	2	
	Principles and techniques for radio-transmission of energy. Transformers and resonant transformers (Tesla Coil), and electrically small antennas.	4	
	Antenna scattering matrix. Coupled-Mode Theory and Spherical Mode Theory-Antenna Model application to wireless transmission of energy systems.	4	
	Rectennas.	2	
	Near-field energy and power transmission. Resonant transformer.	4	
	Far-field power transfer.	4	
	Ground energy transfer by far-field systems concept	3	
	Satellite energy transfer system concept	3	
	Norms and standards for wireless energy transfer. Qi standard.	2	
	Electromagnetic Compatibility of wireless energy transfer systems.	2	
	Interference problem between radio-communications systems and radio systems for wireless energy transfer.	2	
	Midterm exam		

	List of laboratory exercises	LE hours
	Measurements and adjustments of inductively fed electrically small antennas	8
	Measurements of transfer performances by Spectrum Analyser, and by Oscilloscope	8
	Measurements of transfer performances by Vector Network Analyser	6
	Tesla Coil Measurements.	8

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

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
	Essay		Seminar essay		Laboratory exercises	0,8
	Tests	0,5	Oral exam		Preparation for laboratory exercises	0,2
	Written exam		Project		(Other)	

Grading and evaluating student work in class and at the final exam	There are one midterm and one final exam. Both midterm test and final test consist of theoretical questions and numerical problems. The students that did not pass the midterm exams take part In the final exams. The midterm and final exams are carried out as written tests. The requirement for passing grade is the positive assessment of laboratory exercises, 40 % points on the midterm exam or the final exam, and the rest of the grade depends on the seminary work presented by the student. Grade (in percentage) is formed according to the formula: Grade(%) = 0,1 NP + 0,1 LV + 0,4 (M + S) the activities in percentage: • NP - attendance at lectures, • LV – laboratory assessment, • M – test results., • S – seminary work results and presentation

Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	• Ki Young Kim (editor), “Wireless Power Transfer-Principles and Engineering Explorations”, InTech, January 2012.		e-learning portal
	• Volakis J., C. C. Chen and K. Fujimoto, “Small antennas: miniaturization techniques and applications”, New York, McGraw-Hill, 2010.		e-learning portal
	• Special issue „Solar Power Satellite and Wireless Power Transmission“, IEEE Microwave Magazine, Vol. 3, No. 4, December 2002.	1	

Optional literature (at the time of submission of study programme proposal)	• Lee J. and S. Nam, “Fundamental aspects of near-field coupling small antennas for wireless power transfer”, IEEE Trans. Antennas Propag., Vol. 58, No. 12, 3442-3449, 2010. • P. Sample, D. T. Meyer, J. R. Smith: Analysis, experimental results, and range adaptation of magnetically coupled resonators for wireless power transfer, IEEE Transactions on Industrial Electronics, Vol. 58, No. 2, 2010, p.p 544-554. • N. Tesla, A. Marinčić: Colorado Springs Notes, Nolit, Beograd, 1978. • Carol Gray Montgomery, Robert Henry Dicke and Edward M. Purcell, “Principles of microwave circuits”, McGraw-Hill Book Company, Inc.,USA, 1948.
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	TRANSMISSION SYSTEMS						
Code	FELJ03	Year of study	1.				
Course teacher	Maja Stella, Ph.D., Assistant Professor	Credits (ECTS)	5				
Associate teachers	Dinko Begušić, Ph.D., Full Professor	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	15	15	0
Status of the course	Obligatory:242 Elective: 241, 250	Percentage of application of e-learning					

COURSE DESCRIPTION			
Course objectives	Training students for: - understanding and application of basic concepts and technologies of transmission systems communication networks, - collaborate in design, development and maintenance of transmission systems and communication networks, - permanent adoption and deepening of the knowledge in the area of transmission systems and communication networks.		
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 apply basic concepts of transmission systems and communication networks, - identify the characteristics and apply the technologies of transmission systems and communication networks, - collaborate in design, development and maintenance of transmission systems and communication networks, - permanently adopt and deepen the knowledge in the area of transmission systems and communication networks.		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	Model of the information network.	2	-
	Access to transmission medium.	2	-
	Layered architecture of the information network. Digital transmission, PCM.	2	-
	Routing of the information within the network.	2	-
	Transmission techniques and multiplexing. Quality of service and network performance assessment.	2	-
	Optical transmission systems. Optical multiplexing systems WDM, OTDM.	2	-
	Plesiochronous digital hierarchy (PDH). Synchronous digital hierarchy (SDH).	2	-
	Transmission network architectures. Synchronization.	2	-
	Asynchronous transfer mode (ATM).	2	-
	Internet architecture and protocols.	2	-
	Carrier Ethernet.	2	-
	Multiprotocol label switching (MPLS).	2	-

	Fundamentals of telecommunication network management (TMN, eTOM).	2	-
	List of auditory exercises		LE hours
	Examples of technical specifications of transmission systems and communication networks.		7
	Examples of professional papers on new technologies of transmission systems and communication networks.		6
	List of laboratory or design exercises		LE hours
	Transmission systems and equipment.		2
	Synchronization in communication networks.		2
	Routing protocols in Ethernet networks.		2
	Ethernet traffic transmission.		2
	Configuration of the Ethernet network.		2
	Platform CPP Cello.		2
	Systems ENUM and DNS.		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	1,0	Research	-	Practical training	-
	Experimental work	-	Report	-	Individual work	2,2
	Essay	-	Seminar essay	0,5	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 and final test consists of 10 theoretical questions and numerical problems. The duration of each test is 2 school hour. 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, the seminar exercise and 50 % points on each midterm exam or the final exam. The continuous knowledge assessment grade (in percentage) is formed according to the formula:

$$Grade(\%) = 0,2\ AV + 0,2\ LV + 0,3(M1 + M2)$$

the activities in percentage:

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

The final grade is based on the grade of the continuous knowledge assessment grade and the oral part of the final exam. The students whose grade may be formed without the need for the oral part of the final exam may not be obliged to attend the oral part of the exam.

<table>
<tr><td></td><td colspan="3">There are two terms for the final exam and one additional term for the make up exam.
The requirement for attendance of the final exam or the make up exam is the passing grade for all laboratory exercises and submitted seminar exercises work. At the final exam the student writes the test from the area of the midterm exam(s) which has/have not been successfully passed before. At the make up exam the student writes the test from the complete course.</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>D.Begušić: Selected topics in transmission systems handouts, FESB, 2016. (in Croatian)</td><td></td><td>e-learning portal</td></tr>
<tr><td>A.Bažant et al.: Basic network architectures, Element Zagreb, 2004. (in Croatian)</td><td>10</td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">- IEEE Communications Magazine,
- Documents of standardization institutions ITU, ETSI, IEEE, IETF and others,</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	WIRELESS COMMUNICATION NETWORKS						
Code	FELJ09	Year of study	1.				
Course teacher	Dinko Begušić, Ph.D., Full Professor	Credits (ECTS)	5				
Associate teachers	Maja Stella, Ph.D., Assistant Professor Marina Rajič, Mag. Ing. Josip Žilić, Magl. Ing. Ante Dagelić, Mag. Ing,	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	15	15	0
Status of the course	Obligatory: 241, 242 Elective: 220, 250	Percentage of application of e-learning					

COURSE DESCRIPTION

Course objectives	Training students for: - understanding and application of basic concepts and technologies of wireless communication systems, - collaboration in design, development and maintenance of wireless communication networks, - collaborate in design, development and maintenance of optical communication systems and networks, - permanent adoption and deepening of the knowledge in the area of wirelessl communication systems and networks.		
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: - identify, select and apply wireless communication systems and networks, - collaborate in design, implementation and maintenance of mobile networks (NMT, GSM, GPRS, EDGE, UMTS, HSDPA, LTE), - collaborate in design, implementation and maintenance of wireless access networks (WIMAN), - collaborate in design, implementation and maintenance of wireless local area networks (WLAN, IEEE 802.11x), - collaborate in design, implementation and maintenance of wireless personal area networks (WPAN, Bluetooth), - collaborate in design, implementation and maintenance of ad-hoc networks, - collaborate in design, implementation and maintenance of sattelite commnication networks (LEO, MEO, GEO), - collaborate in development of services based on wireless communication networks, - permanently adopti and deepening of the knowledge in the area of wireless communication systems and networks.		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	Basic characteristics of wireless communication channels (feding, multipath propagation, Doppler effect).	2	1
	Digital signal processing and diversity combining in wireless commnications.	2	1
	Multiple access techniques and multiplexing (FDMA, TDMA,	2	1

	CDMA, OFDMA).		
	Cellular systems. Interference. Coverage.	2	1
	Mobile networks evolution. First generation networks.	2	1
	Second generation networks.	2	1
	GSM system. Network architecture, physical channels.	2	1
	Implementation and application of discrete time systems.	2	1
	GSM system: logical channels, layered model. 3 Mobile networks 2G+; GPRS, EDGE.	2	1
	Mobile networks 3G+ (UMTS, HSPA).	2	1
	Mobile networks 4G. (LTE, LTE-A). Mobile networks 5G.	2	1
	Wireless access networks. (WMAN); IEEE 802.16. Wireless local networks (WLAN); IEEE 802.11x. Wireless personal area networks (WPAN); Bluetooth., IEEE 802.15	2	1
	Satellite commnication networks (LEO, MEO, GEO). Services in wireless communication networks. Mobile computing and mobile internet.	2	1
	List of laboratory or design exercises		LE hours
	Configuration of IEEE 802.11x based networks.		2
	Throughput measurement in IEEE 802.11x based networks,		2
	Configura and throughput measurement in Bluetooth systems.		2
	Signalling in GSM networks.		2
	Signalling in UMST networks.		2
	Signalling in LTE networks.		2
	Synchronization in mobile networks.		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	D..Begušić: Wireless and mobile communication networks, handouts Optional literature (at the time of submission of study programme proposal) □ IEEE Communications Magazine. □ Documents of standardization institutions ITU, ETSI, IEEE and others. □ Scientific papers in the area of wireless and mobile communication networ	

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

<table>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="3">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 and final test consists of 10 theoretical questions and numerical problems. The duration of each test is 2 school hour. 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, the seminar exercise and 50 % points on each midterm exam or the final exam. The continuous knowledge assessment 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.

The final grade is based on the grade of the continuous knowledge assesment grade and the oral part of the final exam. The students whose grade may be formed without the need for the oral part of the final exam may not be obliged to attend tthe oral part of the exam.
There are two terms for the final exam and one additional term for the make up exam.
The requirement for attendance of the final exam or the make up exam is the passing grade for all laboratory excercises and submitted seminar excercis work. At the final exam the student writes the test from the area of the miterm exam(s) which has/have not been succesfully passed before. At the make up exam the student writes the test from the complete course.</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>D.Begušić: Wireless communication networks, handouts, FESB, 2016.</td><td></td><td>e-learning portal</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">- P.M.Shankar: Introduction to Wireless Systems, John Wiley & sons, USA, 2002 -
- EEE Communications Magazine.
- Documents of standardization institutions ITU, ETSI, IEEE and others.
- Scientific papers in the area of wireless and mobile communication networks.</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	WIRELESS SECURITY						
Code	FELK19	Year of study	2.				
Course teacher	Mario Čagalj, Ph.D., Full Professor	Credits (ECTS)	5				
Associate teachers	Toni Perković, Ph.D., Assistant Professor	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	30	
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	The main objectives of the course are: • provide students with insight into basic features and aspects of protecting wireless communication channels • present students with proven mechanisms for the protection of wireless communication channels • enable students to implement appropriate security mechanisms for the protection of wireless communication channels
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)	After successfully mastering a course, students will be able to: • Explain the key vulnerabilities of wireless communication channels • Explain the essential difference between the vulnerability of classic wire and wireless channels • Demonstrate and implement attacks (in the sense of penetration testing) on wireless technologies such as IEEE 802.11, 2G and 3G mobile networks and contactless cards - DoS attacks on the physical level - DoS attacks at the data level - Attacks on privacy and confidentiality of data • Critically assess the potential security risks of specific wireless communication technology and systems - IEEE 802.11, 2G and 3G, NFC, GPS navigation system - Recommend the use of appropriate protective mechanisms

	Course content	L hours	AE hours
Course content broken down in detail by weekly class schedule (syllabus)	Introduction to the security of wireless communication and navigation systems	1	
	Radio communication channel	2	
	Radio jamming attacks	2	
	Eavesdropping and relay attacks	1	
	Signal interference protection: scattered spectrum techniques (FHSS and DSSS)	2	
	An overview of basic cryptographic primitives	2	
	WiFi network security (802.11 architecture, WEP, WPA, WPA2, 802.11i, anomalies, selfish behavior)	4	
	First midterm exam		
	Mobile network security (GSM and UMTS, interference,	2	

	privacy, man-in-the-middle attacks)		
	Vulnerability of Wireless Navigation Systems (GPS, Gallileo)	2	
	Security of Wireless Sensor Networks (Initialization, Establishment of Encryption Keys, Interference)	4	
	User-friendly message authentication via radio channel (I-codes primitive)	2	
	Location privacy in mobile networks	2	
	Second midterm exam	2	
	List of laboratory exercises		LE hours
	Vulnerability of the radio channel (DoS by interfering with the signal, MitM via ARP spoofing attacks, wiretapping and data analysis)		6
	Basic cryptographic primitives (Cryptool2)		4
	Security of WiFi networks (punctuation of WEP and WPA / WPA2, false AP, SSL stripping attack, failure in configuration of EAP-TTLS authentication method)		10
	Anomaly in performance with IEEE 802.11 standards		2
	Security of Wireless Sensor Networks (Xbee and Arduino Platforms)		4
	Location privacy in cellular networks		4

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

Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*	Class attendance	0,7	Research		Practical training	
	Experimental work		Report		Individual work	2
	Essay		Seminar essay		Laboratory exercises	2
	Tests	0,2	Oral exam			
	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. Students are also required to submit a written report on their work on the laboratory assignments.

The final grade is formed as follows:

$$\text{Grade} = \text{Round}[\, 0{,}05\ P + 0{,}15\ LV + 0{,}30\ M1 + 0{,}50\ M2\ ]$$

where:

- P – is a grade based on attendance at lectures,
- LV – a grade earned during laboratory exercises,
- M1, M2 – test results.

NOTE: If a student fails a given task (P, LV, M1, M2), the corresponding grade is set to 0 in the above formula.

<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>Lecture notes and presentations</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">• Buttyan L., Hubaux J.-P.: Security and Cooperation in Wireless Networks: Thwarting Malicious and Selfish Behavior in the Age of Ubiquitous Computing, Cambridge University Press, 2007.
• Stallings W.: Cryptography and Network Security, Principles and Practice, Prentice Hall, 2005.
• Menezes J., van Oorschot P. C., Vanstone S. A.: Handbook of AppliedCryptography, CRC Press, 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	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	
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 equal to the ECTS value of the course)*						
	Class attendance		Research		Practical training	
	Experimental work		Report		Individual work	30
	Essay		Seminar essay		(Other)	
	Tests		Oral exam		(Other)	
	Written exam		Project		(Other)	

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

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

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	
Location of building	
Year of completion	
Total square area in m^2	
Identification of building	
Location of building	
Year of completion	
Total square area in m^2	

3.2. List of teachers and associate teachers

CODE	Course	Teachers and associate teachers
	List the courses in alphabetical order	
FELJ12	Algorithms	Matko Šarić, Ph.D., Assistant Professor Ante Topić, Teaching Assistant
FELJ37	Analysis methods in fusion technology	Dragan Poljak, Ph.D., Full Professor Anna Šušnjara, Teaching Assistant
FELJ21	Antenna systems	Antonio Šarolić, Ph.D., Full Professor Niko Ištuk, Teaching Assistant
FELJ33	Antennas	Antonio Šarolić, Ph.D., Full Professor Niko Ištuk, Teaching Assistant
FENj01	Application of analytical methods in electromagnetic compatibility	Silvestar Šesnić, Ph.D., Assistant Professor
FELH11	Artificial intelligence	Darko Stipaničev, Ph.D., Full Professor Ljiljana Šerić, Ph.D., Assistant Professor Toni Jakovčević, Ph.D., Assistant Professor
FELJ24	Bioelectromagnetics	Antonio Šarolić, Ph.D., Full Professor Niko Ištuk, Teaching Assistant
FELK10	Cryptography and network security	Mario Čagalj, Ph.D., Full Professor Toni Perković, Ph.D., Assistant Professor
FELK13	Data compression	Matko Šarić, Ph.D., Assistant Professor Ante Topić, Teaching Assistant
FELJ01	Digital telecommunications	Joško Radić, Ph.D., Associate Professor Petar Šolić, Ph.D., Assistant Professor

FELH33	Digital television and video	Mladen Russo, Ph.D., Assistant Professor Nikola Rožić, Ph.D., Professor Emeritus
FELH32	Electroacoustics	Ivo Mateljan, Ph.D., Full Professor
FELH25	Electromagnetic compatibility	Dragan Poljak. Ph.D., Full Professor Antonio Šarolić, Ph.D., Full Professor Niko Ištuk, Teaching Assistant
FELJ26	Electromagnetic ecology and dosimetry	Dragan Poljak, Ph.D., Full Professor Anna Šušnjara, Teaching Assistant
FELH03	Electromagnetic waves	Dragan Poljak, Ph.D., Full Professor Anna Šušnjara, Teaching Assistant
FEMJ02	Information and technology physics	Nikola Godinović, Ph.D., Associate Professor Dunja Polić, Darko Zarić, Toni Vrdoljak
FELJ19	Information systems	Mladen Russo; Ph.D., Assistant Professor
FELJ11	IP Communications	Mladen Russo, Ph.D., Assistant Professor
FELH30	Local and access networks	Josip Lörincz, Ph.D., Assistant Professor Dinko Begušić, Ph.D., Full Professor
FELJ30	Maritime radiocommunications	Antonio Šarolić, Ph.D., Full Professor Niko Ištuk, Teaching Assistant
FELJ22	Measurements in wireless systems	Zoran Blažević, Ph.D., Full Professor Maja Škiljo, Ph.D.
FELJ34	Microwave electronics	Ivan Marinović, Ph.D., Full Professor
FELJ27	Microwave solid-state circuits	Ivan Marinović, Ph.D., Full Professor
FELJ14	Mobile communications	Zoran Blažević, Ph.D., Full Professor Maja Škiljo, Ph.D.
FELJ20	Multimedia systems	Mladen Russo, Ph.D., Assistant Professor Jelena Čulić, Teaching Assistant Martina Bašić, Teaching Assistant
FELJ35	Network and mobile operating systems	Josip Lörincz, Ph.D., Assistant professor Dinko Begušić, Ph.D., Full Professor Ante Dagelć, Teaching Assistant
FELJ17	Numerical methods in communications	Dragan Poljak, Ph.D., Full Professor Vicko Dorić, Ph.D., Associate Professor Anna Šušnjara, Teaching Assistant
FELJ13	Operating systems	Sven Gotovac, Ph.D., Full Professor
FELJ10	Optical communication systems	Dinko Begušić, Ph.D., Full Professor Maja Stella, Ph.D., Assistant Professor Ivica Meštrović, Teaching Assistant Marko Banović, Teaching Assistant Josip Babić, Teaching Assistant
FEXX06	Professional Training	
FETJ01	Project management	Ivica Veža, Ph.D., Full Professor Marko Mladineo, Ph.D.
FELJ28	Radars	Zoran Blažević, Ph.D., Full Professor Maja Škiljo, Ph.D.
FELJ02	Radio communications	Zoran Blažević, Ph.D., Full Professor Maja Škiljo, Ph.D.

FELJ38	Radio frequency identification technology	Joško Radić, Ph.D., Associate Professor Petar Šolić, Ph.D., Assistant Professor
FELJ07	Radiofrequency electronics	Ivan Marinović, Ph.D., Full Professor
FELJ25	Satellite positioning systems	Zoran Blažević, Ph.D., Full Professor Maja Škiljo, Ph.D.
FELJ29	Simulation and measurement of electromagnetic quantities	Dragan Poljak. Ph.D., Full Professor Antonio Šarolić, Ph.D., Full Professor Niko Ištuk, Teaching Assistant
FELJ18	Software engineering in telecommunications	Dinko Begušić, Ph.D., Full Professor Goran Škugor, Teaching Assistant Jelena Mihovilović, Teaching Assistant
FELJ36	Systems for wireless transmission of energy	Zoran Blažević, Ph.D., Full Professor Maja Škiljo, Ph.D.
FELJ03	Transmission systems	Maja Stella, Ph.D., Assistant Professor Dinko Begušić, Ph.D., Full Professor
FELJ09	Wireless communication networks	Dinko Begušić, Ph.D., Full Professor Maja Stella, Ph.D., Assistant Professor Marina Rajič, Teaching Assistant Josip Žilić, Teaching Assistant Ante Dagelić, Teaching Assistant
FELK19	Wireless security	Mario Čagalj, Ph.D., Full Professor Toni Perković, Ph.D., Assistant Professor
FEXX02	Diploma thesis	

3.3. Curriculum vitae of the course teacher

First and last name and title of teacher	**Dinko Begušić, Ph.D., Full Professor**
The course he/she teaches in the proposed study programme	Network and mobile operation systems Optical communication systems Software engineering in telecommunications Transmission systems Wireless communication networks
GENERAL INFORMATION ON COURSE TEACHER	
Address	Trondheimska 4d, Split
Telephone number	021305637
E-mail address	begusic@fesb.hr
Personal web page	www.fesb.hr/~begusic
Year of birth	1960.
Scientist ID	129685
Research or art rank, and date of last rank appointment	Scientific advisor, scientific field of electrical engineering Scientific advisor, scientific field of computing
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Full professor, permanent position (date of election Spetember 11, 2008)
Area and field of election into research or art rank	Scientific area of technical sciences, scientific field of electrical engineering Scientific area of technical sciences, scientific field of computing
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	University of Split, Faculty of electrical engineering, mechanical engineering and naval architecture
Date of employment	1985.
Name of position (professor, researcher, associate teacher, etc.)	Full professor, permanent position
Field of research	Information and communication technology, Telecommunications and informatics, Information processing, Networking technologies, Digital signal processing
Function	Chair of communication technologies and signal processing
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	University of Zagreb, Faculty of electrical engineering and computing
Place	Zagreb
Date	1992.
INFORMATION ON ADDITIONAL TRAINING	
Year	1990.
Place	Bruxelles, Belgija

Institution	Universite Libre de Bruxelles
Field of training	Telecommunications and informatics, Digital signal processing
Year	1992.
Place	London
Institution	King's College London
Field of training	Telecommunications and informatics, Digital signal processing
Year	1998.
Place	Dallas, SAD
Institution	University of Texas at Dallas
Field of training	Telecommunications and informatics, Digital signal processing
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)	Wireless communication networks, Optical communication systems, Transmission systems, Software engineering in telecommunications, (master study of electrical engineering)
Authorship of university/faculty textbooks in the field of the course	D.Begušić: " Wireless communication networks ", handouts, 2016. D.Begušić: "Optical communication systems ", handouts, 2016. D.Begušić: " Programsko inženjerstvo u telekomunikacijama", nastavni tekst, 2016. N.Rožić, D.Begušić, M.Vrdoljak, W.Afrić:"New communication technologies ", ISBN 953-6114-20-8, FESB Split - HT-TKC Split, pp. 416, Split, 1999.
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	T.Perković, M.Čagalj, T.Mastelić,N.Saxena, D.Begušić: “Secure Initialization of Multiple Constrained Wireless Devices for an Unaided User“, IEEE Transactions on Mobile Computing (1536-1233) 11 (2012), 2; pp.337-351 M. Stella, M. Russo, D. Begušić: “RF Localization in Indoor Environment“, Radioengineering, Special issue on advanced RF measurements (ISSN 1210-2512), Vol 21, No. 2, 2012, pp. 557-567 Josip Lorincz, Antonio Capone, Dinko Begušić, “Optimized Network Management for Energy Savings of Wireless Access Networks”, Computer Networks Journal (ISSN: 1389-1286), svezak 55, broj 3, February 2011, str.: 626-648 D.Begušić, N.Rožić, H.Dujmić: "Development of the communication/information infrastructure at the academic institution", Computer Communications, Elsevier, ISSN 0140-3664, No.26, pp. 472-476, 2003. M.Vojnovic, N.Rozic, D.Begusic, J.Ursic, H.Dujmic: "Multimedia Dictionary Network Application: Design and

	Implementation", IEEE Communications Magazine, ISSN 0163-6804, Vol.38 No.2, pp.130-137, February 2000.
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	T.Kilić, I.Puljak, D.Begušić: "*Studying electrical engineering and information technology at the University of Split, Croatia*", International Journal of Electrical Engineering Education, Manchester University Press, ISSN 0020-7209, Vol. 44, No. 2; pp.175-183, Manchester, UK, 2007. D.Begušić, B.Bilić, T.Kilić, I.Puljak:"*Bolonjski proces na Fakultetu elektrotehnike, strojarstva i brodogradnje u Splitu*", Zbornik sažetaka Obrazovanje inženjera Bolonjski proces 3 godine kasnije, Hrvatska akademija tehničkih znanosti, pp.38-39, Zagreb, 2007.
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	Advanced networking technologies and systems, project FESB Advanced heterogeneous networking technologies, project MZOS Collaborative internationalization of software engineering in Croatia j, project TEMPUS Research in the area fo telecommunications, joint project FESB - Ericsson Nikola Tesla International conference on Software, Telecommunications and Computer Networks SoftCOM Journal of Communications Software and Systems
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	Member of Croatian academy of engineering, Department of Information systems
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	**Zoran Blažević, Ph.D., Full Professor**
The course he/she teaches in the proposed study programme	Measurements in Wireless Systems Mobile Communications Radars Radio Communications Satellite Positioning Systems Systems for Wireless Transmission of Energy
GENERAL INFORMATION ON COURSE TEACHER	
Address	Tolstojeva 47, 21000 Split, HR
Telephone number	+385 21 305676
E-mail address	zblaz@fesb.hr
Personal web page	
Year of birth	1968
Scientist ID	238956
Research or art rank, and date of last rank appointment	Scientific Adviser, 20/06/2016
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Senior Full Professor, 16/07/2016
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	14/02/2006
Name of position (professor, researcher, associate teacher, etc.)	Professor
Field of research	Radio-channel modelling, antennas, microwaves
Function	
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Place	Split
Date	30/05/2005
INFORMATION ON ADDITIONAL TRAINING	
Year	
Place	
Institution	
Field of training	
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English (4)
Foreign language and command of foreign language on a scale from 2	

(sufficient) to 5 (excellent)	
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. Šolić, Petar; Blažević, Zoran; Škiljo, Maja; Patrono, Luigi. 2. Impact of Tag Responsiveness on Gen2 RFID Throughput. // IEEE communications letters. 20 (2016) , 11; 2181-2184 3. Šolić, Petar; Maras, Josip; Radić, Joško; Blažević, Zoran. 4. Comparing Theoretical and Experimental Results in Gen2 RFID Throughput. // Ieee transactions on automation science and engineering. 14 (2016) , 1; 349-357 5. Škiljo, Maja; Blažević, Zoran. 6. Spherical helices for resonant wireless power transfer. // International Journal of Antennas and Propagation. 2013 (2013) ; 426574-1-426574-12 7. Škiljo, Maja; Blažević, Zoran; Poljak, Dragan. 8. Interaction Between Human and Near Field of Wireless Power Transfer System. // Progress In Electromagnetics Research C. 67 (2016) ; 1-10 9. Blažević, Zoran; Škiljo, Maja; Poljak, Dragan. 10. Comparison of Generalized Telegrapher Equations Approach and Circuit Model for Wireless Power Transfer // Proceedings of Softcom 2016 Split, 2016. 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)	1. Propagation factors in radio-networks planning, project MZOS 023-0361566-1613, 2007-2013
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	**Mario Čagalj, Ph.D., Full Professor**
The course he/she teaches in the proposed study programme	Cryptography and network security Wireless security
GENERAL INFORMATION ON COURSE TEACHER	
Address	B. Kašića 18, 21312 Podstrana
Telephone number	021 305 663 (posao)
E-mail address	mario.cagalj@fesb.hr
Personal web page	http://www.fesb.hr/~mcagalj/
Year of birth	10.12.1975.
Scientist ID	282821
Research or art rank, and date of last rank appointment	Scientific Adviser, 2016
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Full Professor, 2016
Area and field of election into research or art rank	Technical Sciences, Computer Science and Computing
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	FESB
Date of employment	2006
Name of position (professor, researcher, associate teacher, etc.)	Professor
Field of research	Information security, applied cryptography, computer and communication networks
Function	-
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Swiss Federal Institute of Technology Lausanne (EPFL)
Place	Lausanne, Switzerland
Date	16.01.2006.
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 (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	1. Cryptography and Network Security, (FELK10, 250), graduate study, FESB 2. Wireless Security (FELK19, 250), graduate study, FESB

of study programme)	
Authorship of university/faculty textbooks in the field of the course	Notes for laboratory exercises for the course „Cryptography and Network Security“
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1. Čagalj, Mario; Perković, Toni; Bugarić, Marin. **Timing Attacks on Cognitive Authentication Schemes**. // *IEEE transactions on information forensics and security*. **10** (2015) , 3; 584-596 (članak, znanstveni). 2. Čagalj, Mario; Perković, Toni; Bugarić, Marin; Li, Shujun. **Fortune cookies and smartphones: Weakly unrelayable channels to counter relay attacks**. // *Pervasive and Mobile Computing*. **20** (2015) ; 64-81 (članak, znanstveni). 3. Kovačević, Tonko; Perković, Toni; Čagalj, Mario. **Flashing displays : User-friendly solution for bootstrapping secure associations between multiple constrained wireless devices**. // *Security and Communication Networks*. **9** (2015) , 10; 1050-1071 (članak, znanstveni). 4. Perković, Toni; Čagalj, Mario; Mastelić, Toni; Saxena, Nitesh; Begušić, Dinko. **Secure Initialization of Multiple Constrained Wireless Devices for an Unaided User**. // *IEEE transactions on mobile computing*. **11** (2012) , 2; 337-351 (članak, znanstveni). 5. Perković, Toni; Bugarić, Marin; Čagalj, Mario. **Optimizing Decision Tree Attack on CAS Scheme**. // *Advances in Electrical and Computer Engineering*. **16** (2016) , 2; 69-74 (članak, znanstveni).
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	1. EU FP7 projekt „EPISECC: Establish Pan-European Information Space to Enhance Security of Citizens“ (2014 - 2017) 2. Stručni projekt s Ericsson Nikola Tesla dd, „Zaštitni mehanizmi u novoj generaciji M2M sustava (N-M2M-Sec)“, (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)	

First and last name and title of teacher	**Vicko Dorić, Ph.D., Associate Professor**
The course he/she teaches in the proposed study programme	Numerical methods in communications
GENERAL INFORMATION ON COURSE TEACHER	
Address	Matoševa 1, Split
Telephone number	021305694
E-mail address	vdoric@fesb.hr
Personal web page	https://nastava.fesb.hr/nastava/nastavnici/detalji/vdoric
Year of birth	1974.
Scientist ID	248744
Research or art rank, and date of last rank appointment	higher scientific collaborator, February 2013.
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Associate Professor, September 2016.
Area and field of election into research or art rank	Technical sciences, Electrical Engineering, Radio communications
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Date of employment	20.01.2001.
Name of position (professor, researcher, associate teacher, etc.)	Associate Professor
Field of research	Technical sciences
Function	ERASMUS coordinator
INFORMATION ON EDUCATION – Highest degree earned	
Degree	Phd
Institution	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Place	Split
Date	02.02.2009.
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)	
Authorship of university/faculty textbooks in the field of the course	1. Poljak, D., Dorić, V., Antonijević S.: Modeliranje žičanih antena primjenom računala, Kigen, Zagreb, 2009. 2. D.Poljak N.Kovač, V. Dorić, Numeričke metode u elektrotehnici – interna skripta, FESB-Split 2006.
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1. D.Čavka, D. Poljak, V. Dorić, R. Goić, Transient analysis of grounding systems for wind turbines, Renewable energy, 43, 2012 2. D. Poljak, R. Lucić, V. Dorić, S. Antonijević, Frequency domain boundary element versus time domain finite element model for the transient analysis of horizontal grounding electrode, Engineering analysis with boundary elements, 35, 3, 2011 3. D. Poljak, V. Dorić, D. Čavka, On the use of isoparametric elements for BEM modeling of arbitrarily shaped thin wires in electromagnetic compatibility applications, Boundary Elements and other Mesh Reduction Methods XXXIV, 2012. 4. D. Čavka, D. Poljak, V. Dorić, S. Antonijević, Some Computational Aspects of Using Current and Voltage Sources in Electromagnetic Models of Lightning Return Strokes, ICLP 2012, CONFERENCE PROCEEDINGS, 2012. 5. V. Dorić, D. Poljak, K. El Kamichi Drissi, Human Exposure to Outdoor PLC System, PIERS 2011 Marrakesh Progress In Electromagnetics Research Symposium, 2011.
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)	EUROfusion – Code Development for Integrated Modelling 2014.- Electromagnetic Interference (EMI) Study of Power Line Communications (PLC) Services 2011.-2012.
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?	
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	

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

Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	Italian 4
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	German 2
COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	Nuclear physcis, Experimtnal Methods of Moderan Physics, graduate program, University of Split, Fcaulty of Scince.
Authorship of university/faculty textbooks in the field of the course	Faculty text book*:* *Instructions for laboratory exercises in Physics 1* *Instructions for laboratory exercises in Physics 1*
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1. *Teraelectronvolt pulsed emission from the Crab Pulsar detected by MAGIC,* MAGIC Collaboration, Ansoldi, S.; et al., . (Authors: MAGIC collaboration), Astronomy and Astrophysics 585, Article Number: A133 (2016) IF: 4.479. 2. *The major upgrade of the MAGIC telescopes, Part I: The hardware improvements and the commissioning of the system*, (Authors: MAGIC Collaboration,) Astroparticle Physics 72, pages: 61-75 (2016) IF: 3.584. 3. *The major upgrade of the MAGIC telescopes, Part II: A performance study using observations of the Crab Nebula*, (Authors: MAGIC Collaboration), Astroparticle Physics 72, pages: 76-94 (2016) IF: 3.584. 4. *Measurement of the properties of a Higgs boson in the four-lepton final state*, By: Chatrchyan, S.; Khachatryan, V.; Sirunyan, A. M.; et al., Group Author(s): CMS Collaboration, Physical Review D 89, Issue: 9, Article Number: 092007 (2014) IF: 4.506 5. *Study of the Mass and Spin-Parity of the Higgs Boson Candidate via Its Decays to Z Boson Pairs*, S. Chatrchyan et al. (CMS Collaboration), Physical Review Letters 110, 081803 – Published 21 February 2013; Erratum Phys. Rev. Lett. 110, 189901 (2013). IF: 7.512.
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	None
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	***HRZZ Research Projects* (IP-11-2013)**, Croatian Sicnece Foundation zaklada za znanost (1.10.2014. god. – 30.9.2018. god.). ***HRZZ Research Projects* (Very high energy gamma ray astronomy with the MAGIC telescopes)**, Croatian Sic nece Foundation zaklada za znanost (1.7.2012. god. – 31.12.2016.).
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?	

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

First and last name and title of teacher	**Sven Gotovac, Ph.D., Full Professor**
The course he/she teaches in the proposed study programme	Operating systems
GENERAL INFORMATION ON COURSE TEACHER	
Address	Đorđićeva 5, 21000 Split
Telephone number	+385 21 305850
E-mail address	sven.gotovac@fesb.hr
Personal web page	www.fesb.hr
Year of birth	1960
Scientist ID	108173
Research or art rank, and date of last rank appointment	Scientific Adviser/2004.
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Senior Full Professor/2009.
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	December, 1983
Name of position (professor, researcher, associate teacher, etc.)	Professor
Field of research	Computer architecture, Implementation of Computer Vison Algorithms on Advanced Computer Architecture.
Function	Head of Chair of Computer Architecture and Operating Systems, Dean of Faculty
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Tehnical University Berlin, Germany
Place	Berlin, Germany
Date	24.5.1994.
INFORMATION ON ADDITIONAL TRAINING	
Year	From 2004.
Place	CERN, Genève, Switzerland
Institution	Genève, Switzerland
Field of training	Distributed Computer Architecture
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 4
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)	Digital circuits Impulse electronics

Authorship of university/faculty textbooks in the field of the course	Elektronički sklopovi, P.Slapničar, S. Gotovac, FESB, Split 2000. Osnovni elektronicki poluvodički elementi, I. Zulim, S. Gotovac., FESB, Split 1998.
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1. Vicković, Tomislav. Razvoj i realizacija digitalnog uređaja za mjerenje jakosti treperenja napona/znanstveni magistarski rad. Split : Fakultet elektrotehnike, strojarstva i brodogradnje, 08.11. 2010, 161 str. Voditelj: Gotovac, Sven. 2. Vicković, Linda; Mudnić, Eugen; Gotovac, Sven. Parity information placement in the disk array model. //COMPEL: The International Journal for Computation and Mathematics in Electrical and Electronic Engineering. 28 (2009) , 6; 1428-1441
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. ALICE experiment CERN, Modelling of the distributed computing system for storage and retrieval of mass data for high energy physics. – HPC Systems. International scientific project since 2004. 2. Computing system of the University of Mostar.
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	Special award for the development of the University of Mostar Award for Scientific Achievements from University of Split
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	**Josip Lörincz, Ph.D., Assistant Professor**
The course he/she teaches in the proposed study programme	Local and access networks Network and mobile operating systems
GENERAL INFORMATION ON COURSE TEACHER	
Address	FESB, R. Boškovića 32, 21000 Split, Croatia
Telephone number	0914305665
E-mail address	josip.lerinc@fesb.hr
Personal web page	http://www.josip-lorincz.com
Year of birth	1978.
Scientist ID	272921
Research or art rank, and date of last rank appointment	Scientific advisor, February 2013.
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Assistant professor (docent), December 2011.
Area and field of election into research or art rank	Area: electrical engineering, field: telecommunications and informatics
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of electrical engineering, mechanical engineering and naval architecture (FESB), University of Split
Date of employment	October 1, 2003.
Name of position (professor, researcher, associate teacher, etc.)	Assistant professor
Field of research	• Information and communication technologies, • Computing, • Electrical engineering, • Telecommunications and informatics, • Energy-efficient networking and computing, • Optimization in telecommunications.
Function	Faculty teacher and research scientist
INFORMATION ON EDUCATION – Highest degree earned	
Degree	Ph. D. in electrical engineering, University of Split, FESB-Split, 2010
Institution	Faculty of electrical engineering, mechanical engineering and naval architecture (FESB), University of Split
Place	Split, Croatia
Date	June 2010.
INFORMATION ON ADDITIONAL TRAINING	
Year	2009-2010
Place	Milano, Italy
Institution	Politecnico di Milano
Field of training	Doctoral research visit
Year	2003, 2009

Place	Split and Zagreb, Croatia
Institution	Croatian academic and research network (CARNet):
Field of training	Professional specialisation for instructor of international CCNA (Cisco Certified Network Associate) i CCNP (Cisco Certified Network Professional) 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 - Excellent (5)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	Italian – sufficient (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)	**Introduction of new curriculum:** • Introduction of new course on graduate study: Network and mobile operating systems, Ships local computer networks • Introduction of completely new laboratory exercises for next courses on graduate study: Network and mobile operating systems, Local and access networks, Ships local computer networks • Extension of existing laboratory exercises with new content for next courses on graduate study: Wireless communication networks, IP communications, Engineering graphics and presentation **Establishment and organization of new faculty laboratories:** • Participation in establishment and development of new Laboratory for network technologies of Cathedra of communication technologies and signal processing on FESB, University of Split.
Authorship of university/faculty textbooks in the field of the course	**Authorship of internal teaching materials:** • Internal script: Network and mobile operating systems • Internal script: Local and access networks • Internal script: Ships local computer networks • Internal script: Ships local computer networks **Authorship of internal laboratory exercise manuals:** • Manual for laboratory exercise: Network and mobile operating systems • Manual for laboratory exercise: Wireless communication networks • Manual for laboratory exercise: Local and access networks • Manual for laboratory exercise: Engineering graphics and presentation
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	**Scientific Monography (book):** Josip Lorincz, **„***Optimizing energy consumption of wireless access networks”*, Lambert Academic Publishing, Germany, 2012, str. 210

	Scientific papers published in international scientific journals: 1. Chiaraviglio, Luca; Cuomo, Francesca; Maisto, Maurizio; Gigli, Andrea; Lorincz, Josip; Zhou, Yifan; Zhao, Zhifeng; Qi, Chen; Zhang, Honggang, Which is the Best Spatial Distribution to Model Base Station Density? A Deep Dive in Two European Mobile Networks, *IEEE Access*, Vol.: 4 (2016) , p.p. 1434-1443 2. J. Lorincz, L. Chiaraviglio, F. Cuomo, A Measurement Study of Short-time Cell Outages in Mobile Cellular Networks, Computer communications, Vol.: **79** (2016), p.p.: 92-102 3. L. Chiaraviglio, P. Wiatr, P. Monti, J. Chen, J. Lorincz, F. Idzikowski, M. Listanti, L. Wosinska, „*Is Green Networking Beneficial in Terms of Device Lifetime?“,* IEEE Communications Magazine, Volume: 53, Issue: 5, 2015, p.p.: 232-240 4. J. Lorincz, I. Bule, M. Kapov, *„Performance Analyses of Renewable and Fuel Power Supply Systems for Different Base Station Sites”*, Energies journal, Volume: 7 Issue:12, 2014, p.p.: 7816 – 7846 5. J. Lorincz, T. Matijevic, G. Petrovic, "*On interdependence among transmit and consumed power of macro base station technologies",* Computer communications (ISSN: 0140-3664), Volume (issue): 50 (2014), p.p.: 10-28 6. J. Lorincz, T. Matijevic, "*Energy-efficiency analyses of heterogeneous macro and micro base station sites*", Computers and Electrical Engineering (ISSN: 0045-7906), Volume: 40, Issue: 2, 2014, p.p.: 330-349 7. J. Lorincz, I. Cubic, T. Matijevic, „*Adaptive and Resilient Solutions for Energy Savings of Mobile Access Networks*“, International Journal of Adaptive, Resilient and Autonomic Systems (IJARAS), Svezak: 5, Broj: 3, 2014, p.p.: 82-102 8. J. Lorincz, Energy-efficient wireless cellular communications through network resource dynamic adaptation, International Journal of Business Data Communications and Netwrking (IJBDCN), Svezak: 9, broj: 2, 2013, p.p.: 1-14 9. J. Lorincz, I. Bule, „Renewable energy sources for power supply of base station sites“, International Journal of Business Data Communications and Netwrking (IJBDCN), Svezak: 9, broj: 3, 2013, p.p.: 53-74 10. J. Lorincz, A. Capone, D. Begusic, "*Impact of service rates and base station switching granularity on energy consumption of cellular networks*", EURASIP Journal on Wireless Communications and Networking (ISSN: 1687-1499), Volume (issue): 2012 (342), 2012, p.p.: 1-24 11. J. Lorincz, T. Garma, G. Petrovic, "*Measurements and Modelling of Base Station Power Consumption under Real Traffic Loads*", Sensors Journal (ISSN: 1424-8220), Volume 12, Issue: 4, travanj 2012, p.p.: 4281-4310. 12. J. Lorincz, A. Capone, D. Begušić, “*Heuristic Algorithms for Optimization of Energy Consumption in Wireless Access Networks*”, KSII Transactions on Internet and Information Systems (ISSN: 1976-7277), Volume: 5, Issue: 5, 2011., p.p.: 514-540 13. Lorincz, A. Capone, D. Begušić, “*Optimized Network Management for Energy Savings of Wireless Access Networks”,* Computer Networks Journal (ISSN: 1389-1286), Volume: 55, Issue: 2011, p.p.: 626-648

	Scientific papers published on international scientific conferences with international review: 1. Luca Chiaraviglio, Josip Lorincz, Paolo Monti, „Towards Luca Chiaraviglio, Marco Listanti, Josip Lorincz, Edoardo Manzia, Martina Santucci, „Modelling the Impact of Power State Transitions on the Lifetime of Cellular Networks“, Proceedings of the 2015 IEEE 82nd Vehicular Technology Conference – Fall (IEEE VTC2015-Fall), 06.-09.09.2015, Boston, SAD, p.p.: 1-5 (ISSN: 978-1-4799-8090-1) 2. Luca Chiaraviglio, Josip Lorincz, Paolo Monti, „Towards Sustainable and Reliable Networks with LIFETEL“, Proceedings of the IEEE Conference on Computer Communications - INFOCOM 2015, 26.4.-1.5.2015, Hong Kong, China, p.p.: 39-40, (ISSN: 978-1-4673-7131-5) 3. Lorincz Josip, Mujaric Eldis, Begusic Dinko, „Energy consumption analysis of real metro-optical network“, Proceedings of the 38th International Conference on Information and Communication Technologies, Electronics and Microelectronics (MIPRO2015), 25.-29.5.2015., Opatija, Croatia, p.p.: 621-626., (ISSN: 978-953-233-083-0) 4. L. Chiaraviglio, P. Wiatr, P. Monti, J. Chen, L Wosinska, L. Lorincz, F. Idzikowski, M. Listanti, „Impact of Energy-Efficient Techniques on a Device Lifetime“, Proceedings of the IEEE Online Conference on Green Communications (GreenCom 2014), 12. – 14.11.2014., On-line conference, p.p.: 1-6. 5. Luca Chiaraviglio, Josip Lorincz, “The Impact of Sleep Modes on the Lifetime of Cellular Networks“, The 22nd International Conference on Software, Telecommunications and Computer Networks (SoftCOM 2014), Proceedings of the 22nd International Conference on Software, Telecommunications and Computer Networks (SoftCOM 2014), 17-19. 9. 2014, Split, Croatia, p.p.: 1-5, (ISSN: 978-953-290-051-4)7 6. Luca Chiaraviglio, Antonio Cianfrani, Angelo Coiro, Marco Listanti, Josip Lorincz, Marco Polverini, “Increasing Device Lifetime in Backbone Networks with Sleep Modes”, The 21st International Conference on Software, Telecommunications and Computer Networks (SoftCOM 2013), 18.-20.09.2013, Primošten, Croatia, Proceedings of the 21st International Conference on Software, Telecommunications and Computer Networks (SoftCOM 2013), p.p.: 1-6, (ISSN: 978-953-290-041-5)
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	**Book:** 1. Domagoj Babić, Zvonimir Rakamarić, Josip Lorincz, „A guide for postgraduate study in foreign countries”, P.O.I.N.T. Križevci, Croatia, 2012, p.p.: 100
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	Participation in international scientific projects as project coordinator: • Green networking (HZZ- Croatian Science Foundation) • Doctoral research visit on green networking project (UKF – Unity Through Knowledge Fund)) Participation in international scientific projects as project researcher: • Establish Pan-European Information Space to Enhance seCurity of Citizens – EPISECC (EU FP7: Work

<table>
<tr><td></td><td>programme 2013, Cooperation, Theme 10: Security)
• Increasing the LIFEtime of TELecommunication networks (LIFETEL) – University of Rome (La Sapienza)

Participation in domestic education projects as project participant:
• Modernising doctoral education through implementation of Croatian qualification framework (MODOC) – EU IPA program BGUE 04 06, Human resources development</td></tr>
<tr><td>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?</td><td>In the frame of the programme:
• Modernising doctoral education through implementation of Croatian qualification framework (MODOC) – EU IPA program BGUE 04 06, Human resources development
Participation in workshop dedicated to the development of methodological-psychological-didactic-pedagogical competences.</td></tr>
<tr><td colspan="2">PRIZES AND AWARDS, STUDENT EVALUATION</td></tr>
<tr><td>Prizes and awards for teaching and scholarly/artistic work</td><td>• Yearly award of Okrug County for scientific/research work and promotion of science in 2013.
• Award of Faculty of electrical engineering, mechanical engineering and naval architecture (FESB) for the notable scientific and research results in 2013.
• Award „Vera Johanides“ for 2012. of Croatian Academy of engineering (Academia Scientiarum Tehnicarum Croatica)
• Award of Faculty of electrical engineering, mechanical engineering and naval architecture (FESB) to the most successful scientific novices in 2011.</td></tr>
<tr><td>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)</td><td>Evaluation organizer: University of Split, Faculty of electrical engineering, mechanical engineering and naval architecture (FESB).
Note on grading scale: global index evaluating overall course on scale 1-5
<table>
<tr><td>Course/average grade</td><td>Global index
2011/12</td><td>Global index
2012/13</td><td>Global index
2013/14</td><td>Global index
2014/15</td><td>Global index
2015/16</td></tr>
<tr><td>Network and mobile operating systems</td><td>4,3</td><td>3,3</td><td>3,9</td><td>4,5</td><td>4,1</td></tr>
<tr><td>Local and access networks</td><td>4,8</td><td>4,4</td><td>4,00</td><td>4,2</td><td>/</td></tr>
<tr><td>Electrotechnical materials and technologies</td><td>4,7</td><td>/</td><td>4,6</td><td>/</td><td>4,5</td></tr>
</table></td></tr>
</table>

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

(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)	Microwave electronics, Graduate study programme, Radiocommunications, Graduate 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. I. Marinović, D. Čoko, Inter-Floor Wide Band Radio Channel Measurements and Simulation Applying Saleh-Valenzuela Model, Automatika – Journal for Control, Measurement, Electronics, Computing and Communications, 61(2015), 1, 91-99. 2. D. Čoko, I. Marinović, Experimental Verification of a Deterministic UWB Channel Model for Single Room Propagation Scenarios, International journal on communications, antennas and propagation, 4 (2014) , 2, 37-43. 3. D. Čoko, Z. Blažević, Ivan Marinović, Effects of Bandwidth on Estimation of UWB Channel Parameters, Ultra Wideband Communications: Novel Trends - Antennas and Propagation, Mohammad A. Matin (ur.), Rijeka: InTech, 2011., 97-116. 4. I. Marinović, I. Zanchi, Z. Blažević, Enhanced Procedure for Double Knife-Edge Diffraction Path-Loss Assessment, International Review of Electrical Engineering, 5 (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)	
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences	
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	4.8

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

study programme)	
Authorship of university/faculty textbooks in the field of the course	Ivo Mateljan: Programiranje jezikom C, book published by University of Split, 2010. Ivo Mateljan: Electronic and Virtual Instrumentation, FESB, internal script,, 2004
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1. Sikora, Marjan; Mateljan, Ivo.: A Method for Speeding up Beam-tracing Simulation Using Thread-level Parallelization. // *Engineering with computers*. **30,** 2014. 2. Sikora M., Mateljan I., Bogunovic, N.: *Beam Tracing with Refraction,* Archives of Acoustics Vol.37, 2012. 3. Mateljan I., Sikora M.: *Estimation of loudspeaker drivers parameters*, Proc. of 5th Congress of the Alps Adria Acoustics Association Zadar, 2012. 4. Slamka M., Mateljan I., Howes M.: Virtual Surround for Headphones and Earbuds Headphone Externalization System, US patent 8270616, US class: 381/17; 381/1; 381/309, Assignee: Logitech Europe S.A., Sept. 18,2012.
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	Ivo Mateljan: ARTA software, Artalabs, 2004-2017.
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?-pedagoške kompetencije?	
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	4.6/5

First and last name and title of teacher	**Dragan Poljak, Ph.D., Full Professor**
The course he/she teaches in the proposed study programme	Analysis methods in fusion technology Electromagnetic Compatibility Electromagnetic Ecology and Dosimetry Electromagnetic Waves Numerical Methods in Communications Simulation and measurement of electromagnetic quantities
GENERAL INFORMATION ON COURSE TEACHER	
Address	Vinka Milića 88, Split
Telephone number	0914305698
E-mail address	dragan.poljak @fesb.hr
Personal web page	
Year of birth	1965
Scientist ID	180803
Research or art rank, and date of last rank appointment	Scientific Adviser, 2005.
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Senior Full Professor, 2010.
Area and field of election into research or art rank	Technical Sciences, Area Electronics
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Date of employment	September 1990.
Name of position (professor, researcher, associate teacher, etc.)	Professor
Field of research	Classical electromagnetiism, Numerical methods in electromagnetics, Electromagnetic compatibility, Bioelectromagnetics, Magnetohydrodynamics
Function	Head of Group for Electriomagnetic Compatibility and Numerical Methods in Electronics
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Place	Split
Date	9/30/1996
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 (4)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	French (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)	Fundamentals of Electrical Engineering I and II, (Undergraduate study programme), Electromagnetic Waves, Fields and Waves in Electronics, Numerical Methods in Communications, Electromagnetic Ecology and Dosimetry, Electromagnetic Compatibility (Graduate study programme)
Authorship of university/faculty textbooks in the field of the course	1. D.Poljak, *Teorija elektromagnetskih polja s primjenama u inženjerstvu*, Šk. knjiga Zagreb, 2014. 2. D.Poljak i dr., *Modeliranje žičanih antena primjenom računala*, Kigen Zagreb 2009. 3. D. Poljak, *Advanced Modeling in Computational Electromagnetic compatibility*, Wiley Interscience, New York 2007.
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1. Poljak, Dragan; Antonijević, Siniša; Šesnić, Silvestar; Lallechere, S.; El Khamlichi Drissi, K., On deterministic-stochastic time domain study of dipole antenna for GPR applications. // *Engineering analysis with boundary elements*. 73 (2016) ; 14-20. 2. 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); 3943754-1-3943754-11. 3. Poljak, Dragan; Šesnić, Silvestar; Čavka, 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. 4. Poljak, Dragan; Čavka, Damir; Dodig, Hrvoje; Peratta, Cristina; Peratta, Andres. On the use of the boundary element analysis in bioelectromagnetics. // *Engineering analysis with boundary elements*. 49 (2014) ; 2-14. 5. Antonijevic, Sinisa; Poljak, Dragan. A Novel Time-Domain Reflection Coefficient Function: TM Case. // *IEEE transactions on electromagnetic compatibility*. 55 (2013) , 6; 1147-1153.
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)	• ICES SC6 The IEEE International Committee on Electromagnetic Safety (ICES, Tecnical Committee 95), Subcommittee SC6 on Electromagnetic Field Dosimetry • COST Action BM1309: European network for innovative

	uses of EMFs in biomedical applications • COST Action TU1208: Civil Engineering Applications of Ground Penetrating Radar • COST ACTION IC 1407: Advanced characterisation and classification of radiated emissions in densely integrated technologies (ACCREDIT) • ITER Physics, EUROFusion, WPCD (Code development for Integrated Modeling)
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	Young scientist URSi Award, Toronto, Canada, 1999. National Prize for Science, Zagreb 2004. Annual FESB Prize for Science, Split 2004. Slobodne Dalmacija Award for science, Split 2008. Award for science Nikola Tesla (University of Split), Split 2013. Award for science of Croatian IEEE Section, Zagreb 2016. Annual Award for science (University of Split), Split 2017.
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	**Joško Radić, Ph.D:, Associate Professor**
The course he/she teaches in the proposed study programme	Digital Telecommunications Radio frequency identification technology
GENERAL INFORMATION ON COURSE TEACHER	
Address	Put Pašika 5i, 21400 Supetar, HR
Telephone number	+385 21 305634
E-mail address	radic@fesb.hr
Personal web page	
Year of birth	1975.
Scientist ID	248893
Research or art rank, and date of last rank appointment	Senior Research Associate, March 10, 2016.
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Associate professor, March 16, 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	September 1, 2001.
Name of position (professor, researcher, associate teacher, etc.)	Associate professor
Field of research	Information an Communication technology, Digital Signal Processing, Coding Theory
Function	Head of Chair of Communication and Information Technology
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Place	Split
Date	July 15, 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 (3)
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)	Network Analysis, 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 in the field of the course (5 works at most)	14. Šolić, Petar; Radić, Joško; Rožić, Nikola. Energy Efficient Tag Estimation Method for ALOHA-based RFID systems. // IEEE sensors journal. 14 (2014) , 10; 3637-3647. 15. Šolić, Petar; Radić, Joško; Rožić, Nikola. Software Defined Radio Based Implementation of RFID Tag in Next Generation Mobiles. // IEEE transactions on consumer electronics. 58 (2012) , 3; 1051-1055. 16. Rožić, Nikola; Radić, Joško; Begušić, Dinko. Noise Squared Norm in OFDM Systems Interfered by Impulse Noise // 2014 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP 2014) / Greco, Maria . S ; Piva, Alessandro (ur.). Piscataway, NJ, SAD : IEEE, 2014. 404-408. 17. Radić, Joško; Rožić, Nikola. Soft Decision PAPR Reduction in OFDM // 2012 9th International Multi-Conference on Systems, Signals and Devices. Chemnitz, 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)	- Look into the Future. - ICT Systems and Services Based on Information Integration.
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)	4,6/5

First and last name and title of teacher	**Mladen Russo, Ph.D., Assistant Professor**
The course he/she teaches in the proposed study programme	Digital television and video Information systems IP Communications Multimedia systems
GENERAL INFORMATION ON COURSE TEACHER	
Address	Žnjanska 4, Split
Telephone number	091/2305-844
E-mail address	mrusso@fesb.hr
Personal web page	
Year of birth	1977.
Scientist ID	248902
Research or art rank, and date of last rank appointment	Senior scientific associate, 24.10.2013.
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Assistant professor, 01.01.2013.
Area and field of election into research or art rank	Technical sciences, electrical engineering
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	FESB - Split
Date of employment	08.06.2001.
Name of position (professor, researcher, associate teacher, etc.)	Assistant professor
Field of research	Signal processing, speech recognition, localization
Function	
INFORMATION ON EDUCATION – Highest degree earned	
Degree	Ph.D.
Institution	FESB – Split
Place	Split
Date	29.06.2010.
INFORMATION ON ADDITIONAL TRAINING	
Year	
Place	
Institution	
Field of training	
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English, 4
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	Italian, 2

Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	
COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	
Authorship of university/faculty textbooks in the field of the course	
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	Sikora, Marjan; Grčić, Đana; Russo, Mladen. A tool for soundscape auralization of ancient archaeological sites // Proceedings of 7th congress of Alps Adria Acoustic Association Ljubljana, Slovenija, 2016. Russo, Mladen; Stella, Maja; Kurajica, Maroje. Cochlear Model based Enhancement of Noisy Speech Signals. // International Journal of Circuits, Systems and Signal Processing. 9 (2015), 446-454. Stella, Maja; Russo, Mladen; Begušić, Dinko. Fingerprinting based localization in heterogeneous wireless networks // Expert systems with applications, 41 (2014), 15; 6738-6747. Šarić, Matko; Dujmić, Hrvoje; Russo, Mladen. Scene Text Extraction in HSI Color Space using K-means Algorithm and Modified Cylindrical Distance // Przegląd elektrotechniczny, 5 (2013) 117-121. Russo, Mladen; Šolić, Petar; Stella, Maja. Probabilistic Modeling of Harvested GSM Energy and its Application in Extending UHF RFID Tags Reading Range // Journal of electromagnetic waves and applications, 27 (2013), 4; 473-484. Primorac, Sanja; Russo, Mladen. Android Application for Sending SMS Messages with Speech Recognition Interface // Proceedings of the 35th International Convention MIPRO, 2012. Russo, Mladen; Stella, Maja; Rožić, Nikola. Noise reduction in speech signals using a cochlear model. // Advances in Smart Systems Research. 2 (2012), 1; 7-12.
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)	ELISE: Easy Living in Smart Environments, HRZZ, project leader Mladen Russo, Ph.D., 2015. – 2018. Advanced Interface for Simpler Human-Computer Interaction, SDŽ, project leader Mladen Russo, Ph.D., 2015. – 2017. ICT Systems and Services Based on Integration of Information, MZOS, project leader Nikola Rožić, Ph.D., 2007. – 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)	

First and last name and title of teacher	**Maja Stella, Ph.D., Assistant Professor**
The course he/she teaches in the proposed study programme	Transmission systems
GENERAL INFORMATION ON COURSE TEACHER	
Address	Spinčićeva 2D, Split
Telephone number	091/4305 664
E-mail address	mstella@fesb.hr
Personal web page	
Year of birth	1976
Scientist ID	248924
Research or art rank, and date of last rank appointment	Scientific associate, 06.06.2013.
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Assistant professor, 16.09.2014.
Area and field of election into research or art rank	Technical sciences, electrical engineering
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	FESB, Split
Date of employment	25.09.2001.
Name of position (professor, researcher, associate teacher, etc.)	Assistant professor
Field of research	Signal processing, localization, pattern recognition
Function	
INFORMATION ON EDUCATION – Highest degree earned	
Degree	Ph.D.
Institution	FESB
Place	Split
Date	20.05.2011.
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, 4
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	Italian, 2
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	

COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	
Authorship of university/faculty textbooks in the field of the course	
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	Stella, Maja; Russo, Mladen; Begušić, Dinko. Fingerprinting based localization in heterogeneous wireless networks. // Expert systems with applications. 41 (2014) , 15; 6738-6747. Stella, Maja; Russo, Mladen; Šarić, Matko. RBF Network Design for Indoor Positioning Based on WLAN and GSM. // International Journal of Circuits, Systems and Signal Processing. 8 (2014), 116-122. Stella, Maja; Russo, Mladen; Begušić, Dinko. GSM-Based Approach for Indoor Localization // World Academy of Science, Engineering and Technology. 2013. 195-199. Stella, Maja; Russo, Mladen; Begušić, Dinko. RF Localization in Indoor Environment. // Radioengineering. 21 (2012) , 2; 557-567.
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)	ELISE: Easy Living in Smart Environments, HRZZ, project leader Mladen Russo, Ph.D., 2015. – 2018. Advanced Interface for Simpler Human-Computer Interaction, SDŽ, project leader Mladen Russo, Ph.D., 2015. – 2017. Advanced heterogeneous network technologies, MZOS, project leader Dinko Begušić, Ph.D., 2007. – 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)	

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

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

First and last name and title of teacher	**Matko Šarić, Ph.D., Assistant Professor**
The course he/she teaches in the proposed study programme	Algorithms Data compression
GENERAL INFORMATION ON COURSE TEACHER	
Address	Pojišanska 25, 21000 Split
Telephone number	0914305633
E-mail address	msaric@fesb.hr
Personal web page	
Year of birth	1980
Scientist ID	272954
Research or art rank, and date of last rank appointment	Assistant research scientist, 16.6.2011.
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Assistant professor, September 2014.
Area and field of election into research or art rank	Computer science, information processing
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture, University of Split (FESB Split)
Date of employment	1.6.2004.
Name of position (professor, researcher, associate teacher, etc.)	Assistant professor
Field of research	Computer vision
Function	
INFORMATION ON EDUCATION – Highest degree earned	
Degree	Ph.D. in Electrical Engineering and Information Technology, FESB (Split)
Institution	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture, University of Split (FESB Split)
Place	Split
Date	13.10.2010.
INFORMATION ON ADDITIONAL TRAINING	
Year	
Place	
Institution	
Field of training	
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English - 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 is/was offered, and level of study programme)	• Multimedia systems, graduate study of electrical engineering • Algorithms, graduate study • Signals and systems, undergraduate study of electrical engineering and information technology • Algorithms, undergraduate study of computer science
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. Šarić, Matko; Dujmić, Hrvoje; Russo, Mladen. Scene Text Extraction in IHLS Color Space Using Support Vector Machine. // Information Technology And Control. 44 (2015) , 1; 20-29 2. Šarić, Matko; Dujmić, Hrvoje; Russo, Mladen. Scene Text Extraction in HSI Color Space using K-means Algorithm and Modified Cylindrical Distance. // Przegląd elektrotechniczny. 5 (2013) ; 117-121 3. Šarić, Matko; Stella, Maja; Šolić, Petar. Scene Text Extraction using K-means Clustering in HSI Color Space: Influence of Color Distance Measure. // INTERNATIONAL JOURNAL OF CIRCUITS, SYSTEMS AND SIGNAL PROCESSING. 7 (2013) , 5; 294-301 4. Šarić, Matko; Stella, Maja; Šolić, Petar. Extraction of Scene Text in HSI Color Space using K-means Clustering with Chromatic and Intensity Distance // Recent advances in information sciences - Proceeedings of the 5th European conference of compute science (ECCS'13). 2013. 136-141 5. Dujmić, Hrvoje; Šarić, Matko; Radić, Joško. Scene text extraction using modified cylindrical distance // Recent Researches in Neural Networks, Fuzzy Systems, Evolutionary Computing and Automation (Proceedings of 12th WSEAS conference on Automation & Information). Brasov, 2011. 213-218
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)	• MZOŠ project „ICT systems and services based on information integration“ (2007.-2012.) • HRZZ project „ELISE: Easy Living in Smart Environments“ (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?	
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	**Antonio Šarolić, Ph.D., Full Professor**
The course he/she teaches in the proposed study programme	Antennas Antenna systems Electromagnetic compatibility Bioelectromagnetics Maritime radiocommunications Simulation and measurement of electromagnetic quantities
GENERAL INFORMATION ON COURSE TEACHER	
Address	FESB, Ruđera Boškovića 32, 21000 Split
Telephone number	021 305 700
E-mail address	antonio.sarolic@fesb.hr
Personal web page	https://nastava.fesb.hr/nastava/nastavnici/detalji/asarolic
Year of birth	1971.
Scientist ID	223430
Research or art rank, and date of last rank appointment	Scientific Advisor, 2016.
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Full Profesor, 2016.
Area and field of election into research or art rank	Area: Technical Sciences, Field: Electrical Engineering
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Date of employment	1.1.2006.
Name of position (professor, researcher, associate teacher, etc.)	Full Profesor
Field of research	Applied electromagnetics, wireless communications
Function	Head of Chair for Applied Electromagnetic Fields
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	FER, University of Zagreb
Place	Zagreb
Date	2004.
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English, 5
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	Italian, 2

COMPETENCES FOR THE COURSE	
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	Šarolić, Antonio; Modlic, Borivoj. Measurement of Electric Field Probe Response to Modulated Signals Using Waveguide Setup. // IEEE antennas and wireless propagation letters. 9 (2010) ; 1041-1044 Šarolić, Antonio; Senić, Damir; Živković, Zlatko. Radiation Pattern of a Vertical Dipole over Sea and Setup for Measuring thereof. // Automatika. 53 (2012) , 1; 56-68 Šarolić, Antonio; Matić, Petar. Wireless LAN Electromagnetic Field Prediction for Indoor Environment Using Artificial Neural Network. // Automatika. 51 (2010) , 3; 233-240 Živković, Zlatko; Šarolić, Antonio. Measurements of Antenna Parameters in GTEM Cell. // Journal of communications software and systems. 6 (2010) ; 125-132 Senić, Damir; Holloway, Christopher L.; Ladbury, John M.; Koepke, Galen H.; Šarolić, Antonio. Absorption Characteristics and SAR of a Lossy Sphere inside a Reverberation Chamber // Proceedings of EMC Europe 2014 Gothenburg. IEEE, 2014. 962-967
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	**Ongoing projects:** - Chair of EU COST project Action BM1309: "European network for innovative uses of EMFs in biomedical applications", 2014- - EU COST Action IC1102: "Versatile, Integrated, and Signal-aware Technologies for Antennas (VISTA)", Management Committee Member, 2011- **Completed projects:** - Principal investigator of research project MZOŠ RH "Measurements in EMC and EM health effects research", 2008-2013. - Leader of technological project BICRO PoC4_06_23 "Integral system of radiocommunications and vessel surveillance in marinas", 2013-2014. - EU COST Action IC1004: "Cooperative Radio Communications for Green Smart Environments", Management Committee Member, 2011-2015.
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	Student evaluations in academic year 2016/17: - "Wireless communications": average grade 4,7 out of 5 - "Antenna systems": average grade 5 out of 5 - "Electromagnetic compatibility": average grade 4,9 out of 5 - "Simulation and measurement of electromagnetic quantities": average grade 4,8 out of 5

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

Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	
COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	1. Course name: Artificial Intelligence Name of the study programme in which the course is offered: Automation and Systems, Electrical Engineering, Computer Engineering, Telecommunications and Computer Science, Computer Science The level of the study programme: Graduate study 2. Course name: Intelligent Systems Name of the study programme in which the subject is taught: Electrical Engineering and Information Technology The level of the study programme: Postgraduate study 3. Course name: Web intelligence and large data sets Name of the study programme in which the subject is taught: Electrical Engineering and Information Technology The level of the study programme: Postgraduate study
Authorship of university/faculty textbooks in the field of the course	1) Stipaničev Darko, Šerić Ljiljana. Artificial intelligence. Split, FESB - Internal script, 2012. 2) Bodrožić Ljiljana. Programming languages of artificial intelligence. Split, FESB - Internal script, 2007.
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1) Doko Alen, Štula Maja, Šerić Ljiljana. Improved sentence retrieval using local context and sentence length. Information processing & management, 49 (2013), 6, 1301-1312. 2) Šerić Ljiljana, Stipaničev Darko, Štula Maja. Engineering of holonic multi agent intelligent forest fire monitoring system. AI communications, 26 (2013), 3; 303-316. 3) Šerić Ljiljana, Krstinić Damir, Braović Maja, Milatić Ivan; Mirčevski Aljoša, Stipaničev Darko. Holonic Multi Agent System for Data Fusion in Vehicle Classification. Proceedings of 10th International KES Conference on Agents and Multi-Agent Systems: Technologies and Applications (KES-AMSTA-16). 2016. 4) Stipaničev Darko, Šerić Ljiljana, Krstinić Damir, Bugarić Marin. Wildfire video observers network with physical and virtual sensors. Proceeding of 10th EARSeL Forest Fire Special Interest Group Workshop - Sensors, Multi-Sensor Integration, large Volumes: New opportunities and Challanges in Forest Fire Research, Themistocleous, Kyriacos ; Hadjimitsis, Diofantos; Gitas, Ioannios ; Boschetti, Luigi (ur.). Limassol, Cyprus, 2015. 5) Ukić Nenad, Maras Josip, Šerić Ljiljana. The influence of cyclomatic complexity distribution on the understandability of xtUML models, Software quality journal, PP (2016)
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	AgiSeco – Agent Oriented Intelligent Systems for Environement Monitoring and Control, MZOS, 2007-2012 HOLISTIC – Adriatic Holistic Forest Fire Protection , IPA, 2014- in progres Wind Risk Prevention Projekt – ECHO, Civil Protection Automatic vehicle classification based on computer vision and data fusion

The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?	
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	20 best junior reasearchers, 2013
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	

First and last name and title of teacher	**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?	-
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	**Petar Šolić, Ph.D., Assistant Professor**
The course he/she teaches in the proposed study programme	Radio frequency identification technology
GENERAL INFORMATION ON COURSE TEACHER	
Address	Kupreška 14, 21000 Split, HR
Telephone number	+385981752651
E-mail address	psolic@fesb.hr
Personal web page	marjan.fesb.hr/~psolic
Year of birth	1985
Scientist ID	313610
Research or art rank, and date of last rank appointment	Research associate, 20.07.2015.
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Assistant professor, 01/10/2015
Area and field of election into research or art rank	Technical Sciences,
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Date of employment	01/04/2009
Name of position (professor, researcher, associate teacher, etc.)	Assistant professor
Field of research	Telecommunications
Function	
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Place	Split
Date	04/06/2014
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)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	German (2)

Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	
COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	
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)	
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?	
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	National award for science in 2015 (scientific novice category) Scientific novice award in 2014 (doctorand/postdoc category)
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	**Ivica Veža, Ph.D., Full Professor**
The course he/she teaches in the proposed study programme	Project Management
GENERAL INFORMATION ON COURSE TEACHER	
Address	Odeska 13, 21000 Split, HR
Telephone number	+385 21 305933
E-mail address	iveza@fesb.hr
Personal web page	
Year of birth	1951.
Scientist ID	095643
Research or art rank, and date of last rank appointment	Scientific Adviser - Mechanical Engineering, 08.03.2001. Scientific Adviser – Fundamental Technical Science 05.07.2006.
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Senior Full Professor, 23.01.1998.
Area and field of election into research or art rank	Technical Sciences, Field Industrial engineering
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture
Date of employment	1/1/1981
Name of position (professor, researcher, associate teacher, etc.)	Professor
Field of research	Plant Layout, Organization, Production Engineering
Function	Head of Chair of Inudstrial Engineering
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Faculty of Mechanical Engineering and Naval Architecture
Place	Zagreb
Date	9/11/2001
INFORMATION ON ADDITIONAL TRAINING	
Year	1983/84
Place	Stuttgart, Germany
Institution	University of Stuttgart, Fraunhofer – Institut fuer Produktiontechnik und Automatisierung
Field of training	Plant Layout, Simulation
INFORMATION ON ADDITIONAL TRAINING	
Year	1991
Place	Berlin, Germany
Institution	Technical University of Berlin, Fraunhofer IPK
Field of training	Design of Assembly Systems

MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English (4)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	Germany (4)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	
COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	Economics and Production Organisation, Undergraduate study programme,
Authorship of university/faculty textbooks in the field of the course	Veža, Ivica: Bilić, Boženko; Gjeldum, Nikola; Mladineo, Marko: "Upravljanje projektima", Fakultet elektrotehnike, strojarstva i brodogradnje, Split, 2011.
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1. Perić, Tunjo; Babić, Zoran; Veža, Ivica: Vendor selection and supply quantities determination in a bakery by AHP and fuzzy multi-criteria programming. International journal of computer integrated manufacturing. 26 (2013) , 9; 816-829 2. Veža, Ivica; Mladineo, Marko: SUSTAINABILITY THROUGH PRODUCTION NETWORKS. Management and Production Engineering Review. 4 (2013), 4; 33-39 3. Gjeldum, Nikola; Bilić, Boženko; Veža, Ivica. Investigation and modelling of process parameters and workpiece dimensions influence on material removal rate in CWEDT process. International journal of computer integrated manufacturing. 28 (2015) , 7; 715-728 4. Takakuwa, Soemon; Veža, Ivica: Technology Transfer and World Competitiveness. Procedia Engineering. 69 (2014); 121-127 5. Banduka, Nikola; Veža, Ivica; Bilić, Boženko: An integrated lean approach to Process Failure Mode and Effect Analysis (PFMEA): A case study from automotive industry. Advances in Production Engineering & Management. 11 (2016) , 4; 355-365
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	6. Gečevska, Valentina; Čuš, Franci; Chiabert, Paolo; Veža, Ivica: LINKING LEAN PRODUCTION WITH PRODUCT LIFECYCLE MANAGEMENT FOR SUSTAINABLE BUSINESS ENVIRONMENT, DEVELOPMENT OF INTELLIGENT AND INNOVATIVE TOOLS FOR PRODUCTION PROCESS ENGINEERING AND SUSTAINABLE MANAGEMENT, Čuš, F.; Gečevska, V. (Ed.). Maribor, Slovenija: Faculty of Mechanical engineering, Maribor, 2013. 19-39. 7. Čelar, Stipe; Turić, Mili; Dragičević, Srdjana; Veža, Ivica. Digital Learning Factory at FESB – University of Split , ZBORNIK RADOVA YU INFO 2016, 2016. 001-006 8. Veža, Ivica; Gjeldum, Nikola; Mladineo, Marko: Logistics Personal Excellence by Continuous Self-Assessment (LOPEC): Pilot Implementation - Case Studies. Conference Proceedings - MTSM 2014, Split, 2014. 39-46

	9. Stojkić, Željko; Veža, Ivica; Bošnjak, Igor. CONCEPT OF INFORMATION SYSTEM IMPLEMENTATION (CRM AND ERP) WITHIN INDUSTRY 4.0, Proceedings of the 26th DAAAM International Symposium, Vienna, DAAAM International, 2016. 912-919
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	10. 2008 – 2013 Project TEMPUS-2008-IT-JPCR 144 959, Master Study Program in Product Lifecycle Management with Sustainable Production 11. 2011-2014 LEONARDO DA VINCI Project "LOPEC - Logistics personnel excellence by continuous self-assessment", FESB Split, University of Reutlingen 12. 2013-2016 Network of Innovative Learning Factories NIL, "System - Learning Factory", FESB, Split, University of Reutlingen 13. 2013-2016 Know-how Exchange on the Consequences and Challenges of the Integration of Key Enabling Technologies in European Manufacturing for the Danube Region, Fraunhofer Institute for Systems and Innovation Research ISI – Karlsruhe 14. 2014-2018 Innovative Smart Enterprise, INSENT, Croatian Science Foundation, Zagreb
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?	
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	4,9/5

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

In keeping with the European standards and guidelines for internal quality assurance in higher education institutions (according to "Standards and Guidelines of Quality Assurance in the European Higher Education Area") on the basis of which the University of Zagreb defines procedures for quality assurance, the proposer of the study programme is obliged to draw up a plan of procedures of study programme quality assurance.	
Documentation on which the quality assurance system of the constituent part of the University is based:	
• Regulations on the quality enhancement system of FESB • Quality Assurance Handbook of the constituent part	
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.	
Evaluation of the work of teachers and part-time teachers	• Student evaluation of quality of instruction and teaching activities conducted through student survey (printed questionnaires) • Survey is organised and conducted by the Quality Enhancement Committee of the Faculty (Committee) • Survey results are processed automatically at the University • Survey is conducted each semester • The Committee presents cumulative results of the survey at the sessions of the Faculty Council. The report is published at the Faculty web site. All procedures are conducted in accordance with the Regulations on organisation and role of the quality assurance system of the University of Split, Regulations on procedure of student evaluation of the quality of teachers and teaching of the University of Split and Regulations on the quality enhancement system of FESB.
Monitoring of grading and harmonization of grading with anticipated learning outcomes	Committee for study programmes in Graduate university study in Information and Communication Technology 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