
**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 COMPUTING


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 | Computing | | |
| 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 Computing; mag. ing. com. | | |

# 1. INTRODUCTION

## 1.1. Reasons for starting the study programme

Computing is a field of science and engineering which encompasses, in a wider sense, the study and use of information, specifically the processes of design, implementation and modification of structures used for information exchange, filing and processing. At the present time, computing is interrelated with a large number of areas of human activity. The fundamental concepts are very similar, whether they concern hardware or software systems, or natural and social systems. Accordingly, the demand for experts in the field of computing is very high, and covers the needs for professional use of ready-made solutions, design, application and use of highly complex systems and producing original scientific papers in the area of computing and interdisciplinary areas linked with computing.

The current demands of the economy are primarily reflected in the constant demand for and permanent lack of experts in the field of computing. The prevailing trends indicate that the demand for this profile of experts will further increase. Necessary requirement for reaching the goals defined in the "Croatian Development Strategy in the 21st Century" is sufficient number of highly educated experts in the field of computing.

In the previous time period, computing strongly influenced the development of science, engineering, business management and other areas of human activity. These days nearly every person uses a computer for some of their activities, and many students want to study at least some forms of computing. Computing shall still be present in forming the careers of a large number of experts, and those who choose computing as their professional career path will occupy a crucial role in forming the future society. Development of modern society necessitates that the study of computing attracts excellent students with variety of interests and prepares them to become capable and responsible experts.

The goal of the proposed study programme in Computing is to educate professional staff in the area of computing to meet the demands of the industry, higher education institutions, governmental and public institutions.

## 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, and FESB is the only institution offering study programme in computing in the area. According to the labour market estimates for the area of ICT, during the following short-term period several thousand experts in the area of computing will be required in the Republic of Croatia, and several hundred thousand similar experts in the area of the EU. These estimates are confirmed through regular contact with the companies in the wider area and prospects for this profile of experts are excellent. The fact is confirmed by data on

interest of students in the study programme in computing at FESB-u, which is constantly growing and attracting students from various secondary school programmes.

Following the completion of studies, the acquired knowledge enables the students to find employment in the industrial sector, software and ICT companies, education, service industries, etc. There is virtually no working environment in which experts with completed graduate university degree in Computing could not find employment and the labour market demand for this profile of experts is 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.

At the graduate university study programme in Computing, students acquire competencies for work in various fields computing and information and communication technologies. Following the completion of studies, graduates can demonstrate skills in design, implementation and maintenance of complex computer systems which include integration of software and hardware solutions. 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 professionals able to perform the most complex engineering tasks and scientific-research activities. 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 recommendations of IEEE-ACM Computing Curricula.

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

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

## 1.5. Financing

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

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

During the implementation of the study programme in Computing, the Faculty is actively pursuing the process of development in higher education on global level, and especially in Europe. When developing the new curriculum, special attention was given to consolidating the curriculum and course contents with other renowned foreign higher education institutions. Best practice examples from American universities were included, summarised in the document "Computing Curricula" prepared by the leading professional associations in the area of computing (The Association for Computing - ACM, The Association for Information Systems - AIS, The Computer Society - IEEE-CS). The educational systems in the field of computing differ a lot, both worldwide and in Europe, and there are practically no countries with identical educational systems. The former applies to almost all components of education: type and organisation of studies, fields of study, duration of studies, titles and degrees awarded at individual institutions, names of higher education institutions, etc. As a rule, the first stage is acquiring knowledge of mathematics and fundamental natural sciences, followed by core courses in engineering and information technology and specific specialist courses related to particular branches of computing. In addition, the programme includes a number of non-engineering courses.

The study programme proposal is consolidated with the recommendations given in the framework of the ERASMUS project THEIERE (Towards the Harmonisation of Electrical and Information Engineering Education in Europe, http://www.eaeeie.org/theiere/). The proposal for the programme is consolidated with the recommendations of associations SEFI (European Society for Engineering Education) and CESAER (Conference of European Schools for Advanced Engineering Education and Research). The organisation of the proposed study programme is comparable with related study programmes at renowned European universities, e.g.:

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

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

Graduate university study programme in Computing enables vertical and horizontal mobility of students. In terms of vertical mobility, the graduate university study programme in Computing can primarily be followed by related postgraduate studies. In terms of horizontal mobility, the graduate university study programme in Computing is open for mobility of students of related studies at all Croatian universities. Students have the opportunity to complete a part of the study programme at a similar institution in Croatia or abroad.
Experts educated at the study programme in Computing at FESB shall acquire a wide range of general knowledge which enables them to become engaged in various tasks

related to design, implementation and use of computer systems in the wider area of engineering and other areas which require more complex computer systems. Therefore, the educational activities encourage mobility, providing the students with an opportunity to choose courses from other constituents of the University of Split, as well as courses from other higher education institutions in Croatia and abroad.

On the other hand, the demand for IT education is growing in all professions; consequently the study programme is open for students from other study programmes, who can acquire additional competences at the study programme in Computing.

## 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 Computing conforms with the Strategy of the University of Split 2015-2020. In addition to mission and vision of the University of Split, in the process of defining strategic goals, the following strategic documents were taken into account as guidelines:

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

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

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

The proposed study programme conforms with the strategic document Network of Higher Education Institutions and Study Programmes in the Republic of Croatia, which encourages launching new study programmes in STEM area, as computing 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 and 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 1985, at

the university undergraduate study in Electrical Engineering the field of study in Computer Engineering was introduced and so far over 200 students completed this study programme.

Responding to increased demand for experts in this area, the complete study programme in Computing at FESB was introduced in 2001. So far, over 700 students enrolled the study programme in Computing.

The Faculty delivers postgraduate study programme in Electrical Engineering, providing specialisation in the areas of telecommunications and computer information systems, electronics, power engineering and electromechanical engineering, automation and computing. Based on their scientific-research work and preparation of the doctoral thesis, the Faculty provides the candidates with an option of awarding PhD degrees in the areas of electrical engineering and mechanical engineering.

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 | Scientific area of Engineering sciences, field of Computing |
| 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 Computing or completed other related undergraduate study programme with acquired at least 180 ECTS credits, with corresponding classification procedure. For applicants who have completed other related study programmes, with preconditions defined for enrolment of certain courses, the Faculty Council may determine additional enrolment requirements. |

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

The learning outcomes of the study programme are directly related to the learning outcomes of an individual course and represent learning outcomes to be achieved by each student who completes the graduate university study programme in *Computing*. The learning outcomes are aligned with the Croatian Qualification Framework Act and are listed in the areas of knowledge, skills and related fields of independence and responsibility.

KNOWLEDGE

1. Apply appropriate mathematical, physical and general scientific principles in solving highly complex problems in the field of computing.
2. Apply advanced engineering knowledge and engineering principles in presenting and solving highly complex and original problems in the field of computing.
3. Develop innovative analytical methods and advanced modelling procedures in solving highly complex engineering problems in the field of computing.
4. Critically review the features of new and upcoming technologies in the field of computing.
5. Select optimal engineering and economic solutions in the design and construction of the most complex systems, networks and services in the field of computing.
6. To critically assess and provide arguments for the possibilities of applied techniques and methods and their limitations.

7. Consolidate theoretical knowledge and practical skills in solving highly complex problems in the area of information systems using the methods of software engineering.
8. Propose new procedures and new solutions for advancement of information and computer systems.
9. Develop innovative solutions in the area of information and computer systems.
10. Design advanced solutions in the area of information systems, software engineering and artificial intelligence.
11. Analyse complex information and computer systems using the methods from the area of computing.
12. Organise and manage the investigation of highly complex systems in the area of information and computer systems.

SKILLS

13. Apply advanced techniques of software development and software engineering in solving the most complex problems in the field of computing.
14. Manage multidisciplinary and international teams
15. Prepare design documents and technical reports, using modern technologies.
16. Use literature, databases and other sources of information.
17. Give public presentations, to prepare written reports and present project results in Croatian and English.

INDEPENDENCE

18. Manage and lead development activities in the environment with unforeseen conditions.
19. Make decisions in uncertain conditions.
20. Work in the field in regular working conditions and under unforeseen conditions.

RESPONSIBILITY

21. Demonstrate awareness of the influences of engineering practice on the individual, society and environment.
22. Assume personal and team responsibility for strategic decision-making and successful performance and completion of tasks in unforeseen conditions.
23. Assume social and ethical responsibility during performance of tasks and the consequent results of those tasks.
24. Adopt and transfer new knowledge and technology.

## 2.3. **Employment possibilities**

Following the completion of studies, the acquired knowledge enables the students to find employment in the industry, electric power industry, software and ICT companies, education, service industry, etc. There is virtually no working environment in which experts with completed graduate university degree in Computing could not find employment and the labour market demand for this profile of experts are very high. This is especially relevant in this moment, with social and economic changes driving

the development of new, small and medium technologically advanced enterprises that could serve as the new driving force for economic development.

At the graduate university study programme in Computing, students acquire competencies for work in various fields of computing, such as software development, information system design, development of network applications and information system management. Following the completion of studies, graduates can demonstrate skills in testing, maintenance, monitoring of information systems and the use of corresponding software tools and equipment necessary for their functioning. The special importance of this study programme, with regard to the labour market, is that it represents the second stage of the comprehensive two-cycle educational process which results in producing a fully educated expert capable of solving the most complex engineering tasks and participating in scientific research. The demand for experts with these competences considerably exceeds the available number of educated experts in the region, Croatia and the world.

## 2.4. Possibilities of continuing studies at a higher level

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

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

Undergraduate university study programme in Computing.

## 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. During the first three semesters, the courses cover advanced level natural sciences and advanced level computing. In the first semester, students choose one elective course, and in the second and third semester two elective courses. In the fourth semester, students select the subject for diploma thesis. The final component of the study programme is preparing and defending the diploma thesis. The conditions for enrolling a course are listed in the course table. Lectures are delivered in groups up to 100 students, auditory exercises and seminars in groups of 30 students and laboratory exercises in groups of 10 students.

## 2.7. Guiding and tutoring through the study system

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

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

Students may enrol 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

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 ☐<br>Diploma thesis ☒ | Final exam ☐<br>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 diploma thesis and the defence is public and held in the presence of the Commission for defence of diploma thesis. | |

## 2.12. List of mandatory and elective courses

| List of courses | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Year of study: 1. | | | | | | | | |
| Semester: I. | | | | | | | | |
| STATUS | CODE | COURSE | HOURS IN SEMESTER* | | | | | ECTS |
| | | | L | S | AE | LE | DE | |
| Mandatory | FEMK01 | Numerical analysis | 30 | 0 | 30 | 0 | 0 | 5 |
| | FELK01 | Human computer interaction | 30 | 0 | 0 | 30 | 0 | 5 |
| | FELK02 | Computing science models | 30 | 0 | 15 | 15 | 0 | 5 |
| | FELK03 | Artificial intelligence | 30 | 0 | 0 | 30 | 0 | 5 |
| | FELK04 | Computer graphics | 30 | 0 | 0 | 30 | 0 | 5 |
| | | Elective Course 1** | | | | | | |
| | Total | | 150 | 0 | 45 | 105 | 0 | 25 |
| * L = lectures, S = seminars, AE = auditory excercise, LE = laboratory excercise, DE = design excercise | | | | | | | | |
| **** Elective courses are selected from the proposed list of elective courses for this field of study. One elective course is selected..** | | | | | | | | |
| Elective** | FELK14 | Advanced algorithms | 30 | 0 | 0 | 30 | 0 | 5 |
| | FELH20 | Designing and using computer networks | 30 | 0 | 0 | 30 | 0 | 5 |
| | FELK32 | Geographic Information systems | 30 | 0 | 0 | 30 | 0 | 5 |
| | FELK33 | Advanced web technologies | 30 | 0 | 0 | 30 | 0 | 5 |
| | FELK18 | Digital image processing and analysis | 30 | 0 | 0 | 30 | 0 | 5 |
| | | Data analysis | 30 | 0 | 15 | 15 | 0 | 5 |
| | | Introduction to Data Science | 30 | 0 | 0 | 30 | 0 | 5 |
| | FELG30 | Introduction to machine learning | 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 | FELK05 | Programming languages and compilers | 30 | 0 | 0 | 30 | 0 | 5 |
| | FELK06 | Optimization methods | 30 | 0 | 0 | 30 | 0 | 5 |
| | FELK07 | Advanced computer architectures | 30 | 0 | 0 | 30 | 0 | 5 |
| | FELK10 | Cryptography and network security | 30 | 0 | 0 | 30 | 0 | 5 |
| | | Elective Course 1** | | | | | 0 | |
| | | Elective Course 2** | | | | | | |
| | Total | | 120 | 0 | 0 | 120 | 0 | 0 |
| * L = lectures, S = seminars, AE = auditory excercise, LE = laboratory excercise, DE = design excercise | | | | | | | | |
| **** Elective courses are selected from the proposed list of elective courses for this field of study. Two elective course is selected.** | | | | | | | | |
| Elective** | FELK16 | Data Warehouse | 30 | 0 | 0 | 30 | 0 | 5 |
| | FELJ09 | Wireless communication networks | 30 | 0 | 15 | 15 | 0 | 5 |
| | FELK30 | Architectures of networked computer systems | 30 | 0 | 0 | 30 | 0 | 5 |
| | FELK21 | Neural networks and genetic algorithms | 30 | 0 | 0 | 30 | 0 | 5 |
| | FELK31 | 3D Renedering | 30 | 0 | 0 | 30 | 0 | 5 |
| | FELK34 | Computer games programming | 30 | 0 | 0 | 30 | 0 | 5 |
| | FELK40 | Computer forensics | 30 | 0 | 0 | 30 | 0 | 5 |
| | FEOK01 | Natural language processing | 30 | 0 | 0 | 30 | 0 | 5 |
| | FELK44 | Bioinformatics | 30 | 0 | 0 | 30 | 0 | 5 |
| | FELK41 | Hardware definition languages | 30 | 0 | 0 | 30 | 0 | 5 |
| | FELK45 | Reinforcement learning | 30 | 0 | 0 | 30 | 0 | 5 |
| | FELG18 | Computational intelligence (neuro-fuzzy-genetic systems) | 30 | 0 | 0 | 30 | 0 | 5 |
| | FELG33 | Optoelectronic measurement methods | 30 | 0 | 0 | 30 | 0 | 5 |
| | FELJ11 | IP communications | 30 | 0 | 0 | 30 | 0 | 5 |
| | FELH32 | Electroacoustics | 30 | 0 | 0 | 30 | 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: III. | | | | | | | | |
| STATUS | CODE | COURSE | HOURS IN SEMESTER* | | | | | ECTS |
| | | | L | S | AE | LE | DE | |
| Mandatory | FELK08 | Multimedia systems | 30 | 0 | 0 | 30 | 0 | 5 |
| | FELK11 | Grid computing systems | 30 | 0 | 30 | 0 | 0 | 5 |
| | FETK01 | Business information systems | 30 | 0 | 0 | 30 | 0 | 5 |
| | FELK12 | Embedded systems | 30 | 0 | 0 | 30 | 0 | 5 |
| | | Elective Course 1** | | | | | | |
| | | Elective Course 2** | | | | | | |
| | Total | | 120 | 0 | 30 | 90 | 0 | 20 |
| * L = lectures, S = seminars, AE = auditory excercise, LE = laboratory excercise, DE = design excercise | | | | | | | | |
| **** Elective courses are selected from the proposed list of elective courses for this field of study. Two elective course is selected.** | | | | | | | | |
| Elective** | FETK03 | Project management | 30 | 0 | 0 | 30 | 0 | 5 |
| | FELK15 | Digital communications | 30 | 0 | 0 | 30 | 0 | 5 |
| | FELJ03 | Transmission systems | 30 | 0 | 15 | 15 | 0 | 5 |
| | FELJ18 | Software engineering in telecommunications | 30 | 0 | 0 | 30 | 0 | 5 |
| | FELK19 | Wireless security | 30 | 0 | 0 | 30 | 0 | 5 |
| | FELK17 | Programming agents | 30 | 0 | 0 | 30 | 0 | 5 |
| | FETK02 | Business intelligence | 30 | 0 | 0 | 30 | 0 | 5 |
| | FELJ35 | Network and mobile operating systems | 30 | 0 | 0 | 30 | 0 | 5 |
| | FELH40 | Programming mobile robots and drones | 30 | 0 | 0 | 30 | 0 | 5 |
| | FELK35 | Parallel programming | 30 | 0 | 0 | 30 | 0 | 5 |
| | FELK36 | Forensic analysis of digital images | 30 | 0 | 0 | 30 | 0 | 5 |
| | FENI51 | Programming FPGA devices | 30 | 0 | 0 | 30 | 0 | 5 |
| | | Data visualization | 30 | 0 | 0 | 30 | 0 | 5 |
| | | Medical devices | 30 | 0 | 0 | 30 | 0 | 5 |
| | FEXX06 | Professional training | | | | | | 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

| | |
|---|---|
| FELK31 | 3D Renedering - Zoraja (trodimenzionalne simulacije) |

| NAME OF THE COURSE | ADVANCED ALGORITHMS | | | | | | |
|---|---|---|---|---|---|---|---|
| **Code** | FELK14 | 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:<br>- Design of efficient algorithms with aim to minimize running timeand memory requirements analysis of algorithms properties (speed and memory)<br>- Adopting the practical knowledge about algorithm design techniques | | |
| Course enrolment requirements and entry competences required for the course | Passed exam “Algorithms” | | |
| Learning outcomes expected at the level of the course (4 to 10 learning outcomes) | Students will be able to:<br>- Design an efficient algorithm<br>- investigate algorithm efficiency<br>- explain and apply different algorithm design techniques<br>- apply advanced graph algorithms | | |
| Course content broken down in detail by weekly class schedule (syllabus) | Course content | L hours | AE hours |
| | Introduction. What are algorithms. Algorithm analysis and design of efficient algorithms and data structures. | 3 | 0 |
| | Overview of sorting algorithms. Sorting with minimization of running time and memory requirements. | 3 | 0 |
| | Asymptotic notation. Limited rule. | 3 | 0 |
| | Mathematical induction and logic. Analysis using recursive equations. | 3 | 0 |
| | Design techniques: divide and conquer, greedy method, backtracking, branch and bound technique, dynamic programing, probabilistic algorithms | 3 | 0 |
| | Graph algorithms | 3 | 0 |
| | BFS algorithm, DFS algorithm, connected components | 3 | 0 |
| | Minimum spanning tree | 3 | 0 |
| | Network flow, bipartite graphs | 3 | 0 |
| | Network routing techniques | 3 | 0 |
| | Examining graph planarity | 3 | 0 |
| | String processing for DNA analysis | 3 | 0 |
| | Parallel algorithms. GPU programming | 3 | 0 |
| | List of laboratory or design exercises | | LE hours |
| | Analysis of algorithm efficiency | | 2 |
| | Sorting with minimization of running time and memory requirements | | 2 |
| | Recursions | | 2 |
| | Design techniques: divide and conquer, greedy method, backtracking, branch and bound technique, dynamic programing, probabilistic algorithms | | 2 |
| | Graph algorithms | | 2 |
| | BFS algorithm, DFS algorithm, connected components | | 2 |
| | Minimum spanning tree | | 2 |
| | Network flow, bipartite graphs | | 2 |
| | Network routing techniques | | 2 |

| | | |
|---|---|---|
| | Examining graph planarity | 2 |
| | String processing for DNA analysis | 2 |
| | Parallel algorithms. | 2 |
| | GPU programming | 2 |

| | | |
|---|---|---|
| Format of instruction | ☒ lectures<br>☐ seminars and workshops<br>☐ exercises<br>☐ *on line* in entirety<br>☐ partial e-learning<br>☐ field work | ☐ independent assignments<br>☐ multimedia<br>☒ laboratory<br>☐ work with mentor<br>☐ (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 | |
| | 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:<br>Grade(%) = 0,5 (M1 + M2)<br>the activities in percentage:<br>• M1, M2 – test results.<br>The final grade is defined in the next way:<br>50% do 63% sufficient (2)<br>64% do 74% good (3)<br>75% do 87% very good (4)<br>88% 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** |
|---|---|---|---|
| | • Hrvoje Dujmić: „Algoritmi“, interna skripta | | e-learning portal |

| | |
|---|---|
| Optional literature (at the time of submission of study programme proposal) | • T.Cormen, C.Leiserson, R.Rivest, C.Stein: „Introduction to Algorithms“, second edition, third printing, McGraw-Hill, 2002 |
| Quality assurance methods that ensure the acquisition of exit competences | - Evaluation of results in accordance with the above learning outcomes<br>- Feedback from students via surveys<br>- Self-evaluation of teachers<br>- Feedback from students who have already obtained BsC degree |
| Other (as the proposer wishes to add) | |

| NAME OF THE COURSE | ADVANCED COMPUTER ARCHITECTURES | | | | | | |
|---|---|---|---|---|---|---|---|
| **Code** | FELK07 | Year of study | 1 | | | | |
| **Course teacher** | Sven Gotovac, Ph.D., Full Professor | Credits (ECTS) | 5 | | | | |
| Associate teachers | Dunja Gotovac, Teaching Assistant | Type of instruction (number of hours) | L | S | AE | LE | DE |
| | | | 30 | | | 30 | |
| Status of the course | Obligatory | Percentage of application of e-learning | 0 | | | | |

**COURSE DESCRIPTION**

| | | | |
|---|---|---|---|
| Course objectives | Training students for:<br>1. Recognize the architecture of modern computer systems.<br>2. Choose the appropriate computer architecture according to the problem being solved computer architecture<br>3. Estimates the impact of computer architecture and its components on system performance<br>4. Develop, adapt and implement solutions on multi-processor and multi-core systems. | | |
| Course enrolment requirements and entry competences required for the course | Computer Architecture | | |
| Learning outcomes expected at the level of the course (4 to 10 learning outcomes) | Students will be able to:<br>1. Understand the Architecture of Modern Computer Systems<br>2. Determine the impact of individual components on the performance of a computer system<br>3. Choose the appropriate computer architecture according to the problem being solved<br>4. Develop and implement solutions on selected architecture (multi-processor, multi-core, many-core.). | | |
| Course content broken down in detail by weekly class schedule (syllabus) | Course content | L hours | AE hours |
| | Introduction to the course, Brief description of the topics to be considered, Brief subjects from the course Digital Architecture: Programming Architecture, Pipeline, Fast Memory | 2 | |
| | Pipeline architecture | 2 | |
| | Instruction execution parallelism. Problems and Solutions. | 2 | |
| | Out of Order Execution. Branch Prediction | 2 | |
| | Cache. Various Cache Architecture | 2 | |
| | Memory Performance Optimization | 2 | |
| | ChipSet | 2 | |
| | MESI Protocol | 2 | |
| | Multi Core Processors | 2 | |
| | Many Core Processor – Xeon Phi | 4 | |
| | Graphical Processing Unit - GPU | 4 | |
| | Application Examples | 4 | |
| | List of laboratory or design exercises | | LE hours |
| | Multi-threading programming. Performance exmples | | 4 |
| | Cache impact on execution performance | | 4 |
| | GPU CUDA Programming | | 4 |
| | Problem implementation on Multi-Core, Many-Core and CUDA architecture. Performance comparison. | | 14 |

<table>
<tr><td>Format of instruction</td><td colspan="6">☒ lectures<br>☒ seminars and workshops<br>☐ exercises<br>☐ on line in entirety<br>☐ partial e-learning<br>☐ field work</td><td colspan="2">☒ independent assignments<br>☒ multimedia<br>☒ laboratory<br>☐ work with mentor<br>☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="8">The presence on lectures in the amount of at least 70 % of the times scheduled. Performed all required laboratory exercises.</td></tr>
<tr><td rowspan="5">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>1</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td>0</td><td>Report</td><td>1</td><td>Laboratory exercises</td><td>1</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>Preparation for laboratory exercises</td><td>0,5</td></tr>
<tr><td>Tests</td><td></td><td>Oral exam</td><td></td><td>Self-study</td><td>0,5</td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td>1</td><td></td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">There are two midterms and final exams. The first midterm exam is after 7 weeks of lecturing and the second one is after the next 6 weeks. First midterm test lasts 60 minutes and consists of 5 to 7 theoretical questions and numerical problems, second midterm is practical example and final tests consist of 6 theoretical questions and numerical problems and example solving. 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:<br>Grade(%) = 0,33 LV + 0,33 (M1 + M2)<br>the activities in percentage:<br>• LV – laboratory assessment,<br>• M1, M2 – test results.<br>The final grade will be determined after the first test term by applying a relative ECTS grading system in accordance with the Regulations on the study and study system of the University of Split. The group of students who passed the exam is divided into four groups: 15% of the best gets the grade A (excellent), 35% of the following B (very good), the next 35% rating C (good), and the last 15% rating D, E ). A group of students who did not pass the exam gains FX score (additional work is required), or F (significant additional work is required). In accordance with the Rulebook for Exam, only two exam periods are organized in the exam period after the completion of classes.<br>According to Article 65 of the Statute of the Faculty, the student is obliged to participate in all forms of teaching and attend: lectures at least 70% of teaching hours and laboratory exercises 100% of teaching hours. If you do not meet these conditions, the student will not be able to access the exam</td><td></td></tr>
<tr><td rowspan="3">Required literature (available in the library and via other media)</td><td colspan="4">Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td colspan="4">• Hennesy & Patterson, "Computer Architecture: A Quantitative Approach", 5rd edition, Morgan Kaufmann, 2011.</td><td>2</td><td>Electronic copy On e-learning</td></tr>
<tr><td colspan="4">• Edward Kandrot and Jason Sanders, CUDA by Example: An Introduction to General-Purpose GPU, NVidi, 2010.</td><td>1</td><td>Electronic copy On e-learning</td></tr>
<tr><td>Optional literature (at the time of</td><td colspan="6">• Ribarić, S.: Naprednije arhitekture mikroprocesora, Tehnička knjiga, Zagreb</td><td></td></tr>
</table>

| | |
|---|---|
| submission of study programme proposal) | |
| Quality assurance methods that ensure the acquisition of exit competences | 1. Class attendance records.<br>2. Evaluation of results in accordance with the above learning outcomes<br>3. Feedback from students via surveys<br>4. Self-evaluation of teachers<br>5. Feedback from students who have already graduated.<br>6. Institutional and non-institutional evaluations |
| Other (as the proposer wishes to add) | |

| NAME OF THE COURSE | ADVANCED WEB TECHNOLOGIES | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | FELK33 | Year of study | 1 | | | | | |
| **Course teacher** | Maja Štula, Ph.D., Full Professor | Credits (ECTS) | 5 | | | | | |
| Associate teachers | Marin Bugarić, Ph.D., | Type of instruction (number of hours) | L | S | AE | LE | DE | |
| | | | 30 | | | 30 | | |
| Status of the course | Elective | Percentage of application of e-learning | 20% | | | | | |

**COURSE DESCRIPTION**

| | | | |
|---|---|---|---|
| Course objectives | Training students for:<br>- Understanding basic concepts and trends in developing modern web applications<br>- Acquiring deep knowledge on different web application frameworks and design patterns<br>- Acquiring knowledge necessary for advanced modern web application development | | |
| Course enrolment requirements and entry competences required for the course | Passed Internet programming course (FELB13) on Undergraduate study in Computing (120) | | |
| Learning outcomes expected at the level of the course (4 to 10 learning outcomes) | Students will be able to:<br>- Apply different web design patterns<br>- Use JavaScript frameworks like AngularJS<br>- Implement complex user requirements in web applications<br>- Develop high performance complex web application | | |
| Course content broken down in detail by weekly class schedule (syllabus) | Course content | L hours | AE hours |
| | Advanced responsive HTML interface development using modern CSS and JS frameworks (example Bootstrap) | 2 | 0 |
| | MVC (Model-View-Controler) pattern in developing web applications (ASP.NET MVC) | 8 | 0 |
| | Object-relational mapping (example Entity framework) | 2 | 0 |
| | User authentication (example ASP.NET Identity) | 2 | 0 |
| | REST API | 2 | 0 |
| | Advanced JavaScript concepts: prototypes, closures | 4 | 0 |
| | Advanced frameworks for web application development on client side, organisational patterns, MVC on client side, routing (example in AngularJS framework) | 8 | 0 |
| | Web application testing | 2 | 0 |
| | List of laboratory or design exercises | | LE hours |
| | Using Bootstrap | | 3 |
| | Basic ASP.NET MVC application | | 4 |
| | Developing model in EF | | 4 |
| | ASP.NET Identity application | | 3 |
| | REST API | | 2 |
| | JS prototypes | | 2 |
| | JS closures | | 2 |
| | AngularJS framework | | 6 |
| | Web application testing | | 4 |
| Format of instruction | ☒ lectures | ☒ independent assignments | |

<table>
<tr><td></td><td colspan="6">☐ seminars and workshops<br>☒ exercises<br>☐ on line in entirety<br>☒ partial e-learning<br>☐ field work</td><td colspan="2">☐ multimedia<br>☒ laboratory<br>☐ work with mentor<br>☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="8">The presence on lectures in the amount of at least 70 % of the times scheduled. Performed and uploaded on e-learning portal all required laboratory exercises and home works.</td></tr>
<tr><td rowspan="5">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>2</td><td>Research</td><td></td><td>Practical training</td><td>1</td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>1</td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td>0,5</td><td>Oral exam</td><td>0,5</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="8">There are two midterms and final exams duration of 90 minutes. The first midterm exam is after 7 weeks of lecturing and the second one is after the next 6 weeks. In the final exams students that did not pass the midterm exams take part. The requirement for passing grade is 50 % points on each midterm exam or the final exam. Grade (in percentage) is formed according to the formula:<br>Grade(%) = 0,2 LV + 0,4 (M1 + M2)<br>the activities in percentage:<br>• NP - attendance at lectures,<br>• LV – laboratory assessment,<br>• M1, M2 – test results.</td></tr>
<tr><td rowspan="6">Required literature (available in the library and via other media)</td><td colspan="5">Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td colspan="5">Secrets of the JavaScript Ninja, John Resig, Bear Bibeault,, Manning Publication, 2013.</td><td></td><td></td></tr>
<tr><td colspan="5">Professional ASP.NET MVC 4, Jon Galloway, Phil Haack, Wrox, 2012.</td><td></td><td></td></tr>
<tr><td colspan="5"></td><td></td><td></td></tr>
<tr><td colspan="5"></td><td></td><td></td></tr>
<tr><td colspan="5"></td><td></td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="8">- AngularJS in Depth, David L. Aden i Jason L. Aden, Manning Publication, 2014</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="8">- Students’ surveys for teacher evaluation<br>- Students attendance track<br>- Annual statistic on passed exam</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="8">Feedback from potential employers on students employability</td></tr>
</table>

| NAME OF THE COURSE | ARCHITECTURES OF NETWORKED COMPUTER SYSTEMS | | | | | | |
|---|---|---|---|---|---|---|---|
| **Code** | FELK30 | Year of study | 4 | | | | |
| **Course teacher** | Milan Vojnović, Ph.D.<br>Dinko Begušić, Ph.D., Full Professor | Credits (ECTS) | 5 | | | | |
| Associate teachers | | Type of instruction (number of hours) | L | S | AE | LE | DE |
| | | | 30 | 0 | 0 | 30 | 0 |
| Status of the course | (Elective: 250) | Percentage of application of e-learning | | | | | |

**COURSE DESCRIPTION**

| | | |
|---|---|---|
| Course objectives | Training students for:<br>- understanding and application of basic concepts and technologies of networking of the computer systems, including the architecture of Internet, peer computer systems, and the system of dana centers,<br>- collaboration in design, development and maintenance of wireless communication networks,<br>- collaborate in design, development and maintenance of networked computer systems,<br>- permanent adoption and deepening of the knowledge in the area of networked computer systems. | |
| Course enrolment requirements and entry competences required for the course | Understanding of basic communications systems amd protocols, understanding of basics of programming, | |
| Learning outcomes expected at the level of the course (4 to 10 learning outcomes) | Students will be able to:<br>- identify, select and apply networked computer systems,<br>- validate and apply methods and tools for development of networked computer systems,<br>- collaborate in design, implementation and maintenance of mobile networks (NMT, GSM, GPRS, EDGE, UMTS, HSDPA, LTE),<br>- collaborate in design, implementation and maintenance of networked computer systems,<br>- collaborate in design, implementation and maintenance of software products and application of methods for development of networked computer systems,<br>- Validate and apply platforms for processing of big quantities of data,<br>- permanently adopti and deepening of the knowledge in the area of networked computer systems. | |
| Course content broken down in detail by weekly class schedule (syllabus) | Course content | L hours |
| | Introduction into the technologies of networking of computer systems | 2 |
| | Technology of Internet | 2 |
| | TCP/IP protocol | 2 |
| | TCP/IP (dana link layer) | 2 |
| | TCP/IP (internal routing), distance-vector, Bellman-Ford, RIP | 2 |
| | TCP IP (external routing) link-state, Dijkstra, OSPF, BGP, didynamic routing, Braess paradox, transport layer, UDP, ZCP, shared network reources theory | 2 |
| | TCP ( traffic control) | 2 |
| | P2P systems, overay networks, Napster, Gnutella, KaZaA, BitTorrent; distributed hash tables, Chored, Kadmella | 2 |
| | Data transfer, file transfer rate, network coding principles | 2 |

| | | |
|---|---|---|
| | Date centers, distributed dana processing systems, parallel processing, MapReduce, Hadoop, Dryad; network file systems, NFS, Google File System (GFS), Coda, Lustre; | 2 |
| | Data storage systems, BigTable, Amazon Dynamo; Big data processing, statistical data sampling, | 2 |
| | Big dana processing systems | 2 |
| | Online services, web document ranking, PageRank, elements of the auctions theory | 2 |

| | | |
|---|---|---|
| | List of laboratory or design exercises | LE or DE hours |
| | Internet administration | 3 |
| | BGP protocol analysis | 3 |
| | TCP protocol | 3 |
| | Bit Torrent | 3 |
| | Hadoop | 3 |
| | Hive | 3 |
| | Mapreduce | 3 |

| | | |
|---|---|---|
| Format of instruction | ☒ lectures<br>☐ seminars and workshops<br>☒ exercises<br>☐ *on line* in entirety<br>☐ partial e-learning<br>☐ field work | ☐ independent assignments<br>☐ multimedia<br>☒ laboratory<br>☐ work with mentor<br>☐ (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 | - | 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:<br>Grade(%) = 0,05 NP + 0,35 L + 0,3 (M1 + M2)<br>the activities in percentage:<br>• NP - attendance at lectures,<br>• L – laboratory assessment,<br>• M1, M2 – test results.<br><br>ZI – the grade of the final exam in percents |

| | |
|---|---|
| | Grade (%) — Grade<br>91%-100% — izvrstan (5)<br>88%-90% — - izvrstan (-5)<br>85%-87% — + vrlo dobar (+4)<br>78%-84% — vrlo dobar (4)<br>75%-77% — - vrlo dobar (-4)<br>72%-74% — + dobar (+3)<br>65%-71% — dobar (3)<br>62%-64% — - dobar (-3)<br>59%-61% — + dovoljan (+2)<br>50%-58% — dovoljan (2)<br><br>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.<br>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.<br>STudents who do not pass the exam by the end of the current academic year have to enroll the course in the next academic year. |

| Required literature (available in the library and via other media) | **Title** | **Number of copies in the library** | **Availability via other media** |
|---|---|---|---|
| | M. Vojnović: Architectures of the netwroked computer systems, handouts, FESB, 2013. | | e-learning portal |
| | | | |

| | |
|---|---|
| Optional literature (at the time of submission of study programme proposal) | • L. Peterson, B. S. Davie, Computer Networks: A Systems Approach, 4th edition, The Morgan Kaufmann Series in Networking, 2007.<br>• J. F. Kurose and K. W. Ross, Computer Networking: A Top Down Approach, 5th edition, Addison-Wesley, 2009.<br>• J. F. Bufford, H. Yu, E. K. Lua, P2P Networking and Applications, Morgan Kaufmann, 2009.<br>• A. Silberschatz, H. F. Korth, S. Sudarshan, Database System Concepts, 5th edition, McGraw-Hill, 2006 |
| Quality assurance methods that ensure the acquisition of exit competences | • Evaluation of results in accordance with the above learning outcomes<br>• Feedback from students via surveys<br>• Self-evaluation of teachers<br>• Institutional and non-institutional evaluations |
| Other (as the proposer wishes to add) | |

| NAME OF THE COURSE | ARTIFICIAL INTELLIGENCE | | | | | | |
|---|---|---|---|---|---|---|---|
| **Code** | FELK03 | Year of study | 1 | | | | |
| **Course teacher** | Darko Stipaničev, Ph.D., Full Professor (60%)<br>Ljiljana Šerić, Ph.D., Assistant Professor (40%) | Credits (ECTS) | 5 | | | | |
| Associate teachers | Toni Jakovčević, Ph.D., Assistant Professor | Type of instruction (number of hours) | L | S | AE | LE | DE |
| | | | 30 | 0 | 0 | 30 | 0 |
| Status of the course | Obligatory | Percentage of application of e-learning | 80 | | | | |

**COURSE DESCRIPTION**

| | |
|---|---|
| Course objectives | The aim of the course is to teach students basic knowledge in the field of 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. |
| Course enrolment requirements and entry competences required for the course | Basic knowledge of computers and programming.<br>To follow the College is necessary knowledge of English. |
| Learning outcomes expected at the level of the course (4 to 10 learning outcomes) | Students will be able to successfully mastering the subject:<br>1. Explain the differences between biological intelligence, artificial intelligence, computational intelligence and distributed intelligence.<br>2. Present complex tasks and prepare them for automatic solving them.<br>3. Understand the difference between data, information and knowledge and systems based on knowledge.<br>4. Explain the procedures of knowledge elicitation and knowledge storing using different types of mathematical logic (propositional logic, predicate logic, non-standard logic).<br>5. Apply the structural representation of knowledge, particularly semantic networks, frames, scenarios, stereotypes, and production rules.<br>6. Describe and present standard methods of solving tasks of artificial intelligence, especially methods of searching the knowledge base (undirected and directed search)<br>7. Apply logical reasoning, probabilistic reasoning, fuzzy reasoning<br>8. Apply simple machine learning tasks (unsupervised and supervised).<br>9. Write simple programs in programming languages and tools of artificial intelligence (Prolog, LISP, AIXML, Jess).<br>10. Describe the application of artificial intelligence, in particular through expert systems. |

| | Course content | L hours | LE hours |
|---|---|---|---|
| Course content broken down in detail by weekly class schedule (syllabus) | 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. | 4 | 0 |
| | Complex tasks and their preparation for solving using AI methods. Problem solving techniques using search (undirected and directed search) | 4 | 0 |
| | Knowledge and storage of knowledge – I part introduction, data, information, knowledge. Knowledge-based systems. Knowledge and storage of knowledge - II part mathematical logic (standard and non-standard logic). | 4 | 0 |

| | | | |
|---|---|---|---|
| | Logical reasoning. Probabilistic reasoning (probability, conditional probability, Bays networks, hidden Markov models). Fuzzy (fuzzy) reasoning. | 6 | 0 |
| | Knowledge and storage of knowledge - Part III structure storage knowledge (semantic networks, stereotypes, the script, frames, production systems). | 2 | 0 |
| | Machine learning (unsupervised and supervised) | 4 | 0 |
| | Examples of applications of artificial intelligence. Expert systems. Processing and understanding speech. Computer vision. | 2 | 8 |
| | The programming language LISP | 0 | 15 |
| | The programming language Prolog and expert system shell | 0 | 15 |

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

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

| | |
|---|---|
| Grading and evaluating student work in class and at the final exam | The exam consists of a written part and if necessary additional oral exam. During the semester will be two tests. The first colloquium in 8 weeks of classes, the second at 18 weeks. A student can pass the course by these tests. In the two final exams in June and July, students who have not collected inadequate number of points through colloquia take the whole subject covered by the two tests. The condition for taking the final exam is successfully finished practical lab exercises.<br><br>The exam is comprehensive and includes the theoretical part of the material and tasks with auditory exercises. The condition for positive assessment is that the student has a total of at least 50% on the exam or when it must have a minimum 25% passing the theoretical part of the material and 25% of the deposited duties. If a student has less than 25% of the points on the tasks and / or less than 25% points from the theoretical part of the material again taken the entire exam. Students who did not pass the exam after two final exams can pass the exam in autumn periods. All test questions students will be known before the exam.<br><br>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.<br><br>The final grade is determined as follows:<br>percentage Rating<br>50% to 61% is sufficient (2)<br>62% to 74% good (3)<br>75% to 87% of very good (4)<br>88% 100% Excellent (5)<br>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. |

<table>
<tr><td></td><td colspan="3">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.<br>- S.Russel, P.Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, 2nd Ed. 2002.<br>- AI on the Web (http://http.cs.berkeley.edu/%7Erussell/ai.html )<br>- 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<br>- Feedback from students via surveys<br>- Self-evaluation of teachers<br>- 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 | BUSINESS INFORMATION SYSTEMS | | | | | | |
|---|---|---|---|---|---|---|---|
| **Code** | FETK01 | Year of study | 2. | | | | |
| **Course teacher** | Stipo Čelar, Ph.D., Associate Professor | Credits (ECTS) | 5 | | | | |
| Associate teachers | Mili Turić, mag. comp.<br>Ivan Drnasin, mag. Comp. | Type of instruction (number of hours) | L | S | AE | LE | DE |
| | | | 30 | | | 30 | |
| Status of the course | Obligatory | Percentage of application of e-learning | 0 | | | | |

**COURSE DESCRIPTION**

| | |
|---|---|
| Course objectives | Training students for:<br>- understanding and application of Business Information Systems (BIS) types,<br>- understanding and analyse of product's and material's life cycle in business systems (BS) and in information systems (IS),<br>- understanding of basic functionalities of ERP solutions,<br>- application of design, implementation and maintenance of transactional IS. |
| 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:<br>- classify different types of BIS,<br>- design a small BIS,<br>- participate in development, implementation and maintenance of ERP solutions,<br>- choose technologically and functionally adequate BIS solution for a bigger business environments,<br>- plan and manage a larger BIS implementation project. |

| Course content broken down in detail by weekly class schedule (syllabus) | Course content | L hours | AE hours |
|---|---|---|---|
| | Introduction to Business Information Systems (BIS). Role of BIS in the business | 2 | |
| | BIS types | 2 | |
| | BIS development methodologies. UML. RUP | 2 | |
| | Business Process Modelling. ARIS | 2 | |
| | Process. Event. Information. Document. Function | 2 | |
| | The basic concepts of transactional IT systems | 2 | |
| | Financial and accounting processes. The processes of document management | 2 | |
| | First midterm exam | | |
| | Item - the product - (repro) material - raw materials – commodities in business and information system | 2 | |
| | Work order. Bill of Materials. | 2 | |
| | Types of production (discrete, process, repeatable). Traceability | 2 | |
| | Price calculation (purchase and production). VAT calculation | 2 | |
| | MRP and ERP systems. Cloud systems | 2 | |
| | Methodologies selection and implementation of information systems | 2 | |
| | Second midterm exam | | |
| | List of laboratory exercises | | LE hours |
| | Introduction to the work method. Defining of project teams and seminar topics selecting | | 2 |
| | Weekly meetings with a mentor (professor / assistant) | | 4 |
| | Exercises in the test ERP system – .NET technology | | 10 |

| | | |
|---|---|---|
| | Exercises in the test system – JAVA technology | 6 |
| | Seminar presentation (with colleagues) | 4 |

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

| Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)* | | | | | | |
|---|---|---|---|---|---|---|
| | Class attendance | 1 | Research | 0,4 | Practical training | |
| | Experimental work | | Report | | Individual work | 2 |
| | Essay | | Seminar essay | 0,5 | Laboratory exercises | 0,7 |
| | Tests | 0,2 | Oral exam | 0,2 | Preparation for laboratory exercises | |
| | Written exam | | Project | | (Other) | |

| | |
|---|---|
| Grading and evaluating student work in class and at the final exam | There are two midterms and final exams. The first midterm exam is after 7 weeks of lecturing and the second one is after the next 6 weeks of lecturing. Each midterm test consists of 5 to 10 theoretical questions and numerical problems. The final test consists of aprox. 10 theoretical questions and numerical problems. In the final exams students that did not pass the midterm exams take part. The midterms 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. After that the students take the oral exam.<br>Grade (in percentage) is formed according to the formula:<br>Grade(%) = 0,3 OE + 0,2 LE + 0,25 (M1 + M2)<br>the activities in percentage:<br>• OE – oral exam,<br>• LE – laboratory assessment,<br>• M1, M2 – test results. |

| Required literature (available in the library and via other media) | **Title** | **Number of copies in the library** | **Availability via other media** |
|---|---|---|---|
| | • S. Čelar: Authorised lectures, FESB | | e-learning portal |
| | • S. Čelar: Authorised instructions for seminar, FESB | | e-learning portal |
| | • M. Turić; S. Čelar: Authorised instructions for laboratory exercises, FESB | | e-learning portal |

| | |
|---|---|
| Optional literature (at the time of submission of study programme proposal) | • Nancy H. Bancroft. 1996. *Implementing SAP R/3*. Prentice Hall PTR, Upper Saddle River, NJ, USA. |
| Quality assurance methods that ensure the acquisition of exit competences | - Evaluation of results in accordance with the above learning outcomes<br>- Feedback from students via surveys<br>- Self-evaluation of teachers<br>- Institutional and non-institutional evaluations |
| Other (as the proposer wishes to add) | |

| NAME OF THE COURSE | BUSINESS INTELLIGENCE | | | | | | |
|---|---|---|---|---|---|---|---|
| **Code** | FETK02 | Year of study | 2. | | | | |
| **Course teacher** | Stipo Čelar, Ph.D., Associate Professor | Credits (ECTS) | 5 | | | | |
| Associate teachers | Linda Vicković, Ph.D., Associate Professor | Type of instruction (number of hours) | L | S | AE | LE | DE |
| | | | 30 | | | 30 | |
| Status of the course | Elective | Percentage of application of e-learning | 0 | | | | |

**COURSE DESCRIPTION**

| | |
|---|---|
| Course objectives | Training students for:<br>- understanding and producing advanced reports (PowerPivot)<br>- understanding of the methodology of knowledge discovery in data (Data Mining – DM)<br>- understanding of Business Intelligence (BI) systems architecture and BI technology,<br>- application of machine learning methods for data processing. |
| Course enrolment requirements and entry competences required for the course | The students should previously pass one of the two courses<br>- *Databases* and/or *Data Warehouse* or<br>- understand the concept of relational databases (if this course is enroled without passing one of the above mentioned courses). |
| Learning outcomes expected at the level of the course (4 to 10 learning outcomes) | Students will be able to:<br>- define the architecture of Business Intelligence systems,<br>- apply advanced methods of reporting (PowerPivot) in a small business environment,<br>- define BI technologies and their characteristics,<br>- apply the methods of data mining in the chosen tool (Weka) in a small business environment,<br>- understand the differences among the methodologies BI projects,<br>- participate in larger BI projects. |

| Course content broken down in detail by weekly class schedule (syllabus) | Course content | L hours | AE hours |
|---|---|---|---|
| | Introduction to Business Intelligence (BI). The definition and brief history of BI. | 2 | |
| | Statistical analysis and advanced reporting. OLAP and PowerPivot | 2 | |
| | Knowledge discovery in data. Machine learning | 2 | |
| | CRISP-DM vs. SEMMA methodology | 2 | |
| | Rules of association. Apriori algorithm | 2 | |
| | Data clustering | 2 | |
| | Bayesian networks | 2 | |
| | First midterm exam | | |
| | Decision trees | 2 | |
| | neural networks | 2 | |
| | BI architecture. The reasons for the introduction of BI | 2 | |
| | BI platforms and their characteristics | 2 | |
| | Big Data | 2 | |
| | BI trends, tools, and technology | 2 | |
| | Second midterm exam | | |
| | List of laboratory exercises | | LE hours |
| | Advanced BI analysis (OLAP, and PowerPivot) | | 4 |
| | Preparing the environment for Data Mining (DM) exercises<br>Preprocessing of data for Data Mining | | 4 |

| | | |
|---|---|---|
| | Association rules | 2 |
| | Data clustering | 2 |
| | Bayesian networks | 2 |
| | Decision trees | 2 |
| | Neural networks | 4 |
| | Knowledge data flow | 2 |
| | Comparison of the machine learning methods results | 4 |

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

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

| | |
|---|---|
| Grading and evaluating student work in class and at the final exam | There are two midterms and final exams. The first midterm exam is after 7 weeks of lecturing and the second one is after the next 6 weeks of lecturing. Each midterm test consists of 5 to 10 theoretical questions and numerical problems. The final test consists of aprox. 10 theoretical questions and numerical problems. In the final exams students that did not pass the midterm exams take part. The midterms 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. After that the students take the oral exam.<br>Grade (in percentage) is formed according to the formula:<br>Grade(%) = 0,3 OE + 0,2 LE + 0,25 (M1 + M2)<br>the activities in percentage:<br>• OE – oral exam,<br>• LE – laboratory assessment,<br>• M1, M2 – test results. |

| Required literature (available in the library and via other media) | **Title** | **Number of copies in the library** | **Availability via other media** |
|---|---|---|---|
| | • S. Čelar: Authorised lectures, FESB | | e-learning portal |
| | • Brian Larson: Delivering Business intelligence. Microsoft ® SQL Server ™ 2008, McGrow Hill, ISBN: 978-0-07-154945-5, 2009. | | |
| | • Michael J. A. Berry, Gordon S. Linoff : Data Mining Techniques for Marketing, Sales, and Customer Relationship Management (Second Edition ), John Wiley & Sons, 2004 | | http:// www.data-miners.com/dmt_companion.htm |
| | • S. Čelar: Authorised instructions for laboratory exercises, FESB | | e-learning portal |

| | |
|---|---|
| Optional literature (at the time of | • Kantardzic, Mehmed: Data Mining: Concepts, Models, Methods, and Algorithms. John Wiley & Sons. ISBN 0471228524. OCLC 50055336, 2003 |

| | |
|---|---|
| submission of study programme proposal) | • Panian, Ž.; Klepac, G.: "Poslovna inteligencija", Masmedia, Zagreb, 2003. |
| Quality assurance methods that ensure the acquisition of exit competences | - Evaluation of results in accordance with the above learning outcomes<br>- Feedback from students via surveys<br>- Self-evaluation of teachers<br>- Institutional and non-institutional evaluations |
| Other (as the proposer wishes to add) | |

| NAME OF THE COURSE | COMPUTER GAMES PROGRAMMING | | | | | | |
|---|---|---|---|---|---|---|---|
| **Code** | FELK34 | Year of study | 1. | | | | |
| **Course teacher** | Jadranka Marasović, Ph.D., Full Professor | Credits (ECTS) | 5 | | | | |
| Associate teachers | Tea Marasović, Ph.D., Assistant Professor | Type of instruction (number of hours) | L | S | AE | LE | DE |
| | | | 30 | 0 | 0 | 30 | 0 |
| Status of the course | Elective | Percentage of application of e-learning | 0 | | | | |

**COURSE DESCRIPTION**

| | |
|---|---|
| Course objectives | Enabling students to acquire basic theoretical and practical knowledge on design and development of computer video games – from concept to final implementation – by working through different game examples, with emphasis placed on their programming. |
| Course enrolment requirements and entry competences required for the course | None |
| Learning outcomes expected at the level of the course (4 to 10 learning outcomes) | After completing this course, students will be able to:<br>- use Unity game development platform to create interactive 2D and 3D content;explain how the physics engine works;<br>- build a simple world using built-in primitive shapes, readily available assets and animated characters imported from 3D modelling programs;<br>- arrange and edit basic GUI elements;<br>- use C# programming language to set up basic game functionality;<br>- incorporate artificial intelligence in the game;<br>- make a simple computer video game and prepare it for publishing. |

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

| Course content | L hours | AE hours |
|---|---|---|
| Introduction. History of computer games. | 2 | 0 |
| General game development guidelines. | 2 | 0 |
| Getting started with Unity. Creating, editing and transforming objects. Materials and textures. | 2 | 0 |
| Scripting in Unity. | 2 | 0 |
| Designing the game's GUI: buttons, sliders, status bars and clocks. | 4 | 0 |
| Introduction to game physics. Rigid bodies. Collison detection and object interaction. Displaying results. | 2 | 0 |
| Adding sound effects and music. Working with cameras. | 2 | 0 |
| Particle systems. Skeletal animation basics. | 2 | 0 |
| Multi-player games. Tic Tac Toe. | 2 | 0 |
| Artificial intelligence in games. State machines. | 4 | 0 |
| Lighting the world. Creating the final build. | 2 | 0 |
| List of laboratory or design exercises | | LE hours |
| Making a simple game: Pong. | | 2 |
| Making a simple collection game. | | 2 |
| Maze game: Setting up basic functionality. | | 2 |
| Maze game: Animating objects in Unity. | | 2 |
| Maze game: Saving and loading the game. | | 2 |
| 3D puzzle game: Level design. Light maps. | | 2 |
| 3D puzzle game: Staging props. | | 2 |

| | | |
|---|---|---|
| | 3D puzzle game: Importing animated characters. Creating movement mechanics. | 4 |
| | 3D puzzle game: The game manager. | 2 |

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

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

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

During semester, there will be two mid-term exams – according to the class schedule – and/or a project assignment, depending on the agreement with the students. The requirement for the positive grade is the attendance and commitment at the laboratory exercises and a minimum of 40 percent correct answers at each mid-term.

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

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

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

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

| Required literature (available in the library and via other media) | **Title** | **Number of copies in the library** | **Availability via other media** |
|---|---|---|---|
| | 1. T. Marasović, J. Marasović; Authorized lectures | | e-Learning portal |

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

1. T. Miller; “Beginning 3D Game Programming“, Sams Publishing, 2004, ISBN: 0-672-32661-2.
2. K. C. Finney; “3D Game Programming All in One”, Premier Press, 2004. ISBN: 1-59200-136-X.
3. S. Blackman; “Beginning 3D Game Development with Unity”, Apress, 2011, ISBN: 978-1-4302-3422-7

**Quality assurance methods that ensure the acquisition of exit competences**

- Keeping records on class attendance
- Annual analysis of exam results
- Student survey on teaching performance
- Teacher self-evaluation
- Feedback information from graduates regarding course content relevancy

| | |
|---|---|
| Other (as the proposer wishes to add) | |

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

**COURSE DESCRIPTION**

| | | | |
|---|---|---|---|
| Course objectives | Training students for:<br>- understanding of basic principles and algorithms of computer graphics,<br>- understanding of computer graphics technologies,<br>- design and applications of computer graphics algorithms in C programming language and utilization of graphical libraries in programming.. | | |
| Course enrolment requirements and entry competences required for the course | None | | |
| Learning outcomes expected at the level of the course (4 to 10 learning outcomes) | Students will be able to:<br>- explain graphical pipeline,<br>- analyse basic algorithms of computer graphics, ,<br>- connect sequence of graphical transformations in order to achieve needed transformation for view,<br>- recommend type of shading and animation in order to achieve desired result,<br>- critical argue on possibilities and limitations of various display and hardcopy technologies,<br>- model simpler objects with computer modelling software tools, ,<br>- create simpler animations with software tools,<br>- create simpler computer programs for object presentation using graphical libraries. | | |
| Course content broken down in detail by weekly class schedule (syllabus) | Course content | L hours | AE hours |
| | Uvod | 2 | |
| | Image elements, vector and raster systems, interactive graphics concept | 2 | |
| | Basic algorithms of computer graphics | 2 | |
| | Primitives filling and clipping | 2 | |
| | Graphical hardware | 4 | |
| | Antialiasing | 2 | |
| | Geometric transformations | 2 | |
| | Objects in 3D space | 2 | |
| | Curves and surfaces | 3 | |
| | Lightning and shading | 3 | |
| | Animation | 2 | |
| | List of laboratory exercises | | LE hours |
| | Introducton to OpenGL | | 4 |
| | OpenGL exercise: Animation | | 2 |
| | OpenGL exercise: Textures | | 2 |
| | OpenGL exercise: Texture filters | | 2 |
| | OpenGL exercise: Ligthing and interaction | | 2 |
| | OpenGL exercise: Color blending | | 2 |

<table>
<tr><td></td><td colspan="5">OpenGL exercise: 3D</td><td>4</td></tr>
<tr><td></td><td colspan="5">Blender: modelling</td><td>4</td></tr>
<tr><td></td><td colspan="5">Blender: animation</td><td>4</td></tr>
<tr><td>Format of instruction</td><td colspan="3">☒ lectures<br>☐ seminars and workshops<br>☐ exercises<br>☐ on line in entirety<br>☐ partial e-learning<br>☐ field work</td><td colspan="3">☒ independent assignments<br>☒ multimedia<br>☒ laboratory<br>☐ work with mentor<br>☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">The presence on lectures in the amount of at least 70 % of the times scheduled. Performed all required laboratory exercises.</td></tr>
<tr><td rowspan="6">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>1,5</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Individual work</td><td>1,4</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>0,8</td><td>Laboratory exercises</td><td>0,5</td></tr>
<tr><td>Tests</td><td>0,2</td><td>Oral exam</td><td></td><td>Preparation for laboratory exercises</td><td>0,5</td></tr>
<tr><td>Written exam</td><td>0,1</td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td></td><td colspan="5"></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">There are two midterms and final exams. The first midterm exam is after 7 weeks of lecturing and the second one is after the next 6 weeks. In the final exams students are answering parts they did not pass in the midterms. The midterm and final exams are carried out as written tests and it lasts for max. 60 minutes.<br>The requirement for passing grade is 50% points on each midterm exam or final exam, written and accepted seminar work and positive assessment of laboratory exercises. In final grading (in percentage), each midterm exam contributes with max. 30%, seminar work with max. 30%, lab. exercises with max. 10% out of total possible points (30%+30%+30%+10%).<br><br>Final grade is formed in the following way:<br><br>Percentage Grade<br>50% to 61% sufficient (2)<br>62% to 74% good (3)<br>75% to 87% very good (4)<br>88% to 100% excellent (5)</td></tr>
<tr><td rowspan="2">Required literature (available in the library and via other media)</td><td colspan="3">Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td colspan="3">• T Papić, V.: Introduction to computer graphics, Faculty textbook, 2013. (in Croatian)</td><td></td><td>e-learning portal</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6">• J.D.Foley, A.Dam, S.K.Feiner, J.F.Hughes, Computer Graphics: Principles and Practice (second edition in C), Addison-Wesley Publishing Company, 1996.<br>• D.Hearn, M.P.Baker, Computer Graphics, C Version, Prentice Hall; 2nd edition, 1996.<br>• F.S.Hill, Jr. i S.M. Kelley, Computer Graphics Using OpenGL, 3rd edition, Pearson education, 2007.<br>• Shreiner, D., Woo, M., Neider, J., Davis, T., OpenGL vodič za programere, Kompjuter biblioteka, 2007.</td></tr>
</table>

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

| NAME OF THE COURSE | COMPUTER SCIENCE MODELS | | | | | | |
|---|---|---|---|---|---|---|---|
| **Code** | FELK02 | Year of study | 1 | | | | |
| **Course teacher** | Julije Ožegović, Ph.D., Full Professor | Credits (ECTS) | 5 | | | | |
| Associate teachers | Marina Prvan, Teaching Assistant | 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:<br>- Course provides advanced theoretical knowledge of automata, grammars and languages as basis of computer science core. | | |
| 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:<br>- organize lexical, syntactical i semantic analysis<br>- implement and evaluate deterministic finite automata<br>- create and justify non-deterministic finite automata<br>- shape regular expressions<br>- present pumping lemma<br>- generate Chomsky and Greibach normal forms<br>- develop pushdown automata<br>- evaluate Turing machines and unrestricted grammars<br>- evaluate linear bounded automata<br>- systematize automata and language classes | | |
| | Course content | L hours | AE hours |
| | Language processors. | 2 | 0 |
| | Deterministic finite automata. Minimization. | 2 | 2 |
| | Non-deterministic and epsilon-non-deterministic finite automata. | 3 | 2 |
| | Finite automat with output. | 1 | 1 |
| | Regular languages, Regular expressions, properties. | 2 | 2 |
| | Pumping lemma. | 1 | 0 |
| | Regular grammars. | 3 | 2 |
| | Context-free grammars. Ambiguity. Grammar simplification. | 2 | 2 |
| | Chomsky and Greibach normal forms. | 2 | 2 |
| | Pushdown automata. Transformations. | 2 | 2 |
| | Turing machine. Properties. | 2 | 0 |
| | Unrestricted productions grammars. Recursive languages. | 2 | 0 |
| | Computability and decidability. | 1 | 0 |
| | Context sensitive languages. Linear bounded automata. | 2 | 0 |
| | Language complexity. Languages classification by complexity. | 3 | 0 |
| | List of laboratory or design exercises | | LE hours |
| | Deterministic finite automata. | | 2 |
| | DFA software implementation. | | 2 |
| | Regular grammar. | | 2 |
| | Regular expressions with application (RegExp). | | 2 |

| | | |
|---|---|---|
| | Context free languages. | 2 |
| | Pushdown automata synthesis. | 2 |
| | Turing machine. | 2 |

| | | |
|---|---|---|
| Format of instruction | ☒ lectures<br>☐ seminars and workshops<br>☒ exercises<br>☐ *on line* in entirety<br>☐ partial e-learning<br>☐ field work | ☒ independent assignments<br>☐ multimedia<br>☒ laboratory<br>☐ work with mentor<br>☐ (other) |
| Student responsibilities | Attend all forms of teaching, pass ingress and egress tests, perform 100% laboratory exercises, pass preliminary exams or full exam (numeric and theory). | |

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

| | |
|---|---|
| Grading and evaluating student work in class and at the final exam | Continuous assessment: laboratory tests, practical tests, knowledge tests, preliminary exams. Exam: written and oral (numeric and theory) as unity. |

| Required literature (available in the library and via other media) | **Title** | **Number of copies in the library** | **Availability via other media** |
|---|---|---|---|
| | 1. Srbljić, Siniša.: Jezični procesori 1, Element, Zagreb, 2002. | | |
| | | | |
| | | | |
| | | | |
| | | | |

| | |
|---|---|
| Optional literature (at the time of submission of study programme proposal) | - Lecture notes: Ožegović, J., Modeli računarstv, continuously upgraded<br>- M. Prvan: Upute za laboratorijske vježbe, Internet |
| Quality assurance methods that ensure the acquisition of exit competences | - Lecture attending evidence<br>- Annual exam passing analysis<br>- Student feedback with teacher evaluation<br>- Teacher self-evaluation<br>- Graduated students feedback |
| Other (as the proposer wishes to add) | |

| NAME OF THE COURSE | CRYPTOGRAPHY AND NETWORK SECURITY | | | | | | |
|---|---|---|---|---|---|---|---|
| **Code** | FELK10 | Year of study | 1. | | | | |
| **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 | Mandatory | Percentage of application of e-learning | 0 | | | | |

**COURSE DESCRIPTION**

| | | | |
|---|---|---|---|
| Course objectives | The main objectives of the course are:<br>• provide students with insight into basic features and aspects of digital information protection by using cryptographic mechanisms<br>• present students with proven tools and mechanisms for the protection of digital information<br>• enable students to apply cryptographic mechanisms in real-world communication-information 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) | After successfully mastering the course, students will be able to:<br>• Explain key concepts of information security (confidentiality, integrity and availability)<br>• Explain the essential difference between ensuring integrity and confidentiality of messages<br>• Select appropriate / secure mechanisms to protect digital information<br>• Characterize the level of protection provided by IPsec and TLS protocols for the given configuration<br>• Establish a virtual private network (VPN) by using cryptographic protection at the network and transport level<br>• Recommend cryptographic mechanisms to protect confidentiality and integrity at the application level<br>• Integrate and use cryptographic libraries in their own software solutions<br>• Generate and manage digital certificates<br>• Design systems for authentication of users based on digital certificates<br>• Critically evaluate the security of information systems based on basic cryptographic primitives (AES, HMAC, CBC-MAC, DH, RSA etc.) | | |
| Course content broken down in detail by weekly class schedule (syllabus) | Course content | L hours | AE hours |
| | Introduction to Information Security (Security Threats, Basic Security Aims) | 2 | |
| | Cryptography based on the symmetric secret key (secret-key cryptography) | 2 | |
| | Basic Modes of Modern Codes (ECB, CBC, CFB, OFB, CTR mode) | 2 | |
| | Cryptography based on an asymmetric public key (public-key cryptography) | 4 | |
| | Authentication Functions (hash and MAC algorithms, digital signatures and digital public key certificates) | 4 | |
| | 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<br>☐ seminars and workshops<br>☐ exercises<br>☐ *on line* in entirety<br>☐ partial e-learning<br>☐ field work | ☐ independent assignments<br>☐ multimedia<br>☒ laboratory<br>☐ work with mentor<br>☐ (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.

| Required literature (available in the library and via other media) | **Title** | **Number of copies in the library** | **Availability via other media** |
|---|---|---|---|
| | Lecture notes and presentations | | e-learning portal |

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

- 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.

**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 | DATA WAREHOUSE | | | | | | |
|---|---|---|---|---|---|---|---|
| **Code** | FELK16 | Year of study | 1. | | | | |
| **Course teacher** | Stipo Čelar, Ph.D., Associate Professor | Credits (ECTS) | 5 | | | | |
| Associate teachers | | Type of instruction (number of hours) | L | S | AE | LE | DE |
| | | | 30 | | | 30 | |
| Status of the course | Elective | Percentage of application of e-learning | 0 | | | | |

**COURSE DESCRIPTION**

| | |
|---|---|
| Course objectives | Training students for:<br>- understanding of the role of Data Warehouse (DW) in information systems and business systems,<br>- understanding of the DW architecture,<br>- understanding and applying of dimensional data model,<br>- using DW environment,<br>- applying of small DW project. |
| Course enrolment requirements and entry competences required for the course | The students should previously pass one of the two courses<br>- *Databases* or<br>- understand the concept of relational database (if this course is emroled without passing of the above mentioned course). |
| Learning outcomes expected at the level of the course (4 to 10 learning outcomes) | Students will be able to:<br>- define the role, advantages and technologies of DW in information systems and business systems,<br>- identify and critically evaluate DW architectures for a small business system (up to 10 dimensions),<br>- design a dimensional model for a small business system,<br>- develop a whole DW project for a small business system,<br>- work as a part of a larger DW project team. |

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

| Course content | L hours | AE hours |
|---|---|---|
| Introduction to Data Warehouse (DW) | 2 | |
| DW technologies & environment | 2 | |
| DW architecture. Concepts. Cube. OLAP. Data Mart | 2 | |
| DW history and characteristics | 2 | |
| Business processes (introduction) | 2 | |
| ETL | 2 | |
| Dimensional model. Star schema vs. snowflake schema | 2 | |
| First midterm *pause* | | |
| Fact table. Examples | 2 | |
| Dimensional table. Surrogate keys. Examples | 2 | |
| DW projects and methodologies | 2 | |
| OLAP tools and analysis. CubePlayer | 2 | |
| Business Intelligence. Data Mining | 2 | |
| DW projects examples | 2 | |
| Second midterm *pause* | | |

| List of laboratory exercises | LE hours |
|---|---|
| Introduction to the work method. Defining of project teams | 2 |
| Installation and configuration of DW environment.<br>Business process (BP) selection | 4 |
| BP analysis – *short presentation* | 2 |
| DW architecture design | 2 |
| Dimensional model design – *logical design (short presentation)* | 4 |

| | | |
|---|---|---|
| | DW physical design | 2 |
| | DW detailed design (with data) | 4 |
| | OLAP cube | 4 |
| | Reporting – *short presentation* | 2 |

| | | |
|---|---|---|
| Format of instruction | ☒ lectures<br>☐ seminars and workshops<br>☒ exercises<br>☐ *on line* in entirety<br>☐ partial e-learning<br>☐ field work | ☒ independent assignments<br>☐ multimedia<br>☒ laboratory<br>☒ work with mentor<br>☐ (other) |
| Student responsibilities | The presence on lectures in the amount of at least 70 % of the times scheduled.<br>Well made (written material) and personally presented project. | |

| 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 | 0,8 | Practical training | 1 |
| | Experimental work | | Report | | Individual work | 1 |
| | Essay | | Seminar essay | | Laboratory exercises | 0,2 |
| | Tests | | Oral exam | 0,5 | Preparation for laboratory exercises | |
| | Written exam | | Project | 0,5 | (Other) | |

| | |
|---|---|
| Grading and evaluating student work in class and at the final exam | There is no midterms and final exams (tests). During the semester the students work on a practical project – they create your own Data Warehouse. The project is done in small project teams, under the professor's mentorship. The teams present their work on a project (business problem, concept, model, design, reports) several times in a semester.<br>The exam is taken individually or in small groups (project teams), carried out as practical oral exam (based on team's project). The exam is public and may be attended by all students who had passed it already.<br>Grade (in percentage) is formed according to the formula:<br><br>Grade(%) = 0,8 OE + 0,2 LE<br><br>the activities in percentage:<br>• OE – oral exam,<br>• LE – laboratory assessment (*written project material*). |

| Required literature (available in the library and via other media) | **Title** | **Number of copies in the library** | **Availability via other media** |
|---|---|---|---|
| | • S. Čelar: Authorised lectures, FESB | | e-learning portal |
| | • William Inmon: Building the Data Warehouse (2005) John Wiley and Sons, ISBN 978-81-265-0645-3 | | |
| | • Kimball, R., Ross, M.: The Data Warehouse Toolkit, The Definitive Guide to Dimensional Modeling, Third Edition, John Wiley & Sohns, 2013 | | |
| | • S. Čelar: Authorised instructions for laboratory exercises, FESB | | e-learning portal |

| | |
|---|---|
| Optional literature (at the time of submission of study programme proposal) | • Kimball, R., Ross, M.: The Data Warehouse Toolkit, The Complete Guide to Dimensional Modeling, Second Edition, Wiley Computer Publishing, 2002 |
| | • Todman, C.: Designing a Data Warehouse: Supporting Customer Relationship Management , 1st Edition, Prentice Hall PTR, ISBN: 0-13-089712-4, 2000 |
| Quality assurance methods that ensure the acquisition of exit competences | - Evaluation of results in accordance with the above learning outcomes<br>- Feedback from students via surveys<br>- Self-evaluation of teachers<br>- Institutional and non-institutional evaluations |
| Other (as the proposer wishes to add) | |

| NAME OF THE COURSE | DESIGNING AND USING COMPUTER NETWORKS | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | FELH20 | Year of study | 250: 1; 220: 2 | | | | | |
| **Course teacher** | Julije Ožegović; Ph.D., Full Professor | Credits (ECTS) | 5 | | | | | |
| Associate teachers | Vesna Pekić, Ph.D.<br>Ante Kristic, 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:<br>- Course provides advanced knowledge of computer 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:<br>- evaluate basic parts of computer network project<br>- design computer network project obeying investor's parameters<br>- evaluate structural cabling of computer network<br>- organize functionality of active and passive network equipment<br>- plan basic network services<br>- manage computer network<br>- argue computer network operational problems | | |
| Course content broken down in detail by weekly class schedule (syllabus) | Course content | L hours | AE hours |
| | Architecture and technology of local computer networks. | 2 | 0 |
| | Structural cabling architecture. | 2 | 0 |
| | Wired and optical local networks components. | 2 | 0 |
| | Implementation prerequisites and installation measurements. | 2 | 0 |
| | Project documentation organization and development. | 2 | 0 |
| | Network elements tagging system. | 2 | 0 |
| | Work groups as network project basis. | 2 | 0 |
| | Virtual local networks design and management. | 2 | 0 |
| | Internet protocols, IP addressing. | 2 | 0 |
| | Internet routing. | 2 | 0 |
| | Virtual private networks. | 2 | 0 |
| | Computer networks virtualization. | 2 | 0 |
| | Network services and functions. | 2 | 0 |
| | Network management. | 2 | 0 |
| | Computer network security projecting. | 2 | 0 |
| | List of laboratory or design exercises | | LE hours |
| | Structural cabling. | | 2 |
| | Data link measurements. | | 4 |
| | IP addressing and subnetworks. | | 4 |
| | TCP/IP protocol stack and routing. | | 2 |
| | Internet routing protocols. | | 4 |
| | Access lists, NAT, DHCP. | | 3 |
| | Switch management, STP. | | 3 |
| | VLAN management. | | 2 |
| | Wireless local networks. | | 2 |

<table>
<tr><td></td><td colspan="5">Complex network system implementation (final test)</td><td>4</td></tr>
<tr><td>Format of instruction</td><td colspan="3">☒ lectures<br>☐ seminars and workshops<br>☒ exercises<br>☐ on line in entirety<br>☐ partial e-learning<br>☐ field work</td><td colspan="3">☒ independent assignments<br>☐ multimedia<br>☒ laboratory<br>☐ work with mentor<br>☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Attend all forms of teaching, pass ingress and egress tests, perform 100% laboratory exercises, pass preliminary exams or full exam (numeric and theory).</td></tr>
<tr><td rowspan="6">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>1</td><td>Research</td><td></td><td>Practical training</td><td>1</td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Auditory exercises</td><td>0,5</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>Individual learning</td><td>2,5</td></tr>
<tr><td>Tests</td><td></td><td>Oral exam</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td></td><td colspan="5"></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">Continuous assessment: laboratory tests, practical tests, knowledge tests, preliminary exams. Exam: written and oral (numeric and theory) as unity.</td></tr>
<tr><td rowspan="6">Required literature (available in the library and via other media)</td><td colspan="3">Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td colspan="3">2. Turk, S.: Računarske mreže, Školska knjiga, Zagreb, 1991..</td><td></td><td></td></tr>
<tr><td colspan="3">3. Rožić, N.: Informacije i komunikacije: kodiranje s primjenama, Zagreb 1992</td><td></td><td></td></tr>
<tr><td colspan="3">4. Ožegović, J., Pezelj I. Projektiranje i upravljanje računalnim mrežama, Veleučilište u Splitu, 2000.</td><td></td><td></td></tr>
<tr><td colspan="3"></td><td></td><td></td></tr>
<tr><td colspan="3"></td><td></td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6">- Lecture notes: Ožegović, J., Projektiranje i korištenje računalnih mreža, continuously upgraded<br>- Upute za laboratorijske vježbe, Internet</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="6">- Lecture attending evidence<br>- Annual exam passing analysis<br>- Student feedback with teacher evaluation<br>- Teacher self-evaluation<br>- Graduated students feedback</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="6"></td></tr>
</table>

| NAME OF THE COURSE | DIGITAL COMMUNICATIONS | | | | | | |
|---|---|---|---|---|---|---|---|
| **Code** | FELK15 | Year of study | 2. | | | | |
| **Course teacher** | Joško Radić, Ph.D., Associate Professor | Credits (ECTS) | 5 | | | | |
| Associate teachers | Petar Šolić, Ph.D., Assistant Professor | Type of instruction (number of hours) | L | S | AE | LE | DE |
| | | | 30 | 0 | 0 | 30 | 0 |
| Status of the course | Elective | Percentage of application of e-learning | 0 | | | | |

**COURSE DESCRIPTION**

| | |
|---|---|
| Course objectives | Training students for:<br>- Understanding the structure of a digital communication system<br>- Application of analytical models necessary to understand the effects and the design of digital communication systems<br>- Analyse a simple communication system |
| Course enrolment requirements and entry competences required for the course | None |
| Learning outcomes expected at the level of the course (4 to 10 learning outcomes) | Students will be able to:<br>1. Explain the role of the filters in the transmitter and receiver<br>2. Analyze the properties of communication systems with redundant coding applied<br>3. Design transceiver filters for transmission without ISI<br>4. Explanation of the role of synchronization in a digital communication system<br>5. Select the corresponding ARQ system with respect to the parameters of the communication channel<br>6. Specify the topology of the communication network<br>7. Describe the switching in communication networks |

| Course content broken down in detail by weekly class schedule (syllabus) | Course content | L hours | AE hours |
|---|---|---|---|
| | Real channels Equalisation | 2 | 0 |
| | Nyquist filters, correlation filters, | 2 | 0 |
| | Linear and non-linear equalization, Nyquist signaling filters, | 2 | 0 |
| | Echo cancellation, scrambling, | 2 | 0 |
| | Parallel and serial, synchronous and asynchronous, simplex and duplex transmission, | 2 | 0 |
| | Synchronization of digital signals (clock, the frame and carrier) | 2 | 0 |
| | Redundant coding, block codes, | 2 | 0 |
| | First midterm exam | | |
| | Convolutional codes and turbo coding | 2 | 0 |
| | Space time coding | 2 | 0 |
| | BCH and Reed Solomon codes | 2 | 0 |
| | ARQ system, FEC systems, encryption and protocols, | 2 | 0 |
| | The topology of the network. networking groups and signaling | 2 | 0 |
| | Spatial and temporal switching | 2 | 0 |
| | 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 |

<table>
<tr><td></td><td colspan="5">Optimum receiver</td><td>2</td></tr>
<tr><td>Format of instruction</td><td colspan="3">☒ lectures<br>☐ seminars and workshops<br>☒ exercises<br>☐ on line in entirety<br>☐ partial e-learning<br>☐ field work</td><td colspan="3">☐ independent assignments<br>☐ multimedia<br>☒ laboratory<br>☐ work with mentor<br>☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">The presence on lectures in the amount of at least 70 % of the times scheduled.<br>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>2</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>Laboratory exercises</td><td>1</td></tr>
<tr><td>Tests</td><td>0,1</td><td>Oral exam</td><td></td><td>Preparation for laboratory exercises</td><td>1</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="6">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.<br>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:<br>Grade (%) = 0,5 * (0.5 * M1 + 0,5 * M2) + 0,5 * L;<br>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.<br>The final evaluation is determined as follows:<br>percentage Rating<br>50% to 61% is sufficient (2)<br>62% to 74% good (3)<br>75% to 87% of very good (4)<br>88% 100% Excellent (5)</td></tr>
<tr><td rowspan="4">Required literature (available in the library and via other media)</td><td colspan="3">Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td colspan="3">• J. Proakis: Digital Communication, IV. Ed.</td><td></td><td></td></tr>
<tr><td colspan="3">• S. Benedetto: Principles of digital transmission: with wireless application</td><td></td><td></td></tr>
<tr><td colspan="3">• L. W. Couch II: Digital and Analog Communication Systems</td><td></td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6"></td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="6">- Evaluation of results in accordance with the above learning outcomes<br>- Feedback from students via surveys<br>- Self-evaluation of teachers<br>- Institutional and non-institutional evaluations</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="6"></td></tr>
</table>

<table>
<tr><td>NAME OF THE COURSE</td><td colspan="6">DIGITAL IMAGE PROCESSING AND ANALYSIS</td></tr>
<tr><td>Code</td><td>FELK18</td><td>Year of study</td><td colspan="4">1</td></tr>
<tr><td>Course teacher</td><td>Damir Krstinić, Ph.D., Associate Professor<br>Darko Stipaničev, Ph.D., Full Professor</td><td>Credits (ECTS)</td><td colspan="4">5</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2">Maja Braović, Ph.D.</td><td rowspan="2">Type of instruction (number of hours)</td><td>L</td><td>S</td><td>AE</td><td>LE</td><td>DE</td></tr>
<tr><td>30</td><td></td><td></td><td>30</td><td></td></tr>
<tr><td>Status of the course</td><td>Elective</td><td>Percentage of application of e-learning</td><td colspan="4">30%</td></tr>
<tr><td colspan="7">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="6">Training students for:<ul><li>Understanding the biological and machine vision</li><li>Understanding acquisition, encoding and storage of digital image</li><li>Understanding and using of mathematicam model of digital image</li><li>Application of aritmetic, gemoetric and logical operations to manipulate and improve digital images</li><li>Understanding statistical parameters of digital images and extracting features useful for image interpretation</li><li>Application of mathematical operations for processing image sequences</li></ul></td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="6">Knowledge of mathematics</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="6">Students will be able to:<ul><li>Describe the principles of biological and machine vision</li><li>be aware of standards for retrieving, storage and transfer of digital images</li><li>understand the mathematical representation of digital image</li><li>understand and apply techniques for digital image analysis based on statistical features and image histogram</li><li>apply image processing techniques based on local features</li><li>describe and apply morphological operations on binary image</li><li>understand and apply method for object extracting based on image segmentation</li><li>understand methods for feature extraction</li><li>understand techniques for processing image sequences</li></ul></td></tr>
<tr><td rowspan="9">Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="4">Course content</td><td>L or S hours</td><td>AE hours</td></tr>
<tr><td colspan="4">Introduction to digital image processing and applications</td><td>2</td><td></td></tr>
<tr><td colspan="4">Biological and machine vision, basic concepts of the theory of vision</td><td>2</td><td></td></tr>
<tr><td colspan="4">CCD camera and conversion of an analogue to electrical signal. Standards: RGB, Y-C (SuperVHS), composite video signal (NTSC, PAL). System components for aquisition and digitalization of digital images</td><td>2</td><td></td></tr>
<tr><td colspan="4">The theory of digital images. Elements of digital images. Types of digital images. Color images in RGB and HSI color space. The mathematical representation of digital image. Storage of digital image. Histograms</td><td>2</td><td></td></tr>
<tr><td colspan="4">Processing of digital images: optimization, reconstruction and transformation</td><td>2</td><td></td></tr>
<tr><td colspan="4">Unary operations and LUT. Geometric operations</td><td>2</td><td></td></tr>
<tr><td colspan="4">Binary and multi-modal operations, arithmetic and logical operations on digital images.</td><td>2</td><td></td></tr>
</table>

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

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

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

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

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

| NAME OF THE COURSE | EMBEDDED SYSTEMS | | | | | | |
|---|---|---|---|---|---|---|---|
| **Code** | FELK12 | Year of study | 2 | | | | |
| **Course teacher** | Sven Gotovac, Ph.D., Full Professor | Credits (ECTS) | 5 | | | | |
| Associate teachers | Dunja Gotovac, Teaching Assistant | Type of instruction (number of hours) | L | S | AE | LE | DE |
| | | | 30 | | | 30 | |
| Status of the course | Obligatory | Percentage of application of e-learning | 0 | | | | |

**COURSE DESCRIPTION**

| | | | |
|---|---|---|---|
| Course objectives | Training students to:<br>1. Analyze and design embedded computing systems.<br>2. Create related software support.<br>3. Select and customize system support according to the system requirements<br>4. Select and match the circuits and software solution (hardware-software co-design)<br>5. Analyze complexity and system performance. | | |
| 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:<br>1. Design embedded computer system.<br>2. Design and build related software support.<br>3. Select and match the needs of system software support.<br>4. Analyze and evaluate overall system performance. | | |
| Course content broken down in detail by weekly class schedule (syllabus) | Course content | L hours | AE hours |
| | Introduction, Importance and scope of application of embedded computing systems. | 2 | |
| | Design methods of embedded computing systems | 2 | |
| | Tools for design of embedded computing systems. | 2 | |
| | Embedded systems hardware and their interconnections. | 2 | |
| | Microprocessor, microcontroller | 2 | |
| | Digital signal processors | 2 | |
| | Different peripherals and their interconnection | 2 | |
| | The interface problem is considered at the level of computer architecture, logic circuits, time diagrams, and protocols. | 2 | |
| | Connecting analog and digital systems. | 2 | |
| | Sensors and actuators | 2 | |
| | Software support for embedded computing systems. | 2 | |
| | Operating Systems of Embedded Systems. | 2 | |
| | Operating systems for real-time operation. | 2 | |
| | Hardware-software codesign. Examples. | 4 | |
| | List of laboratory or design exercises | | LE hours |
| | ARM and AVR microprocessors/microcontrollers. | | 6 |
| | Assembler programming | | 4 |
| | EMBEST IDE board, Raspberry PI board, Arduino board | | 4 |
| | Application for one of the boards | | 4 |
| | Project | | 12 |

<table>
<tr><td>Format of instruction</td><td colspan="3">☒ lectures<br>☒ seminars and workshops<br>☐ exercises<br>☐ on line in entirety<br>☐ partial e-learning<br>☐ field work</td><td colspan="3">☒ independent assignments<br>☒ multimedia<br>☒ laboratory<br>☐ work with mentor<br>☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">The presence on lectures in the amount of at least 70 % of the times scheduled. Performed all required laboratory exercises.</td></tr>
<tr><td rowspan="6">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>1</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Laboratory exercises</td><td>1</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>Preparation for laboratory exercises</td><td>0,5</td></tr>
<tr><td>Tests</td><td></td><td>Oral exam</td><td></td><td>Self-study</td><td>0,5</td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td>2</td><td></td><td></td></tr>
<tr><td colspan="6"></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">There are two midterms and final exams. The first midterm exam is after 7 weeks of lecturing and the second one is after the next 6 weeks. First midterm test lasts 60 minutes and consists of 5 to 7 theoretical questions and numerical problems, second midterm is practical example and final tests consist of 6 theoretical questions and numerical problems and example solving. 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:<br>Grade(%) = 0,33 LV + 0,33 (M1 + M2)<br>the activities in percentage:<br>• LV – laboratory assessment,<br>• M1, M2 – test results.<br><br>The final grade will be determined after the first test term by applying a relative ECTS grading system in accordance with the Regulations on the study and study system of the University of Split. The group of students who passed the exam is divided into four groups: 15% of the best gets the grade A (excellent), 35% of the following B (very good), the next 35% rating C (good), and the last 15% rating D, E ). A group of students who did not pass the exam gains FX score (additional work is required), or F (significant additional work is required). In accordance with the Rulebook for Exam, only two exam periods are organized in the exam period after the completion of classes.<br>According to Article 65 of the Statute of the Faculty, the student is obliged to participate in all forms of teaching and attend: lectures at least 70% of teaching hours and laboratory exercises 100% of teaching hours. If you do not meet these conditions, the student will not be able to access the exam</td></tr>
<tr><td>Required literature (available in the library and via other media)</td><td colspan="3">Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td></td><td colspan="3">• Wayne Wolf, Computers as Components Principles of Embedded Computing Systems Design, Morgan Kaufmann 2008.</td><td>1</td><td>Electronic copy On e-learning</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6">• Frank Vahid, Tony D. Givargis, Embedded System design: A Unified Hardware/Software Introduction, John Wiley 2001, ISBN 0-471-38678-2<br>• Qing Li, Caroline Yao, "Real-Time Concepts for Embedded Systems", Published by CMP Books, 2003. ISBN: 1-57820-124-1</td></tr>
</table>

| | |
|---|---|
| Quality assurance methods that ensure the acquisition of exit competences | 1. Class attendance records.<br>2. Evaluation of results in accordance with the above learning outcomes<br>3. Feedback from students via surveys<br>4. Self-evaluation of teachers<br>5. Feedback from students who have already graduated.<br>6. Institutional and non-institutional evaluations |
| Other (as the proposer wishes to add) | |

| NAME OF THE COURSE | FORENSIC ANALYSIS OF DIGITAL IMAGES | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | FELK36 | Year of study | 2 | | | | | |
| **Course teacher** | Damir Krstinić; Ph.D., Associate Professor | Credits (ECTS) | 5 | | | | | |
| Associate teachers | Maja Braović, Ph.D. | Type of instruction (number of hours) | L | S | AE | LE | DE | |
| | | | 30 | | | 30 | | |
| Status of the course | Elective | Percentage of application of e-learning | 40% | | | | | |

**COURSE DESCRIPTION**

| | | | |
|---|---|---|---|
| Course objectives | • understanding the process of acquisition, encoding and storage of digital images<br>• detailed knowledge of formats of digital images and compression techniques with and withouth loss of information<br>• understanding the structure of digital data , introduction to techniques for digital data analysis, the ability to notice patterns and anomalies in the digital data<br>• understanding mathematical methods in image processing, extracting global and local features of the digital image, implementing methods for image manipulation<br>• acquiring knowledge needed for forensic analysis of digital photography, abbility to identify the origin, confirm authenticity and detect manipulation of the digital photography. | | |
| Course enrolment requirements and entry competences required for the course | Completed undergraduate study in the field of Computing or Electrical Engineering and Information technology | | |
| Learning outcomes expected at the level of the course (4 to 10 learning outcomes) | Students will be able to:<br>perform forensic analysis of digital records in order to detect irregularities in digital files<br>analyze digital photohraphy to verify the authenticity of the photography<br>apply forensic methods to determine source of the photography and identify equipment used for photography acquisition<br>perform forensic analysis to detect manipulation in the photograhy<br>apply methods for manipulation of digital photography<br>search and analyze the scientific literature in the field of digital image processing and forensic analysis of digital photography. | | |
| Course content broken down in detail by weekly class schedule (syllabus) | Course content | L hours | AE hours |
| | Introduction to digital photography: the acquisition of digital photography, optical filters, antialiasing, CFA mosaic filters, conversion of analogue optical signal into digital electrical signal, CCD and CMOS sensors, quantization | 2 | |
| | Analysis of digital image: a mathematical model of digital image, color spaces, histograms, histogram transformation, gamma correction | 2 | |
| | Digital image formats: raw formats, compression without information loss, compression with informatin loss, standard formats of digital images (JPEG, PNG, GIF, BMP, TIFF) | 2 | |
| | Structural analysis of digital files: global structure of digital record, hexadecimal dana, EXIF record, MAC times | 2 | |
| | Source identification techniques: detecting the type of device used for image acquisition, identification of device manufacturer and model | 2 | |

| | | | |
|---|---|---|---|
| | Forensic analysis of camera sensor: PRNU pattern – the unique fingerprinf of each individual sensor, defective pixels | 2 | |
| | Assesment of the integrity of digital image: authentication of the digital photographym, detecting traces of the manipulation of digital photography | 2 | |
| | Preliminary exam | 2 | |
| | Detecting manipulation by structural analysis of digitla photography: analysis of light intensity, tone and color saturation analysis, quantization tables, compression level analysis | 2 | |
| | JPEG format analysis: chromatic and luminescence components, DCT coefficients, frequency domain | 2 | |
| | Forensic analysis of JPEG blocks, compression ration, detecting ghosts in JPEG photos | 2 | |
| | Local structure analysis: detection of manipulated areas in digital photography, detection of glued elements, cloned sample detection, inconsistent color aberration | 2 | |
| | Preliminary exam | 2 | |
| | List of laboratory or design exercises | | LE hours |
| | Analysis and processing of digital images, histograms, gamma correction | | 2 |
| | Convolution and correlation, nonlinear filters | | 2 |
| | Digital image formats, compression, JPEG format encoding | | 4 |
| | Structural analysis of digital files | | 2 |
| | EXIF dana | | 2 |
| | Forensic detection of the source of digital photography | | 4 |
| | Forensic evaluation of the quthenticity of digital photography | | 4 |
| | Detection of inconsitencies in JPEG dana | | 4 |
| | Cloning of samples, bonding elements | | 2 |
| | Double edge detection | | 2 |
| | Counter forensic: hiding the traces of manipulation of digital photography | | 2 |

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

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

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

| | Title | Number of copies in the library | Availability via other media |
|---|---|---|---|
| Required literature (available in the library and via other media) | H. T. Sencar, N. Memon, Digital Image Forensics, ISBN: 978-1-4614-0756-0, Springer, 2013 | | |
| | J. C. Russ, Forensic Uses of Digital Imaging, ISBN: 9781498733076, CRC Press, 2016. | | |
| | A. K. Jain, Fundamentals of Digital Image Processing, ISBN: 0-13-336165-9, Prentice Hall Int., London, 1989. | | |
| | B. Jahne, Digital Image Processing, ISBN: 978-3-662-11565-7, Springer-Verlag, Berlin, 1991. | | |
| Optional literature (at the time of submission of study programme proposal) | W. B. Pennebaker, J. L. Mitchell, JPEG: Still Image Data Compression Standard, ISBN 978-0-442-01272-4, Springer US, New York, 1993.<br><br>D. Taubman, M. Marcellin, JPEG2000 Image Compression Fundamentals, Standards and Practice, ISBN 978-1-4615-0799-4, Springer, 2002. | | |
| Quality assurance methods that ensure the acquisition of exit competences | • Evaluation of resutls in accordance with the above learning outcomes<br>• Feedback from student via surveys<br>• Self-evaluation of teachers<br>• Institutional and non-institutional evaluations | | |
| Other (as the proposer wishes to add) | | | |

| NAME OF THE COURSE | GEOGRAPHIC INFORMATION SYSTEMS | | | | | | |
|---|---|---|---|---|---|---|---|
| **Code** | FELK32 | Year of study | 1 | | | | |
| **Course teacher** | Marjan Sikora, Ph.D., Assistant Professor | Credits (ECTS) | 5 | | | | |
| Associate teachers | | Type of instruction (number of hours) | L | S | AE | LE | DE |
| | | | 30 | | | 30 | |
| Status of the course | Elective | Percentage of application of e-learning | 10 | | | | |

| COURSE DESCRIPTION | | | |
|---|---|---|---|
| Course objectives | Training students for:<br>- understanding and application of basic principles of spatial data<br>- design and setting up of GIS systems<br>- performing the analysis of spatial data | | |
| 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:<br>- define the laws and types of spatial data,<br>- apply design techniques for GIS systems<br>- perform the input and georeferencing of spatial data<br>- determine the correct cartographic projection<br>- create a map using GIS system<br>- perform the spatial dana analysis<br>- create and install the distributed GIS system | | |
| Course content broken down in detail by weekly class schedule (syllabus) | Course content | L hours | AE hours |
| | Introduction to class | 2 | |
| | Introduction to GIS, three examples of GIS systems | 2 | |
| | Spatial data models, generalization | 2 | |
| | Spatial data characteristics | 2 | |
| | Modeling of spatial data | 2 | |
| | GIS software | 2 | |
| | Project planning | 2 | |
| | Georeferencing | 2 | |
| | Data acquisition | 2 | |
| | Cartography | 2 | |
| | Spatial data analysis | 2 | |
| | Spatial data and the object model | 2 | |
| | Project realization | 2 | |
| | List of laboratory or design exercises | | LE hours |
| | Introduction | | 2 |
| | GIS software basics | | 2 |
| | GIS data bases | | 2 |
| | Spatial data visualization | | 2 |
| | Data classification | | 2 |
| | Labeling | | 2 |
| | Georeferencing | | 2 |
| | Cartographic projections | | 2 |
| | Data base creation | | 2 |

| | | |
|---|---|---|
| | Data input | 2 |
| | Data editing | 2 |

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

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

| | |
|---|---|
| Grading and evaluating student work in class and at the final exam | Each student joins the project team that consists of 2-3 members. Each project team must deliver the project plan (PP), the input data report (IUP), map (K), distributed GIS (DG) and final report (ZI). Team members present their project (PR) and the final grade is the result of:<br><br>Grade (%) = 0,3 DG + 0,3 K + 0,15 PR + 0,15 ZI + 0,05 PP + 0,05 IUP |

| | **Title** | **Number of copies in the library** | **Availability via other media** |
|---|---|---|---|
| Required literature (available in the library and via other media) | • Maguire, D. J.; Goodchild, M. F.; Rhind, D. W., Geographical information systems and Science, John Wiley and Sons, Ltd., 2005. | 1 | |
| | • Galati, S.R.: Geographic Information Systems Demystified, Artec House, Inc., 2006. | | |
| | • Tutić, D.; Vučetić, N.; Lapaine, M., Uvod u GIS, Sveučilište u Zagrebu, Geodetski fakultet, 2002. | | |

| | |
|---|---|
| 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<br>- Feedback from students via surveys<br>- Self-evaluation of teachers<br>- Institutional and non-institutional evaluations |
| Other (as the proposer wishes to add) | |

| NAME OF THE COURSE | GRID COMPUTING SYSTEMS | | | | | | |
|---|---|---|---|---|---|---|---|
| **Code** | FELK11 | Year of study | 2. | | | | |
| **Course teacher** | Eugen Mudnić, Ph.D., Assistant Professor | Credits (ECTS) | 5 | | | | |
| Associate teachers | | Type of instruction (number of hours) | L | S | AE | LE | DE |
| | | | 30 | 0 | 30 | | |
| Status of the course | Obligatory | Percentage of application of e-learning | 0 | | | | |

**COURSE DESCRIPTION**

| | |
|---|---|
| Course objectives | Training students for<br>- Understanding and application of Grid computing systems.<br>- Further evolving of knowledge and skills for design and use of distributed computing systems. |
| Course enrolment requirements and entry competences required for the course | Previously taken courses : Distributed computing systems, Programming languages. |
| Learning outcomes expected at the level of the course (4 to 10 learning outcomes) | Students will be able to:<br>- Determine applicability of grid computing for different computational tasks.<br>- Install and use virtualized computer environments.<br>- Install and use Grid computing system.<br>- Write and execute complex jobs in Grid environment.<br>- Determine job costs and performance in Grid environment. |

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

| Course content | L hours | AE hours |
|---|---|---|
| Introduction to Grid systems. Technological background of Grid computing. | 2 | 2 |
| Grid architecture and functionality. | 2 | 2 |
| Grid systems classification. | 2 | 2 |
| Virtualization and Grid systems. | 2 | 2 |
| Grid data management – functions, requirements | 2 | 2 |
| Replication and efficient data management. | 2 | 2 |
| Metadata in Grid systems | 2 | 2 |
| Job brokering for Grid systems. | 2 | 2 |
| First midterm exam | | |
| Job scheduling algorithms for parallel computers | 2 | 2 |
| Job scheduling algorithms for meta-computers | 2 | 2 |
| HTCondor - distributed parallelization of computationally intensive tasks | 2 | 2 |
| Grid security | 2 | 2 |
| Cloud computing systems | 2 | 2 |
| Second midterm exam | 2 | 2 |
| List of laboratory exercises | | LE hours |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

<table>
<tr><td>Format of instruction</td><td colspan="6">☒ lectures<br>☐ seminars and workshops<br>☒ exercises<br>☐ on line in entirety<br>☐ partial e-learning<br>☐ field work</td><td colspan="6">☒ independent assignments<br>☒ multimedia<br>☐ laboratory<br>☐ work with mentor<br>☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="12">The presence on lectures in the amount of at least 70 % of the times scheduled.</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">Class attendance</td><td>1,7</td><td colspan="2">Research</td><td></td><td colspan="2">Practical training</td><td></td></tr>
<tr><td colspan="3">Experimental work</td><td></td><td colspan="2">Report</td><td></td><td colspan="2">Individual work</td><td>2,0</td></tr>
<tr><td colspan="3">Essay</td><td></td><td colspan="2">Seminar essay</td><td></td><td colspan="2">Laboratory exercises</td><td>0,0</td></tr>
<tr><td colspan="3">Tests</td><td>0,2</td><td colspan="2">Oral exam</td><td></td><td colspan="2">Preparation for laboratory exercises</td><td>0,0</td></tr>
<tr><td colspan="3">Written exam</td><td>0,1</td><td colspan="2">Project</td><td>1,0</td><td colspan="2">(Other)</td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="12">There are two midterms and final exams. The first midterm exam is after 7 weeks of lecturing and the second one is after the next 6 weeks. Each midterm test consists of 20 questions and final tests consist of 20 theoretical questions and numerical problems. In the final exams students that did not pass the midterm exams take part. The midterm and final exams are carried out as written tests. The requirement for passing grade is 50 % points on each midterm exam or the final exam. Final grade (in percentage) is formed according to the formula:<br>Grade(%) = 0.1 NP + 0.45 (M1 + M2)<br>the activities in percentage:<br>• NP - attendance at lectures,<br>• M1, M2 – test results.</td></tr>
<tr><td rowspan="2">Required literature (available in the library and via other media)</td><td colspan="8">Title</td><td colspan="2">Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td colspan="8">• E. Mudnić: Authorised Lectures, FESB</td><td colspan="2"></td><td>e-learning portal</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="12">Introduction to Grid Computing, Frédéric Magoulès, Jie Pan, Kiat-An Tan, Abhinit Kumar, CRC Press, Taylor & Francis Group, 2009</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="12">- Evaluation of results in accordance with the above learning outcomes<br>- Feedback from students via surveys<br>- Self-evaluation of teachers<br>- Institutional and non-institutional evaluations<br>- Feedback from graduated students</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="12"></td></tr>
</table>

| NAME OF THE COURSE | HUMAN COMPUTER INTERACTION | | | | | | |
|---|---|---|---|---|---|---|---|
| **Code** | FELK01 | Year of study | 1. | | | | |
| **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 | Mandatory | Percentage of application of e-learning | 0 | | | | |

**COURSE DESCRIPTION**

| | | | |
|---|---|---|---|
| Course objectives | The main objectives of the course are:<br>• provide students with insight into the basics of interaction design between man and computer<br>• present students with proven techniques for deploying and improving user interfaces<br>• enable students to apply system design procedures in order to develop user-friendly 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) | After successfully mastering a course, students will be able to:<br>• explain the relevance of the methodical approach to design of user interfaces<br>• explain the notion of a good design<br>• apply the iterative process of creating and evaluating user interfaces<br>• identify the users and tasks that the interface must support<br>• justify the development of low fidelity prototypes prior to development of the final interface<br>• create and evaluate low- and hi-fidelity prototypes of user interfaces<br>• evaluate user interfaces using cognitive walkthrough techniques<br>• evaluate user interfaces by heuristic evaluation<br>• justify the appropriate visual design based on the basic principles of the visual design | | |
| Course content broken down in detail by weekly class schedule (syllabus) | Course content | L hours | AE hours |
| | Introductory considerations. Human and Computer Interaction. User Interface. | 2 | |
| | Psychology and design of everyday things | 2 | |
| | Understanding Users and Their Tasks | 2 | |
| | Development of interactive computer systems | 2 | |
| | Task / user / focused design process | 2 | |
| | Man and technology / computer: human interaction | 4 | |
| | First midterm exam | | |
| | Models of human behavior in interaction with a computer | 2 | |
| | The process of interactive system development: iteration of design and evaluation | 2 | |
| | Designing a user interface. Principles and Design Guidelines | 2 | |
| | Evaluating the user interface. Definition of usability | 2 | |
| | Models of human behavior in interaction with a computer | 2 | |
| | Implementation and production of prototypes | 2 | |
| | Second midterm exam | | |

| | List of laboratory exercises | LE hours |
|---|---|---|

| | | |
|---|---|---|
| | Introduction to HCI Methods (design heuristics, Prototype Design, Evaluation) | 4 |
| | Work on the project | 22 |
| | Presentation of projects | 4 |

| | | |
|---|---|---|
| Format of instruction | ☒ lectures<br>☐ seminars and workshops<br>☐ exercises<br>☐ *on line* in entirety<br>☐ partial e-learning<br>☐ field work | ☒ independent assignments<br>☐ multimedia<br>☒ laboratory<br>☒ work with mentor<br>☐ (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 project.<br><br>The final grade is formed as follows:<br>Grade = Round[ 0,05 P + 0,35 PR + 0,25 M1 + 0,55 M2 ]<br>where:<br>• P – is a grade based on attendance at lectures,<br>• PR – a grade earned during laboratory exercises,<br>• M1, M2 – test results.<br><br>NOTE: If a student fails a given task (P, PR, M1, M2), the corresponding grade is set to 0 in the above formula. |

| Required literature (available in the library and via other media) | **Title** | **Number of copies in the library** | **Availability via other media** |
|---|---|---|---|
| | Lecture notes and presentations | | e-learning portal |

| | |
|---|---|
| Optional literature (at the time of submission of study programme proposal) | • Dix A., Finaly J., Abowd G. D., Beale R.: Human-Computer Interaction, 3rd, Pearson, Prentice Hall, 2004.<br>• Nielsen J.: Usability Engineering, AP Professional, 1993.<br>• Norman D.: The Psychology of Everyday Things, Basic Books, 1988. |
| Quality assurance methods that ensure the acquisition of exit competences | - Evaluation of results in accordance with the above learning outcomes<br>- Feedback from students via surveys<br>- Self-evaluation of teachers<br>- Institutional and non-institutional evaluations |
| Other (as the proposer wishes to add) | |

<table>
<tr><td>NAME OF THE COURSE</td><td colspan="6">MULTIMEDIA SYSTEMS</td></tr>
<tr><td>Code</td><td>FELK08</td><td>Year of study</td><td colspan="5">2.</td></tr>
<tr><td>Course teacher</td><td>Mladen Russo, 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">Jelena Čulić, mag. ing.<br>Martina Bašić, mag. ing.</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>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:<br>- understanding of multimedia systems and virtual reality<br>- knowledge of the properties and methods for generating speech, audio, image and video signals (including 3D images and video)<br>- understanding of the most important algorithms for compressing speech, audio, image and video signals</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="6">None.</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="6">Students will be able to:<br>- describe the basic principles of human speech, hearing and vision<br>- explain the basic principles of psychoacoustics and their application in compression of audio signals<br>- demonstrate the frequency masking effect<br>- define the most important algorithms for compression of speech, audio, image and video signals<br>- demonstrate the basic mechanisms of JPEG compression</td></tr>
<tr><td rowspan="12">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. History of multimedia systems. Basic terms. Overview of multimedia software tools. Design of multimedia applications.</td><td>2</td><td>0</td></tr>
<tr><td colspan="4">Audio signal. How humans hear and speak. Speech modelling.</td><td>2</td><td>0</td></tr>
<tr><td colspan="4">Generic compression techniques for audio signals. Audio specific algorithms (mp3).</td><td>2</td><td>0</td></tr>
<tr><td colspan="4">Speech specific algorithms (LPC, CELP, RELP, MPE, RPE) and applications in mobile telephony. Review of standards for encoding speech and audio signals.</td><td>2</td><td>0</td></tr>
<tr><td colspan="4">Color in images and video signal. The perception of color (how people perceive electromagnetic radiation). Theory of mixing colors.</td><td>2</td><td>0</td></tr>
<tr><td colspan="4">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).</td><td>2</td><td>0</td></tr>
<tr><td colspan="4">Basics of video and television. Analog television and video. Digital television and video. Video formats and memory requirements.</td><td>2</td><td>0</td></tr>
<tr><td colspan="4">Image compression. JPEG modes.</td><td>2</td><td>0</td></tr>
<tr><td colspan="4">Video compression: H.261. H.263.</td><td>2</td><td>0</td></tr>
<tr><td colspan="4">Video compression: MPEG-1. MPEG -2.</td><td>2</td><td>0</td></tr>
</table>

| | | | |
|---|---|---|---|
| | 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<br>☐ seminars and workshops<br>☒ exercises<br>☐ *on line* in entirety<br>☐ partial e-learning<br>☐ field work | ☐ independent assignments<br>☐ multimedia<br>☒ laboratory<br>☐ work with mentor<br>☐ (other) |
| Student responsibilities | The presence on lectures in the amount of at least 70 % of the times scheduled.<br>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.<br>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:<br>Grade(%) = 0,5*M1+0,5*M2; M1, M2 – midterm test results.<br>The final grade is determined as follows:<br>Percentage Grade<br>50% to 61% sufficient (2)<br>62% to 74% good (3)<br>75% to 87% very good (4)<br>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** |
| | • H. Dujmić: Multimedijski sustavi, internal script | 1 | e-learning portal |
| Optional literature (at the time of submission of study programme proposal) | • Steinmetz, Nahrstedt: "Multimedia Fundamentals: Media Coding and Content Processing", Prentice Hall, 2002<br>• Rao, Bojkovic, Milovanovic: "Multimedia Communication Systems: Techniques, Standards and Networks", Prentice Hall, 2002 | | |
| Quality assurance methods that ensure the acquisition of exit competences | - Evaluation of results in accordance with the above learning outcomes<br>- Feedback from students via surveys<br>- Self-evaluation of teachers<br>- Institutional and non-institutional evaluations | | |
| Other (as the proposer wishes to add) | | | |

<table>
<tr><td>NAME OF THE COURSE</td><td colspan="6">NETWORK AND MOBILE OPERATING SYSTEMS</td></tr>
<tr><td>Code</td><td>FELJ35</td><td>Year of study</td><td colspan="4">2.</td></tr>
<tr><td>Course teacher</td><td>Josip Lörincz, Ph.D., Assistant professor</td><td>Credits (ECTS)</td><td colspan="4">5</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2">Dinko Begušić, Ph.D., Full Professor<br>Ante Dagelć, mag. ing. comp.</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 (university graduate programme, 242)<br>- Optional (university graduate programme, 250, 220, 241)</td><td>Percentage of application of e-learning</td><td colspan="4">10%</td></tr>
<tr><td colspan="7">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="6">Training students for:<br>• knowledge of the structure and working mode of network and mobile operating systems,<br>• knowledge of the application possibilities of network and mobile operating systems and cloud computing,<br>• ability to configure networks and network devices,<br>• knowledge of application development techniques for network and mobile platforms,<br>• knowledge of basic techniques of virtualization.</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="6">Basic computer skills.<br>Basic knowledge of English.<br>Knowledge of basic principles of programming.<br>Knowledge of basic protocols in telecommunications.</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:<br>- define basic terms and concepts of network and mobile operating systems,<br>- express the basic terms and concepts of cloud computing,<br>- distinguish between different types of wireless communication networks and protocols,<br>- apply the concept of virtualization of computer systems,<br>- configure the network and mobile devices,<br>- analyse the possibilities of mobile applications and apply the network and mobile operating systems as well as tools for application development on mobile platforms,<br>- develop applications for network and mobile platforms,<br>- continuously monitor the progress in the development of network and mobile operating systems and their applications.</td></tr>
<tr><td rowspan="7">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">General characteristics and classification of operating systems</td><td>2</td><td></td></tr>
<tr><td colspan="4">Android operating system</td><td>2</td><td></td></tr>
<tr><td colspan="4">Mobility in communications systems (GSM, UMTS, LTE systems)</td><td>2</td><td></td></tr>
<tr><td colspan="4">Communication networks and protocols (multiplexing, OSI model, TCP / IP protocol)</td><td>2</td><td></td></tr>
<tr><td colspan="4">Computer languages and hierarchical structures of network and mobile operating systems</td><td>2</td><td></td></tr>
<tr><td colspan="4">Software middleware and basic characteristics of network and mobile operating systems (multiprocessing)</td><td>2</td><td></td></tr>
</table>

| | | | |
|---|---|---|---|
| | 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<br>☒ seminars and workshops<br>☐ exercises<br>☐ *on line* in entirety<br>☐ partial e-learning<br>☐ field work | ☐ independent assignments<br>☐ multimedia<br>☒ laboratory<br>☐ work with mentor<br>☐ (other) | |

<table>
<tr><td>Student responsibilities</td><td colspan="6">The conditions for overall positive assessment are:<br><br>• positive assessment of laboratory exercises (above 50 %)<br>• minimum presence during 70% of overall class teaching time in a semester,<br>• presence on laboratory exercises during 100% of overall laboratory exercise time in a semester,<br>• Submitted and presented seminar work,<br>• 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.<br><br>Rating (%) = 0.1PL + 0.2SW + 0,2LA + 0.25 (M1 + M2)<br>PL – presence on the lectures (expressed in percentage),<br>LA- grades from laboratory assessment (expressed in percentage),<br>SW - seminar work grades (expressed in percentage),<br>M1, M2- the 1st and 2nd mid-term exam grades or final exam grades (expressed in percentage),<br><br>The final grade is determined as follows:<br>percentage Rating<br>50% to 61% is sufficient (2)<br>62% to 74% good (3)<br>75% to 87% of very good (4)<br>88% 100% Excellent (5)<br><br>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.<br><br>Examinations:<br>1st Final exam<br>2nd Final exam<br>3rd Final (correctional) exam<br>4th Final (correctional) exam<br>5th Final (commission) exam (organized only based on decision of Faculty council in specific academic year)</td></tr>
</table>

<table>
<tr><td rowspan="4">Required literature (available in the library and via other media)</td><td>Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td>Josip Lorincz, Network and mobile operating systems, FESB Split, internal teaching text, 2016.</td><td></td><td>e-learning portal</td></tr>
<tr><td>Josip Lorincz, Ante Dagelić: Laboratory Exercises for course network and mobile operating systems, FESB Split, internal teaching text, 2015.</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">1. Operating Systems Concepts Essentials, A. Silberschatz, P.B. Galvin, G. Gagne, John Wiley and Sons, Inc., 2011<br>2. Operacijski sustavi, L. Budin, Element d.o.o., 2011<br>3. Internet</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<br>- Feedback from students via surveys<br>- Self-evaluation of teachers<br>- Institutional and non-institutional evaluations<br>- Feedback from graduated students 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 | NEURAL NETWORKS AND GENETIC ALGORITHMS | | | | | | |
|---|---|---|---|---|---|---|---|
| **Code** | FELK21 | Year of study | 1 | | | | |
| **Course teacher** | Damir Vučina, Ph.D., Full Professor<br>Igor Pehnec, Ph.D., Assistant Professor | Credits (ECTS) | 5 | | | | |
| Associate teachers | Ivo Marinić- Kragić, mag. ing. | Type of instruction (number of hours) | L | S | AE | LE | DE |
| | | | 30 | 0 | 0 | 30 | 0 |
| Status of the course | Elective | Percentage of application of e-learning | 0 | | | | |

**COURSE DESCRIPTION**

| | |
|---|---|
| Course objectives | Theoretical and applied knowledge. Methods of genetic algorithms and neural networks, related methods and other metaheuristics. Modeling and applications in solving engineering problems.<br>Examples of algorithms with different operators in C- language and MATLAB. |
| Course enrolment requirements and entry competences required for the course | Mathematics, Programming (B.Sc.) |
| Learning outcomes expected at the level of the course (4 to 10 learning outcomes) | After completing the course the students will be able to:<br>- formulate the engineering problem for solving using NNs and GAs<br>- model the set of decision variables, constraints and excellence functions<br>- draft flowcharts for different methods<br>- apply evolutionary methods and metaheuristics (GA; ACO, SA, NN) to engineering problems<br>- apply feed-forward NNs as surrogate models<br>- develop and apply different training methods for FF NNs<br>- develop and test own models and methods in MATLAB |

| Course content broken down in detail by weekly class schedule (syllabus) | Course content | L hours | AE hours |
|---|---|---|---|
| | Introduction, GA basic algorithms. Basic operators. | 2 | |
| | Coding genes and representation. Population generation. Fitness. Scaling, norming. | 2 | |
| | Various operators for selection, crossover, mutation. | 2 | |
| | Advanced and special operators, elite and segregation operators, directed crossover, subpopulations, migrations | 2 | |
| | Operators for network problems. | 2 | |
| | Other metaheuristic search algorithms with and without constraints. Ant collonies. Particle swarm. Tabu search. Simulated annealing. | 2 | |
| | Applications of GAs, seminars | 2 | |
| | First midterm exam | | |
| | - Basic NM algorithm. Biological model and analogies. | 2 | |
| | - Basic terms and structure of FF networks. Neurons, links and synaptic weights. | 2 | |
| | Activation functions. Network output. Concept of training. | 2 | |
| | NM training, terms and formalization. Error minimization. Backpropagation algorithm. | 2 | |
| | Advanced training algorithms. Overfitting. | 2 | |
| | Modeling and application with engineering problems. Examples of algorithms with different operators in C and MATLAB. | 2 | |

| | | |
|---|---|---|
| | Second midterm exam | |
| | List of laboratory exercises | LE hours |
| | Matlab framework for Gas and evolutionary algorithms. | 4 |
| | Workflows in Modefrontier. | 2 |
| | Coding genes and representation. Population generation. Fitness. Scaling, norming. Various operators for selection, crossover, mutation. | 2 |
| | Solving network problems using GAs. | 2 |
| | Metaheuristic search algorithms with and without constraints. Ant collonies. Particle swarm. Tabu search. Simulated annealing. | 2 |
| | Applications of GAs, seminars | 2 |
| | NN workflows in Matlab and Modefrontier. | 2 |
| | Basic NM algorithm. Biological model and analogies | 2 |
| | NM training. Error minimization. Advanced training algorithms. Overfitting. | 2 |
| | Modeling and application with engineering problems. Examples of algorithms in Modefrontier. | 2 |
| | Modeling and application with engineering problems. Examples of algorithms in MATLAB. | 2 |
| | Examples of application in engineering and modeling | 2 |

| | | |
|---|---|---|
| Format of instruction | ☒ lectures<br>☐ seminars and workshops<br>☒ exercises<br>☐ *on line* in entirety<br>☐ partial e-learning<br>☐ field work | ☐ independent assignments<br>☐ multimedia<br>☒ laboratory<br>☐ work with mentor<br>☐ (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 |
| | Essay | | Seminar essay | | Laboratory exercises | |
| | Tests | | Oral exam | | Preparation for laboratory exercises | |
| | Written exam | | Project | | (Other) | |

| | |
|---|---|
| Grading and evaluating student work in class and at the final exam | There are two midterms and final exams. The first midterm exam is after 7 weeks of lecturing and the second one is after the next 6 weeks. Each midterm test consists of respective theoretical questions and numerical problems. The final tests consist of overall 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:<br>Grade(%) = 0,5 (M1 + M2)<br>the activities in percentage:<br>• M1, M2 – test results. |

<table>
<tr><td rowspan="4">Required literature (available in the library and via other media)</td><td>Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td>- Goldberg, D.E., "Genetic algorithms in search, optimization and machine learning", Addison Wesley, 1989.</td><td></td><td></td></tr>
<tr><td>- Haykin, S., "Neural Networks", Prentice Hall International, 1999.</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">- Vučina, D., "Metode inženjerske numeričke optimizacije, Sveučilište u Splitu, FESB 2005.<br>- Coello, C.C., "Evolutionary Algorithms for Solving Multiobjective Problems", Springer, 2007.<br>- Baeck, T., Fogel, D.B., Michalewicz, Z., "Evolutionary Computation 1: Basic Algorithms and Operators", "Evolutionary Computation 2: Advanced Algorithms and Operations", Taylor and Francis, 2000.<br>- Andersson, J.A., "An Introduction to Neural Networks", MIT Press 1995.<br>- Mathworks: "Neural Networks Toolbox"<br>- Mathworks: "Genetic Algorithm and Direct Search Toolbox"<br>- Belegundu, A. D., Chandrupatla, T. R., "Optimization Concepts and Applications in Engineering", Prentice Hall, 1999.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">- Evaluation of results in accordance with the above learning outcomes<br>- Feedback from students via surveys<br>- Self-evaluation of teachers<br>- 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 | NUMERICAL ANALYSIS | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | FEMK01 | Year of study | 1 | | | | | |
| **Course teacher** | Ivan Slapničar, Ph.D., Full Professor | Credits (ECTS) | 5 | | | | | |
| Associate teachers | Lana Periša<br>Anita Carević | Type of instruction (number of hours) | L | S | AE | LE | DE | |
| | | | 30 | | 30 | | | |
| Status of the course | Obligatory | Percentage of application of e-learning | 20 | | | | | |

**COURSE DESCRIPTION**

| | |
|---|---|
| Course objectives | Training students for:<br>- understanding concepts and skills of numerical analysis: error analysis of computer aruthmetics, solving systems of linear equations, polynomial interpolation, splines, least squares method, numerical integration, solving nonlinear equations, solving digfferential equations,<br>- applications of the above concepts to natural sciences and engineering. |
| Course enrolment requirements and entry competences required for the course | |
| Learning outcomes expected at the level of the course (4 to 10 learning outcomes) | Students will be able to:<br>- perform analysis of numerical algorithms and estimate backward and forward stability,<br>- estimate duration of the algorithm,<br>- explain main ideas behibnd numerical methods,<br>- derive basic numerical mathods and illustrate their properties by examples,<br>- write simple computer programs for numerical methods in some of higler-level languages (Matlab or Julia),<br>- find and use computer programs for numerical mathods available on Internet and critically estimate their properties,<br>- choose appropriate numerical methods and apply own or third party computer programs for solving engineering problems. |

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

<table>
<tr><td></td><td colspan="6"></td></tr>
<tr><td>Format of instruction</td><td colspan="3">x lectures<br>☐ seminars and workshops<br>x exercises<br>☐ on line in entirety<br>☐ partial e-learning<br>☐ field work</td><td colspan="3">x independent assignments<br>☐ multimedia<br>☐ laboratory<br>☐ work with mentor<br>☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Regular attendence to and active participation in lectures and excercises.</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>Self study</td><td>2</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td>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 semester two mid-term exams are held. The first exam is scheduled after 7 weeks of lectures, and the second in the week following the lectures. At each mid-term exam students can get 40 points, while the remaining 20 points are attained through assignements during lectures and excercises. The condition for passing the course is minimum 20 points on each mid-term exams and a total of at least 50 points. After semester, two final exams and two correction exams are held.<br><br>Students which did not pass one mid-term exam, can take only this part of the exam during final exams.<br><br>Students which did not pass any mid-term exam, take the final exam with comprehensive course content. In that case, masimum numbers of available points is 80. The condition for passing the course is minimum 40 points in the final exam and a total of at least 50 points. The grade is formed as follows:<br>85 and more points - excellent (5),<br>75-84 points - very good (4),<br>60-74 points - good (3), and<br>50-59 points - sufficient (2).<br><br>Students who did not pass the course after final exams, and have obtained total of at leat 10 points, can attend corrections exam. On the correction exam maximal number of points is 80, and the minimum requirement for a passing grade is minimum of 40 points in the exam and a total of at least 50 points.<br><br>Mid-term exams, final exams and correction exams are held according to the exam schedule.</td></tr>
</table>

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

| NAME OF THE COURSE | OPTIMIZATION METHODS | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | FELK06 | Year of study | 1. | | | | | |
| **Course teacher** | Jadranka Marasović, Ph.D., Full Professor | Credits (ECTS) | 5 | | | | | |
| Associate teachers | Martina Bašić, mag.img. | Type of instruction (number of hours) | L | S | AE | LE | DE | |
| | | | 30 | 0 | 0 | 30 | 0 | |
| Status of the course | Obligatory | Percentage of application of e-learning | 0 | | | | | |

**COURSE DESCRIPTION**

| | | | |
|---|---|---|---|
| Course objectives | Training students for:<br>To enable students using examples to understand the importance of optimimal solutions for engineering practice and research. By gaining knowledge through basic concepts of optimization, the necessary theoretical knowledge about different approaches can be achieved, about mathematical and heuristic methods, about the fastest and organized search for optimal solutions, too. To enable students to acquire practical knowledge, user-oriented, on the need for software solutions and precision interface in order to work independently to obtain optimal solutions. Examples from everyday life are used. | | |
| 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:<br>1. iimplement models of different systems, quantitative (math) and qualitative (graphs, tables, text) models,<br>2. apply mathematical conversion to the original models and to understand the purpose of these conversions in the application of known methods of optimization, if the solutions and methods for the original model do not exist,<br>3. describe the difference between defined mathematical optimization methods and search methods and describe the impossibility of finding a universal method of solving,<br>4. pick and sort out the proper method of optimization based on model,<br>5. apply the results optimum analysis on the appropriate practices,<br>6. calculate the strategic optimum,<br>7. solve independently complex tasks of optimizing where it is necessary to combine several methods. | | |
| Course content broken down in detail by weekly class schedule (syllabus) | Course content | L hours | AE hours |
| | Introduction: Systems approach and purpose and power of modeling (in the analysis and understanding of systems acting and in the problems with the synthesis of the "living" systems). The model is an approximation of the system. Modeling is an iterative process during which resolves a compromise between complex models and quality of approximation. | 2 | 0 |
| | Quantitative models and diffferences of the systems characteristics: deterministic, stochastic, static, dynamic, continuous, discrete, linear and nonlinear. The selection of input and output variables and their impact on the complexity of the model. Physical, economic and other laws as a basis for building models. Qualitative models. | 2 | 0 |
| | The impact of constraints on the behavior of the system and how to add them to the original model - space of solutions. Objective function as an indicator of optimality. | 2 | 0 |

| | | | |
|---|---|---|---|
| | Optimal is not perfect - depends on objective function,on constraints and on methods of solving. Multidisciplinary approach as the main feature of all tasks optimization. | | |
| | Operations research, history and way of thinking with the tasks of optimization.<br>Mathematical conversions and mathematical operations - basic ideas used through the orientation in space of solutions and seeking optimum. | 2 | 0 |
| | Linear static models. The standardization of models. Problems with unbounded spaces solutions (infinite limits). | 2 | 0 |
| | Simplex algorithm - one of 10 the best algorithms of the 20th century. Examples of solving. The meaning of optimality criteria and feasibility criteria. | 2 | 0 |
| | Qualitative models - poorly structured models. Heuristics. Search. Branching (Branch and Bound method). | 2 | 0 |
| | Transport problem. Methods seeking basic possible solutions and methods of seeking improved solution to the optimum - the basics of search. | 2 | 0 |
| | Transport problems with ambiguous warehouses (transshipment problem) | 2 | 0 |
| | 0-1 Programming. Backpack problem (loading / unloading). Travelling salesperson. | 2 | 0 |
| | Game theory and optimal strategic decisions-making. | 2 | 0 |
| | Nonlinear Programming: mathematical procedures that can create problems to resolve and seek optimum. It is essential to create characteristic search, which can become complicated, but can unexpectedly diverge. Basic information are what, why and how to keep it under control. | 2 | 0 |
| | Graph theory. Modeling events and activities. Optimization tasks modeled using graph theory (CPM method - Critical Path Method). Software solutions such tasks. | 2 | 0 |
| | List of laboratory or design exercises | | LE hours |
| | Postoptimal analysis, the reasons for its implementation to the optimal results from the practice. | | 2 |
| | Sensitivity analysis of optimal solutions depending on the change of the coefficients of the objective function. Examples. | | 2 |
| | Sensitivity analysis of optimal solutions depending on the change of the coefficient from the right side of constraints. Examples. | | 2 |
| | Preparing for use of already created software solutions with examples of linear programming, data for software: input and output | | 2 |
| | Integer programming: the need and ways to search for such solutions in linear programming. Examples. | | 2 |
| | A simple example of solving linear programming tasks - solving using already created software on a digital computer and "hand-made mathematical solutions". | | 2 |
| | Testing problems of parameters sensitivity, solving tasks using already created software on a digital computer and "hand-made mathematical solutions". | | 2 |
| | Solving simple example of dual Simplex, using digital computer and graphics solutions. | | 2 |
| | The application of the dual simplex in practice with the example of optimal cutting shape, minimization of material thrown.<br>The use of linear programming tasks in automation systems. | | 2 |
| | Solving examples of optimal transport of goods between several towns in Croatia - the basic transport problem. | | 2 |
| | Solving examples of optimal transport of goods between several cities in Croatia - ambiguous warehouses. | | 2 |
| | Illustration "the power of models" in the example of problem-solving scheduling (students - classrooms). The problem layout, basically 0-1 | | 2 |

<table>
<tr><td></td><td colspan="6">programming can be mathematically translated into a form of transport problems and dealt with using "its" program.</td><td></td></tr>
<tr><td></td><td colspan="6">Problem solving traveling salesman, optimal touring several cities in Croatia.</td><td>2</td></tr>
<tr><td>Format of instruction</td><td colspan="3">☒ lectures<br>☐seminars and workshops<br>☐ exercises<br>☐on line in entirety<br>☐partial e-learning<br>☐field work</td><td colspan="3">☒ independent assignments<br>☐ multimedia<br>☒ laboratory<br>☐work with mentor<br>☒ seminar essay (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Minimum of 70 percent lecture attendance. Completing all the required laboratory exercises.</td></tr>
<tr><td rowspan="5">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>1.5</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Individual work</td><td>0.5</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>1</td><td>Laboratory exercises</td><td>1</td></tr>
<tr><td>Tests</td><td>0.5</td><td>Oral exam</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>0.5</td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">During the semester there will be two mid-term exams (tests). The first mid-term will be held during class (according to the calendar), and the other colloquium after the end of classes. Individual colloquium will be considered passed if it achieved 40% correct answers, or total points achieved that give a positive evaluation must be at least 50% correct.<br><br>It is necessary during the semester to resolve homework and seminars to be recognized (enrolled) score achieved by tests and exams.<br><br>The final grade is determined based on the total number of points earned, which is calculated as follows (Including laboratory exercises points, M3)<br><br>Grade [%] = 0.45 * M1 + 0.45*M2 + 0,1*M3<br><br>Percentage Grade<br>50% to 61% sufficient (2)<br>62% to 74% good (3)<br>75% to 87% very good (4)<br>88% to 100% excellent (5)<br><br>The final exam encompasses the entire course load or selected parts of it that students' did not pass at either of mid-term exams. The correction exam encompasses the entire course load. The requirement for passing the exam is minimum of 50 percent correct answers. The exams are held according to the class schedule.</td></tr>
</table>

<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>J.Marasović: “Introduction in Operations Research“ (in Croatian: Uvod u operacijska istraživanja, Authorized lectures, FESB, 2000.</td><td></td><td>e-learning portal</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">- T.B. Boffey: “Graph Theory in Operations Research”, McMillan Press, Hong Kong, 1982.<br>- R. Bronson, G. Naadimuthu: “Operations Research”, Schaum’s Outline of Operations Research, McGraw Hill, 1998.<br>- H.A. Taha: “Operations Research: An Introduction”, Prentice Hall, 1997</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">- Keeping records on class attendance<br>- Annual analysis of exam results<br>- Student survey on teaching performance<br>- Teacher self-evaluation<br>- Feedback information from graduates regarding course content relevancy</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="3"></td></tr>
</table>

| NAME OF THE COURSE | PARALLEL PROGRAMMING | | | | | | |
|---|---|---|---|---|---|---|---|
| **Code** | FELK35 | Year of study | 2 | | | | |
| **Course teacher** | Tamara Grujić, Ph.D., Full Professor | Credits (ECTS) | 5 | | | | |
| Associate teachers | Ana Kuzmanić Skelin, Ph.D., Assistant Professor | Type of instruction (number of hours) | L | S | AE | LE | DE |
| | | | 30 | | | 30 | |
| Status of the course | Elective | Percentage of application of e-learning | | | | | |

**COURSE DESCRIPTION**

| | | | |
|---|---|---|---|
| Course objectives | Training students:<br>- to develop an understanding of basic aspects of parallel computing<br>- to understand main parallel programming techniques and common software packages/libraries | | |
| Course enrolment requirements and entry competences required for the course | Programming in C | | |
| Learning outcomes expected at the level of the course (4 to 10 learning outcomes) | Students will be able to:<br>- explain fundamental concepts of parallelism<br>- identify algorithms which would benefit parallelization for performance enhancement<br>- implement simple parallel algorithms | | |
| Course content broken down in detail by weekly class schedule (syllabus) | Course content | L hours | AE hours |
| | Introduction to Parallel Programming. Overview of basic computing systems and parallel programming concepts. | 2 | n/a |
| | Types of parallelism. | 2 | n/a |
| | Programming environments for parallel computing. Extensions to traditional languages. | 4 | n/a |
| | Programming structures, types, operators, functions. Introduction to programming GPUs for general-purpose computing tasks | 4 | n/a |
| | General-purpose GPU programming. GPU vs. CPU. Programming concepts. GPU techniques. | 4 | n/a |
| | Performance analysis: CPU and GPU implementation of parallel programming solutions. | 4 | n/a |
| | Examples study: sorting, reduction, matrix operations, image processing, video processing, histograms | 4 | n/a |
| | Different parallel algorithm implementation | 2 | n/a |
| | List of laboratory or design exercises | | LE |
| | Examples of Open Multiprocessing (OpenMP). | | 4 |
| | MPI model. Examples of MPI programs. | | 6 |
| | GPU programming with CUDA C/C++. | | 6 |
| | Work on independent assignments | | 14 |
| Format of instruction | ☒ lectures<br>☐ seminars and workshops<br>☒ exercises<br>☐ *on line* in entirety<br>☐ partial e-learning<br>☐ field work | ☒ independent assignments<br>☐ multimedia<br>☒ laboratory<br>☒ work with mentor<br>☐ (other) | |

<table>
<tr><td>Student responsibilities</td><td colspan="6">At least 70% attendance of the scheduled lecture hours is required.<br>All laboratory assignments must be completed. Independent assignments must be completed and demonstrated.</td></tr>
<tr><td rowspan="5">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>1</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Laboratory exercises</td><td>2</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>1.5</td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td>0.25</td><td>Oral exam</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>0.25</td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">There are two midterm exams and final exam. The first midterm exam is after 7 weeks of lecturing and the second one is after next 6 weeks. Students that did not pass the midterm exams take part in final exam. Midterm exams and final exam will be performed as written test in duration of 90 minutes.<br><br>The requirement for passing grade is at least 50% of total points of midterm exams or final exam, passing grade in laboratory exercises and individual assignment. Grade (in percentage) is formed according to the formula:<br>Grade(%) =0,4(M1 + M2) + 0,2L<br>the activities in percentage:<br>• M1, M2 – test results<br>• LV – laboratory assessments and independent assignments</td></tr>
<tr><td rowspan="3">Required literature (available in the library and via other media)</td><td colspan="3">Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td colspan="3">• A. Grama, G. Karypis, V. Kumar, A. Gupta: Introduction to Parallel Computing, 2nd Edition. Addison-Wesley, 2003.</td><td></td><td>Teacher/ intranet</td></tr>
<tr><td colspan="3">• David B. Kirk and Wen-mei W. Hwu: Programming Massively Parallel Processors: A Hands-on Approach. Morgan Kaufmann, 2nd Edition, Elsevier, 2012.</td><td></td><td>Teacher/ intranet</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6">- J. Sanders, E. Kandrot: CUDA by example. Addison-Wesley, 2011.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="6">- Evaluation of results in accordance with learning outcomes<br>- Feedback from students via surveys<br>- Self-evaluation of teachers<br>- Institutional and non-institutional evaluations</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="6"></td></tr>
</table>

<table>
<tr><td>NAME OF THE COURSE</td><td colspan="7">PROFESSIONAL TRAINING</td></tr>
<tr><td>Code</td><td>FEXX06</td><td colspan="2">Year of study</td><td colspan="3">2</td></tr>
<tr><td>Course teacher</td><td>Head of the professional training from the Faculty</td><td colspan="2">Credits (ECTS)</td><td colspan="3">5</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2">Head of the professional training from the private institution</td><td colspan="2" rowspan="2">Type of instruction (number of hours)</td><td>L</td><td>S</td><td>AE</td><td>LE</td><td>DE</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Status of the course</td><td>Elective</td><td colspan="2">Percentage of application of e-learning</td><td colspan="3"></td></tr>
<tr><td colspan="8">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="7">Training students for:<br>- consolidating theoretical knowledge and practical skills in solving highly complex engineering problems<br>- acquaintance with the organization, work and business of the receiving institution,<br>- solving practical problems,<br>- inclusion in the labour market,<br>- writing technical reports</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="7">Acquired 120 ECTS credits</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="7">Students will be able to:<br>- consolidate theoretical knowledge and practical skills in solving problems<br>- use literature, databases and other sources of information<br>- select appropriate methods and procedures for solving practical problems<br>- apply technical knowledge and skills to effectively solve engineering problems<br>- prepare a written report on the work results</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="7">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.</td></tr>
<tr><td>Format of instruction</td><td colspan="3">☐ lectures<br>☐ seminars and workshops<br>☐ exercises<br>☐ on line in entirety<br>☐ partial e-learning<br>☒ field work</td><td colspan="4">☒ independent assignments<br>☐ multimedia<br>☐ laboratory<br>☒ work with mentor<br>☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="7">Independent work</td></tr>
<tr><td rowspan="6">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td></td><td>Research</td><td></td><td>Practical training</td><td colspan="2">4</td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Independent work</td><td colspan="2"></td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>Report writing</td><td colspan="2">1</td></tr>
<tr><td>Tests</td><td></td><td>Oral exam</td><td></td><td>(Other)</td><td colspan="2"></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td>(Other)</td><td colspan="2"></td></tr>
</table>

<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<br>- Self-evaluation of the head of professional training<br>- 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 | PROGRAMMING AGENTS | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | FELK17 | Year of study | 2 | | | | | |
| **Course teacher** | Maja Štula, Ph.D., Full Professor | Credits (ECTS) | 5 | | | | | |
| Associate teachers | | Type of instruction (number of hours) | L | S | AE | LE | DE | |
| | | | 30 | | | 30 | | |
| Status of the course | Elective | Percentage of application of e-learning | 20% | | | | | |

**COURSE DESCRIPTION**

| | |
|---|---|
| Course objectives | Training students for:<br>- Acquiring knowledge on methodologies and tools for design and development on multi-agent systems<br>- Acquiring deep knowledge on programming frameworks for multi-agent systems development<br>- Acquiring basic knowledge necessary for design, management and deployment of multi-agent systems |
| Course enrolment requirements and entry competences required for the course | None |
| Learning outcomes expected at the level of the course (4 to 10 learning outcomes) | Students will be able to:<br>- Explain differences between multi-agent systems architecture<br>- Implement multi-agent programming paradigm<br>- Use JADE and NetLogo frameworks<br>- Solve complex user requirements to multi-agent systems<br>- Explain pros of using multi-agent approach in developing applications |

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

| Course content | L hours | AE hours |
|---|---|---|
| Agents. Examples of agents, intelligent agents, agents and objects. | 2 | 0 |
| Using JADE framework | 8 | 0 |
| Using agent-based models (ABM) | 2 | 0 |
| Agent types and architectures. | 2 | 0 |
| Knowledge presentation and formalization, ontologies, content languages. | 2 | 0 |
| Using NetLogo framework | 4 | 0 |
| Agent communication language. Communication definition and models.<br>Interaction protocols. | 8 | 0 |
| Multi-agent systems application area, organisation definition and interaction | 2 | 0 |

| List of laboratory or design exercises | LE hours |
|---|---|
| Simple JADE application | 4 |
| Developing ABM in JADE | 4 |
| Implementing different agent types | 4 |
| Building own ontology | 4 |
| Simple NetLogo application | 2 |
| Design multi-agent system | 2 |
| Define multi-agent system organisation and interaction | 2 |
| Implement designed system in JADE framework | 8 |

<table>
<tr><td>Format of instruction</td><td colspan="6">☒ lectures<br>☐ seminars and workshops<br>☒ exercises<br>☐ on line in entirety<br>☒ partial e-learning<br>☐ field work</td><td colspan="2">☒ independent assignments<br>☐ multimedia<br>☒ laboratory<br>☐ work with mentor<br>☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="8">The presence on lectures in the amount of at least 70 % of the times scheduled. Performed and uploaded on e-learning portal all required laboratory exercises and home works.</td></tr>
<tr><td rowspan="5">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>2</td><td>Research</td><td></td><td>Practical training</td><td>1</td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>1</td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td>0,5</td><td>Oral exam</td><td>0,5</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="8">There are two midterms and final exams duration of 90 minutes. The first midterm exam is after 7 weeks of lecturing and the second one is after the next 6 weeks. In the final exams students that did not pass the midterm exams take part. The requirement for passing grade is 50 % points on each midterm exam or the final exam. Grade (in percentage) is formed according to the formula:<br>Grade(%) = (M1 + M2)/2<br>the activities in percentage:<br>• M1, M2 – test results.</td></tr>
<tr><td rowspan="5">Required literature (available in the library and via other media)</td><td colspan="5">Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td colspan="5">Ferber J., Multi-agent Systems, An Introduction to Distributed Artificial Intelligence, Addison-Wesley, England, 1999.</td><td>1</td><td></td></tr>
<tr><td colspan="5">Wooldridge M., Jennings N., Intelligent Agents: Theory and Practice, Knowledge Engineering Review, Vol. 10, No. 2, Cambridge University Press, 1995</td><td></td><td></td></tr>
<tr><td colspan="5"></td><td></td><td></td></tr>
<tr><td colspan="5"></td><td></td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="8"></td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="8">- Students’ surveys for teacher evaluation<br>- Students attendance track<br>- Annual statistic on passed exam</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="8">Feedback from potential employers on students employability</td></tr>
</table>

| NAME OF THE COURSE | PROGRAMMING LANGUAGES AND COMPILERS | | | | | | |
|---|---|---|---|---|---|---|---|
| **Code** | FELK05 | Year of study | 1. | | | | |
| **Course teacher** | Ivo Mateljan, Ph.D., Full Professor<br>Marjan Sikora, Ph.D., Assistant Professor | Credits (ECTS) | 5 | | | | |
| Associate teachers | Marjan Sikora, Ph.D., Assistant Professor | 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 | 0 | | | | |

**COURSE DESCRIPTION**

| | |
|---|---|
| Course objectives | Training students for:<br>- Understanding of imperative, OOP, functional and logic programing languages<br>- Understanding of lexical analysis and LL(1) and LR(1) parsing<br>- Use of compiler generators programs: ELL, LEX and YACC |
| 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:<br>- Understand programming in assembler, imperative, OOP, functional and logic programing languages<br>- Define language grammar with BNF and EBNF<br>- Make recursive descent parser<br>- Make parser using ELL parser generator<br>- Make lexical analyser using program LEX<br>- Make LR(1) parser using program YACC<br>- Define program structures for compilers: symbol tables and AST<br>- Define attributed grammar and semantic actions<br>- Make simple interpreter<br>- Define assembler code for source code translation |

| Course content broken down in detail by weekly class schedule (syllabus) | Course content | L hours | AE hours |
|---|---|---|---|
| | History and elements of programming languages | 2 | |
| | Lexical, syntatic and semantic analysis | 2 | |
| | Recursive descent parser | 2 | |
| | Embedding semantic analysis | 2 | |
| | Lexical analysis and DFA | 2 | |
| | Generators of LL and LR table driven parsers | 2 | |
| | Attributed grammar | 2 | |
| | Structures for semantic analysis | 2 | |
| | Assembler and run-time structures | 2 | |
| | Introduction to code generation | 2 | |
| | Functional languages – Scheme | 2 | |
| | Logical language – Prolog | 2 | |
| | Script languages | 2 | |
| | List of laboratory or design exercises | | LE hours |
| | Intepreter of mathematical expressions | | 2 |
| | Using LEX | | 2 |
| | Using YAC | | 2 |
| | Interpreter design using LEX and YACC | | 2 |
| | Writing assembler program | | 2 |

| | | |
|---|---|---|
| | Code generation for C—language | 2 |
| | Writing Scheme program | 2 |
| | Writing Prolog program | 2 |

| | | |
|---|---|---|
| Format of instruction | ☒ lectures<br>☒ seminars and workshops<br>☒ exercises<br>☐ *on line* in entirety<br>☒ partial e-learning<br>☐ field work | ☒ independent assignments<br>☐ multimedia<br>☐ laboratory<br>☐ work with mentor<br>☐ (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 | | Progr. Exercise | 0.5 |
| | Tests | | Oral exam | | Exercise test | 0.2 |
| | Written exam | 0.1 | Project | 0.2 | | |

| | |
|---|---|
| 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:<br>Grade(%) = 0,1 SR + 0,1 LV + 0,8 UI<br>the activities in percentage:<br>• SR – seminar,<br>• LV – laboratory assessment,<br>• 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: Prevoditelji i interpreteri, skripta, FESB, 2004 | | Internet |
| | LEX – manual, UNIX | | Internet |
| | YACC – manual, UNIX | | Internet |

| | |
|---|---|
| Optional literature (at the time of submission of study programme proposal) | Aho, Sethi, Ullman: Compilers - Principles, Techniques and Tools, Adison Wesley, 1986.<br>A. Appel: Modern Compiler Implementation in C, Cambridge University Press, 1997 |
| Quality assurance methods that ensure the acquisition of exit competences | - Evaluation of results in accordance with the above learning outcomes<br>- Feedback from students via surveys<br>- Self-evaluation of teachers<br>- Institutional and non-institutional evaluations |
| Other (as the proposer wishes to add) | |

| NAME OF THE COURSE | PROGRAMMING MOBILE ROBOTS AND DRONES | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | FELH40 | Year of study | 2. | | | | | |
| **Course teacher** | Mirjana Bonković, Ph.D., Full Professor<br>Josip Musić, Ph.D., Assistant Professor | Credits (ECTS) | 5 | | | | | |
| Associate teachers | Miroslav Dujmović, BSc (external collaborator) | Type of instruction (number of hours) | L | S | AE | LE | DE | |
| | | | 30 | 0 | 0 | 30 | 0 | |
| Status of the course | Elective | Percentage of application of e-learning | 0 | | | | | |

| COURSE DESCRIPTION | | |
|---|---|---|
| Course objectives | Training students for:<br>- understanding basic working principles and limitations of individual robot components (actuators, sensors and control units).<br>- understanding and applying number of different techniques for solving problems in the robotics domain such as control and navigation, as well as programming robot/drone to perform desired task. | |
| Course enrolment requirements and entry competences required for the course | None | |
| Learning outcomes expected at the level of the course (4 to 10 learning outcomes) | Students will be able to:<br>- describe basic mobile robot and drone components.<br>- describe properties of widely used sensors in mobile robotics.<br>- explain different modes of mobile robot control.<br>- develop PID controller for mobile robot control.<br>- design algorithms for data fusion based on Kalman filter.<br>- formulate algorithm for path planning, obstacle avoidance and simple navigation.<br>- demonstrate application of computer vision in mobile robot control (visual servoing).<br>- apply acquired knowledge in higher level programming languages (e.g. Visual C#, Python, Java).<br>- evaluate efficiency of path planning and navigation algorithms. | |
| Course content broken down in detail by weekly class schedule (syllabus) | Course content | L hours |
| | Introduction: mobile robot (drone) components. | 2 |
| | Microcontrollers. Arduino IDE for robot control. | 2 |
| | Sensors: sensor characteristics, uncertainty representation, sensor types: incremental encoders, position and orientation sensors, inertial sensors, vision sensors. | 4 |
| | Mobile robot kinematics. Drive. Mobile robot control modes: on-off control, PID controller, speed and position controller. | 4 |
| | Robot localization: Kalman, particle and information filter. | 4 |
| | Navigation: planning and control. | 2 |
| | Control with navigation error as input. | 2 |
| | Visual servoing. | 2 |
| | Selected practical examples of control of mobile robots and drones. | 4 |

| | | |
|---|---|---|
| | List of laboratory or design exercises | LE hours |
| | Arduino development environment. | 2 |
| | Digital I/O – ultrasonic sensor. | 3 |
| | Motor control. Connection motors and sensors. | 3 |
| | Line following. | 2 |
| | Obstacle avoidance. | 4 |
| | Working on project assignments. | 16 |

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

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

| | |
|---|---|
| Grading and evaluating student work in class and at the final exam | During the semester there are two midterm exams. The first midterm exam is after 7 weeks of lectures and the second one is after 13 weeks of lectures (in a form of presentation and defense of the project assignment). Each midterm test (as well as the final test) is carried out in a written format with duration of 90 minutes. The requirement for passing grade is the positive assessment of laboratory exercises and 50 % points on average midterm exam ((M1 + M2)/2) or the final exam. Students are allowed to have at least 45% of total points on each midterm exams, as long as the final midterm average is at least 50% of total points.<br>Grade (in percentage) is formed according to the formula:<br><br>Grade(%) = 0,1L + 0,25M1 + 0,65M2<br><br>where:<br>• L – laboratory assessment,<br>• M1, M2 – midterm test results.<br><br>According to Article 65. of Faculty's Bylaw, student is required to participate in all teaching activities attending at least 70% of lectures, and 100% of laboratory exercises. If student does not meet these criteria, she or he won't be able to take part in the final exam, and will be required to enroll in the course the next year. |

| | Title | Number of copies in the library | Availability via other media |
|---|---|---|---|
| Required literature (available in the library and via other media) | • T Siegwart, R., Nourbakhsh, I. R., Scaramuzza D., Autonomous Mobile Robots, MIT Press, 2011. | | teacher/Internet |
| | • Thomas Braunl, Embedded Robotics: mobile robot design and applications with embedded systems, Springer, 2006. | | teacher/Internet |
| | • S. Thrun, W. Burgard, D. Fox, Probabilistic Robotics, MIT Press, 2006. | | teacher/Internet |
| | • Saeed B. Niku: Introduction to Robotics: Analysis, Systems, Applications, Prentice Hall, 2001. | | teacher |
| | • M. Bonković, J. Musić, I Stančić: "Mikroregulatori i ugradbeni mrežni sustavi u Arduino razvojnom okruženju", faculty book, FESB | | e-learning portal |
| | • J. Musić, M. Bonković: Authorised lecture notes, FESB | | e-learning portal |
| Optional literature (at the time of submission of study programme proposal) | 1. Tadej Bajd: Osnove robotike, Fakulteta za elektrotehniko, Univerza v Ljubljani, 2000.<br>2. Kovačić, Laci, Bogdan, Osnove robotike, Fakultet elektrotehnike i računarstva, Zagreb, 1999. | | |
| Quality assurance methods that ensure the acquisition of exit competences | - Keeping records of student attendance.<br>- Annual analysis of course statistics in terms of midterm and finals exams.<br>- Feedback from students via surveys.<br>- Teacher self-evaluation.<br>- Feedback from graduated students (or senior students) on course content relevance.<br>- Periodic institutional evolution of course teachers. | | |
| Other (as the proposer wishes to add) | / | | |

| NAME OF THE COURSE | PROJECT MANAGEMENT | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | FETK03 | Year of study | 2. | | | | | |
| **Course teacher** | Ivica Veža, Ph.D., Full Professor | Credits (ECTS) | 5 | | | | | |
| Associate teachers | Marko Mladineo, Ph.D. | Type of instruction (number of hours) | L | S | AE | LE | DE | |
| | | | 30 | 0 | 0 | 30 | | |
| Status of the course | Elective | Percentage of application of e-learning | 0 | | | | | |

**COURSE DESCRIPTION**

| | |
|---|---|
| Course objectives | Training students for:<br>- planning and managing projects<br>- 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:<br>- analyze customer requirements (VOC)<br>- formulate the main goals of the project and rank them<br>- develop the main project activities and the structure of distribution of work – (Work Breakdown Structure)<br>- plan the time (to determine the critical path)<br>- plan capacity (determine bottlenecks and balance activities)<br>- plan costs and risks<br>- apply adopted knowledge and skills from contents of completed course to solve a specific task<br>- 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 | |
| | The concept and definition of project and project management | 2 | |
| | Projects - vision, strategy, goals (examples - automotive and shipbuilding industries) | 2 | |
| | The strategy and project management. Multi-project management. | 2 | |
| | Basics of organization. The project organizational structure. | 2 | |
| | The phases of the project (initiation of project, project selection, project planning, project management and end of project) | 2 | |
| | Methods for project planning. | 2 | |
| | Quality management (planning of improvement and quality control) | 2 | |
| | Cost management. Continuous Improvement - Kaizen. | 2 | |
| | Risk management. | 2 | |
| | Psychological and social component of project management. Project manager. | 2 | |
| | Teamwork. | 2 | |
| | Communication and motivation in the team. Methods for stimulating creativity. | 2 | |
| | List of laboratory or design exercises | | LE hours |
| | Introduction to the technique of network planning. | | 2 |

| | | |
|---|---|---|
| | Basic concepts of network planning technique | 2 |
| | Analysis of time | 2 |
| | CPM method | 2 |
| | PERT method | 2 |
| | PRECEDENCE method | 2 |
| | Cost analysis | 2 |
| | Resource analysis | 2 |
| | Introduction to the software - Microsoft Project | 2 |
| | Introduction to business process management | 2 |
| | Basics of process diagrams | 2 |
| | Mapping processes | 2 |
| | Comparison of different process diagrams | 2 |

| | | |
|---|---|---|
| Format of instruction | ☒ lectures<br>☒ seminars and workshops<br>☒ exercises<br>☐ *on line* in entirety<br>☐ partial e-learning<br>☐ field work | ☒ independent assignments<br>☐ multimedia<br>☒ laboratory<br>☒ work with mentor<br>☐ (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 | 2,0 | 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).<br><br>On the other side students have one test in the field of Network planning techniques (LV) at the end of the semester.<br>• LV - grade of laboratory exercises,<br>• M - points achieved from the project.<br><br>The final grade (in percentage) is formed according to the formula:<br>Grade (%) = 0,30 LV + 0,70 M |

<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>• 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.<br>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<br>• The annual analysis of performance of the examinations<br>• Student survey in order to evaluate teachers<br>• Self-evaluation of teachers<br>• 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 | 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 | Elective: 220, 250 (Obligatory:242) | Percentage of application of e-learning | | | | | |

**COURSE DESCRIPTION**

| | | | |
|---|---|---|---|
| Course objectives | Training students for:<br>- evaluation and application of basic concepts and methods of software engineering in telecommunications,<br>- collaboration in design, development and maintenance of software systems and products in telecommunications,<br>- 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:<br>- define and apply basic concepts and methods of software engineering in telecommunications,<br>- evaluate characteristics of software engineering processes in telecommunications,<br>- collaborate in design, development and maintenance of software systems and products in telecommunications,<br>- evaluate and apply methods and tools for development of telecommunications software,<br>- collaborate in telecommunications software development process and apply adequite methods of software engineering<br>- 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 | - |

<table>
<tr><td rowspan="8"></td><td colspan="4">Techniques for robust telecommunications software development.</td><td>2</td><td>-</td></tr>
<tr><td colspan="4">Software projects management in telecommunications.</td><td>2</td><td>-</td></tr>
<tr><td colspan="5">List of laboratory or design exercises</td><td>LE hours</td></tr>
<tr><td colspan="5">Introduction in laboratory excercises.</td><td>2</td></tr>
<tr><td colspan="5">Project definition.</td><td>2</td></tr>
<tr><td colspan="5">Requirements specification.</td><td>2</td></tr>
<tr><td colspan="5">Project development cycles 1-9.</td><td>18</td></tr>
<tr><td colspan="5">Project presentations.</td><td>2</td></tr>
<tr><td>Format of instruction</td><td colspan="3">☒ lectures<br>☐ seminars and workshops<br>☒ exercises<br>☐ on line in entirety<br>☐ partial e-learning<br>☐ field work</td><td colspan="3">☐ independent assignments<br>☐ multimedia<br>☒ laboratory<br>☐ work with mentor<br>☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6"></td></tr>
<tr><td rowspan="5">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>1,0</td><td>Research</td><td>-</td><td>Practical training</td><td>-</td></tr>
<tr><td>Experimental work</td><td>-</td><td>Report</td><td>-</td><td>Individual work</td><td>2,2</td></tr>
<tr><td>Essay</td><td>-</td><td>Seminar essay</td><td>-</td><td>Laboratory exercises</td><td>1,0</td></tr>
<tr><td>Tests</td><td>0,2</td><td>Oral exam</td><td>-</td><td>Preparation for laboratory exercises</td><td>0,5</td></tr>
<tr><td>Written exam</td><td>0,1</td><td>Project</td><td>-</td><td>(Other)</td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">There are two midterms and final exams. The first midterm exam is after 7 weeks of lecturing and the second one is after the next 6 weeks. 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:<br>Grade(%) = 0,05 NP + 0,35 LV + 0,3 (M1 + M2)<br>the activities in percentage:<br>• NP - attendance at lectures,<br>• LV – laboratory assessment,<br>• M1, M2 – test results.<br><br>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.<br>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>
</table>

| | Title | Number of copies in the library | Availability via other media |
|---|---|---|---|
| Required literature (available in the library and via other media) | D.Begušić: Software engineering in telecommunications, handouts, FESB, 2016. | | e-learning portal |
| | | | |
| Optional literature (at the time of submission of study programme proposal) | - G. Utas: Robust Communications Software, John Wiley & Sons, 2005 I. - Sommerville: Software Engineering, Addison Wesley, UK, 2006. DIEEE - Communications Magazine.<br>- Documents of standardization institutions ITU, ETSI, IEEE and others.<br>- Scientific papers in the area of software engineering in telecommunications<br>- Antun Carić: Design of Telecommunications Software, 2003.<br>- L. Rising: Design Patterns in Communications Software, Cambridge University Press, 2001<br>- Robert S. Pressman: Software Engineering: A Practitioner's Approach, McGraw-Hill Inc., 2000. | | |
| Quality assurance methods that ensure the acquisition of exit competences | - Evaluation of results in accordance with the above learning outcomes<br>- Feedback from students via surveys<br>- Self-evaluation of teachers<br>- 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 | Elective: 241, 250<br>Obligatory: 242 | Percentage of application of e-learning | | | | | |

**COURSE DESCRIPTION**

| | |
|---|---|
| Course objectives | Training students for:<br>- understanding and application of basic concepts and technologies of transmission systems communication networks,<br>- collaborate in design, development and maintenance of transmission systems and communication networks,<br>- 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:<br>- define and apply basic concepts of transmission systems and communication networks,<br>- identify the characteristics and apply the technologies of transmission systems and communication networks,<br>- collaborate in design, development and maintenance of transmission systems and communication networks,<br>- 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<br>☐ seminars and workshops<br>☒ exercises<br>☐ *on line* in entirety<br>☐ partial e-learning<br>☐ field work | ☐ independent assignments<br>☐ multimedia<br>☒ laboratory<br>☐ work with mentor<br>☐ (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:

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

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.
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.

| | Title | Number of copies in the library | Availability via other media |
|---|---|---|---|
| Required literature (available in the library and via other media) | D.Begušić: Selected topics in transmission systems handouts, FESB, 2016. (in Croatian) | | e-learning portal |
| | A.Bažant et al.: Basic network architectures, Element Zagreb, 2004. (in Croatian) | 10 | |
| Optional literature (at the time of submission of study programme proposal) | - IEEE Communications Magazine,<br>- Documents of standardization institutions ITU, ETSI, IEEE, IETF and others, | | |
| Quality assurance methods that ensure the acquisition of exit competences | - Evaluation of results in accordance with the above learning outcomes<br>- Feedback from students via surveys<br>- Self-evaluation of teachers<br>- Institutional and non-institutional evaluations | | |
| Other (as the proposer wishes to add) | | | |

| 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<br>Marina Rajič, Mag. Ing.<br>Josip Žilić, Mag. Ing.<br>Ante Dagelić, Mag. Ing. | Type of instruction (number of hours) | L | S | AE | LE | DE |
| | | | 30 | 0 | 15 | 15 | 0 |
| Status of the course | Elective: 220, 250 (Obligatory: 241, 242) | Percentage of application of e-learning | | | | | |

**COURSE DESCRIPTION**

| | | | |
|---|---|---|---|
| Course objectives | Training students for:<br>- understanding and application of basic concepts and technologies of wireless communication systems,<br>- collaboration in design, development and maintenance of wireless communication networks,<br>- collaborate in design, development and maintenance of optical communication systems and networks,<br>- 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:<br>- identify, select and apply wireless communication systems and networks,<br>- collaborate in design, implementation and maintenance of mobile networks (NMT, GSM, GPRS, EDGE, UMTS, HSDPA, LTE),<br>- collaborate in design, implementation and maintenance of wireless access networks (WIMAN),<br>- collaborate in design, implementation and maintenance of wireless local area networks (WLAN, IEEE 802.11x),<br>- collaborate in design, implementation and maintenance of wireless personal area networks (WPAN, Bluetooth),<br>- collaborate in design, implementation and maintenance of ad-hoc networks,<br>- collaborate in design, implementation and maintenance of sattelite commnication networks (LEO, MEO, GEO),<br>- collaborate in development of services based on wireless communication networks,<br>- 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, CDMA, OFDMA). | 2 | 1 |
| | 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<br>☐ seminars and workshops<br>☒ exercises<br>☐ *on line* in entirety<br>☐ partial e-learning<br>☐ field work | ☐ independent assignments<br>☐ multimedia<br>☒ laboratory<br>☐ work with mentor<br>☐ (other) |
| Student responsibilities | D..Begušić: Wireless and mobile communication networks, handouts<br>Optional literature (at the time of submission of study programme proposal)<br>□ 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) | |

| | |
|---|---|
| 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:<br>Grade(%) = 0,05 NP + 0,15 LV + 0,4 (M1 + M2)<br>the activities in percentage:<br>• NP - attendance at lectures,<br>• LV – laboratory assessment,<br>• M1, M2 – test results. |

<table>
<tr><td></td><td colspan="3">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.<br>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 -<br>- EEE Communications Magazine.<br>- Documents of standardization institutions ITU, ETSI, IEEE and others.<br>- 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<br>- Feedback from students via surveys<br>- Self-evaluation of teachers<br>- 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:<br>• provide students with insight into basic features and aspects of protecting wireless communication channels<br>• present students with proven mechanisms for the protection of wireless communication channels<br>• 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:<br>• Explain the key vulnerabilities of wireless communication channels<br>• Explain the essential difference between the vulnerability of classic wire and wireless channels<br>• 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<br>- DoS attacks on the physical level<br>- DoS attacks at the data level<br>- Attacks on privacy and confidentiality of data<br>• Critically assess the potential security risks of specific wireless communication technology and systems<br>- IEEE 802.11, 2G and 3G, NFC, GPS navigation system<br>- Recommend the use of appropriate protective mechanisms |

| Course content broken down in detail by weekly class schedule (syllabus) | Course content | L hours | AE hours |
|---|---|---|---|
| | 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, privacy, man-in-the-middle attacks) | 2 | |
| | 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<br>☐ seminars and workshops<br>☐ exercises<br>☐ *on line* in entirety<br>☐ partial e-learning<br>☐ field work | ☐ independent assignments<br>☐ multimedia<br>☒ laboratory<br>☐ work with mentor<br>☐ (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.<br>The final grade is formed as follows:<br>Grade = Round[ 0,05 P + 0,15 LV + 0,30 M1 + 0,50 M2 ]<br>where:<br>• P – is a grade based on attendance at lectures,<br>• LV – a grade earned during laboratory exercises,<br>• M1, M2 – test results.<br><br>NOTE: If a student fails a given task (P, LV, M1, M2), the corresponding grade is set to 0 in the above formula. |

| Required literature (available in the library and via other media) | **Title** | **Number of copies in the library** | **Availability via other media** |
|---|---|---|---|
| | Lecture notes and presentations | | e-learning portal |

| | |
|---|---|
| Optional literature (at the time of submission of study programme proposal) | • 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.<br>• Stallings W.: Cryptography and Network Security, Principles and Practice, Prentice Hall, 2005.<br>• Menezes J., van Oorschot P. C., Vanstone S. A.: Handbook of AppliedCryptography, CRC Press, 1996. |
| Quality assurance methods that ensure the acquisition of exit competences | - Evaluation of results in accordance with the above learning outcomes<br>- Feedback from students via surveys<br>- Self-evaluation of teachers<br>- Institutional and non-institutional evaluations |
| Other (as the proposer wishes to add) | |

<table>
<tr><td>NAME OF THE COURSE</td><td colspan="7">DIPLOMA THESIS</td></tr>
<tr><td>Code</td><td>FEXX02</td><td colspan="2">Year of study</td><td colspan="4">2</td></tr>
<tr><td>Course teacher</td><td></td><td colspan="2">Credits (ECTS)</td><td colspan="4">30</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2"></td><td colspan="2" rowspan="2">Type of instruction (number of hours)</td><td>L</td><td>S</td><td>AE</td><td>LE</td><td>DE</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Status of the course</td><td>Mandatory</td><td colspan="2">Percentage of application of e-learning</td><td colspan="4"></td></tr>
<tr><td colspan="8">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="7">Training students for:<br>- consolidating theoretical knowledge and practical skills in solving highly complex engineering problems,<br>- being independent in solving problems under the given conditions,<br>- applying scientific-research and ethical principles,<br>- writing and presenting the project results.</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="7">Acquired 60 ECTS credits</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="7">Students will be able to:<br>- To consolidate theoretical knowledge and practical skills in solving highly complex engineering problems<br>- To use literature, databases and other sources of information<br>- To select appropriate methods and procedures for solving the most complex engineering problems<br>- To apply scientific and technical knowledge and skills to effectively solve engineering problems<br>- To apply scientific research methodology and ethical principles in the science<br>- To give oral public presentation, to prepare written report and present project results</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="7">Diploma thesis is the independent work of the student produced according to the task and instructions given by the supervisor, and according to the scientific research methodology and ethical principles.</td></tr>
<tr><td>Format of instruction</td><td colspan="3">☐ lectures<br>☐ seminars and workshops<br>☐ exercises<br>☐ on line in entirety<br>☐ partial e-learning<br>☐ field work</td><td colspan="4">☐ independent assignments<br>☐ multimedia<br>☐ laboratory<br>☒ work with mentor<br>☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="7">Independent work</td></tr>
<tr><td rowspan="6">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td></td><td>Research</td><td></td><td>Practical training</td><td colspan="2"></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Individual work</td><td colspan="2">30</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>(Other)</td><td colspan="2"></td></tr>
<tr><td>Tests</td><td></td><td>Oral exam</td><td></td><td>(Other)</td><td colspan="2"></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td>(Other)</td><td colspan="2"></td></tr>
<tr><td colspan="7"></td></tr>
</table>

<table>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="3">Producing of the diploma thesis is evaluated by the supervisor based on the student's achievements during the process of preparing the diploma thesis. Commission for defence of the diploma thesis gives an assessment, representing an average grade for the preparation and defence of the thesis.</td></tr>
<tr><td rowspan="2">Required literature (available in the library and via other media)</td><td>Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td>1. Etički kodeks Fakulteta elektrotehnike, strojarstva i brodogradnje u Splitu<br>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.<br>3. Žugaj, Miroslav; Dumičić, Ksenija; Dušak, Vesna: Temelji znanstvenoistraživačkog rada, Metodologija i metodika, Fakultet organizacije iinformatike, Varaždin, 2006.<br><br>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<br>- 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 | |
| FELK31 | 3D Renedering | Ivan Zoraja, Ph.D., Associate Professor<br>Marko Žarković, Teaching Assistant |
| FELK14 | Advanced algorithms | Matko Šarić, Ph.D., Assistant Professor<br>Ante Topić, Teaching Assistant |
| FELK07 | Advanced computer architectures | Sven Gotovac, Ph.D., Full Professor<br>Dunja Gotovac, Teaching Assistant |
| FELK33 | Advanced web Technologies | Maja Štula, Ph.D., Full Professor<br>Marin Bugarić, Ph.D. |
| FELK30 | Architectures of networked computer systems | Milan Vojnović, Ph.D.<br>Dinko Begušić, Ph.D., Full Professor |
| FELK03 | Artificial intelligence | Darko Stipaničev, Ph.D., Full Professor<br>Ljiljana Šerić, Ph.D., Assistant Professor<br>Toni Jakovčević, Ph.D., Assistant Professor |
| FETK01 | Business Information Systems | Stipo Čelar, Ph.D., Associate Professor<br>Mili Turić, Teaching Assistant<br>Ivan Drnasin, Teaching Assistant |
| FETK02 | Business Intelligence | Stipo Čelar, Ph.D., Associate Professor<br>Linda Vicković, Ph.D., Associate Professor |
| FELK34 | Computer Games Programming | Jadranka Marasović, Ph.D., Full Professor<br>Tea Marasović, Ph.D., Assistant Professor |
| FELK04 | Computer graphics | Vladan Papić, Ph.D., Full Professor<br>Denis Štajduhar, Teaching Assistant |
| FELK02 | Computing science models | Julije Ožegović, Ph.D., Full Professor<br>Marina Prvan, Teaching Assistant |
| FELK10 | Cryptography and network security | Mario Čagalj, Ph.D., Full Professor<br>Toni Perković, Ph.D., Assistant Professor |
| FELK16 | Data Warehouse | Stipo Čelar, Ph.D., Associate Professor |

| | | |
|---|---|---|
| FELH20 | Designing and using computer networks | Julije Ožegović, Ph.D., Full Professor<br>Vesna Pekić, Ph.D.<br>Ante Kristić, Ph.D. |
| FELK15 | Digital communications | Joško Radić, Ph.D., Associate Professor<br>Petar Šolić, Ph.D., Assistant Professor |
| FELK18 | Digital image processing and analysis | Damir Krstinić, Ph.D., Associate Professor<br>Darko Stipaničev, Ph.D., Full Professor<br>Maja Braović, Ph.D. |
| FELK12 | Embedded systems | Sven Gotovac, Ph.D., Full Professor<br>Dunja Gotovac, Teaching Assistant |
| FELK36 | Forensic Analysis of Digital Images | Damir Krstinić, Ph.D., Associate Professor<br>Maja Braović, Ph.D. |
| FELK32 | Geographic Information Systems | Marjan Sikora, Ph.D., Assistant Professor |
| FELK11 | Grid computing systems | Eugen Mudnić, Ph.D., Assistant Professor |
| FELK01 | Human computer interaction | Mario Čagalj, Ph.D., Full Professor<br>Toni Perković, Ph.D., Assistant Professor |
| FELK08 | Multimedia systems | Mladen Russo, Ph.D., Assistant Professor<br>Jelena Čulić, Teaching Assistant<br>Martina Bašić, Teaching Assistant |
| FELJ35 | Network and mobile operating systems | Josip Lörincz, Ph.D., Assistant professor<br>Dinko Begušić, Ph.D., Full Professor<br>Ante Dagelć, Teaching Assistant |
| FELK21 | Neural networks and genetic algorithms | Damir Vučina, Ph.D., Full Professor<br>Igor Pehnec, Ph.D., Assistant Professor<br>Ivo Marinić- Kragić, Teaching Assistant |
| FEMK01 | Numerical analysis | Ivan Slapničar, Ph.D., Full Professor<br>Lana Periša, Anita Carević |
| FELK06 | Optimization methods | Jadranka Marasović, Ph.D., Full Professor<br>Martina Bašić, Teaching Assistant |
| FELK35 | Parallel programming | Tamara Grujić, Ph.D., Full Professor<br>Ana Kuzmanić Skelin, Ph.D., Assistant Professor |
| FEXX06 | Professional Training | |
| FELK17 | Programming agents | Maja Štula, Ph.D., Full Professor |
| FELK05 | Programming Languages and compilers | Ivo Mateljan, Ph.D., Full Professor<br>Marjan Sikora, Ph.D., Assistant Professor |
| FELH40 | Programming Mobile Robots and Drones | Mirjana Bonković, Ph.D., Full Professor<br>Josip Musić, Ph.D., Assistant Professor<br>Miroslav Dujmović, Teaching Assistant |
| FETK03 | Project management | Ivica Veža, Ph.D., Full Professor<br>Marko Mladineo, Ph.D. |
| FELJ18 | Software engineering in telecommunications | Dinko Begušić, Ph.D., Full Professor<br>Goran Škugor, Teaching Assistant<br>Jelena Mihovilović, Teaching Assistant |
| FELJ03 | Transmission systems | Maja Stella, Ph.D., Assitant Professor<br>Dinko Begušić, Ph.D., Full Professor |
| FELJ09 | Wireless communication networks | Dinko Begušić, Ph.D., Full Professor<br>Maja Stella, Ph.D., Assistant Professor<br>Marina Rajič, Teaching Assistant<br>Josip Žilić, Teaching Assistant<br>Ante Dagelić, Teaching Assistant |
| FELK19 | Wireless security | Mario Čagalj, Ph.D., Full Professor<br>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<br>Software engineering in telecommunications<br>Transmission systems<br>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<br>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<br>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.<br>D.Begušić: "Optical communication systems ", handouts, 2016.<br>D.Begušić: " Programsko inženjerstvo u telekomunikacijama", nastavni tekst, 2016.<br>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<br><br>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<br><br>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<br><br>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.<br><br>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.<br><br>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<br>Collaborative internationalization of software engineering in Croatia j, project TEMPUS<br>Research in the area fo telecommunications, joint project FESB - Ericsson Nikola Tesla<br>International conference on Software, Telecommunications and Computer Networks SoftCOM<br>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 | **Mirjana Bonković, Ph.D., Full Professor** |
| The course he/she teaches in the proposed study programme | Programming mobile robots and drones |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | R. Boškovića 32, 21 000 Split, HR |
| Telephone number | +385 91 4 305 641 |
| E-mail address | mirjana.bonkovic@fesb.hr |
| Personal web page | |
| Year of birth | |
| Scientist ID | 190481 |
| Research or art rank, and date of last rank appointment | |
| Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment | Full professor, 2016. |
| Area and field of election into research or art rank | Technical Sciences, Field Electrical engineering |
| INFORMATION ON CURRENT EMPLOYMENT | |
| Institution where employed | Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture |
| Date of employment | 01/7/1991 |
| Name of position (professor, researcher, associate teacher, etc.) | Full professor, 2016. |
| Field of research | 3D modelling, robotics, computer vision, optimization |
| Function | |
| INFORMATION ON EDUCATION – Highest degree earned | |
| Degree | PhD |
| Institution | Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture |
| Place | Split |
| Date | 10/3/2000. |
| INFORMATION ON ADDITIONAL TRAINING | |
| Year | 1995 |
| Place | Oxford, UK |
| Institution | Robotics Research Group |
| Field of training | Robot production lines optimization |
| MOTHER TONGUE AND FOREIGN LANGUAGES | |
| Mother tongue | Croatian |
| Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent) | English (5) |
| Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent) | German (2) |
| Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent) | |
| COMPETENCES FOR THE COURSE | |
| Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme) | Computers and Programming, Undergraduate study program Programming, Undergraduate professional study program |

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

| | |
|---|---|
| First and last name and title of teacher | **Mario Čagalj, Ph.D., Full Professor** |
| The course he/she teaches in the proposed study programme | Cryptography and network security<br>Human computer interaction<br>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 of study programme) | 1. Cryptography and Network Security, (FELK10, 250), graduate study, FESB<br><br>2. Wireless Security (FELK19, 250), graduate study, FESB |
| 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).<br><br>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).<br><br>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).<br><br>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)<br><br>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 | **Stipo Čelar, Ph.D., Associate Professor** |
| The course he/she teaches in the proposed study programme | Business Information Systems<br>Business Intelligence<br>Data Warehouse |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | Vrboran 45 |
| Telephone number | +385 21 305 843 |
| E-mail address | stipe.celar@fesb.hr |
| Personal web page | https://nastava.fesb.hr/nastava/nastavnici/detalji/scelar |
| Year of birth | 1967 |
| Scientist ID | 297890 |
| Research or art rank, and date of last rank appointment | Senior Research Associate, 14/03/2014 |
| Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment | Associate Professor<br>20/09/2016 |
| Area and field of election into research or art rank | • Technical science, Field Computer science (*senior research associate*)<br>• Technical science, Field Basic techn.science (*research associate*) |
| INFORMATION ON CURRENT EMPLOYMENT | |
| Institution where employed | University of Split, FESB |
| Date of employment | 01/01/2008 |
| Name of position (professor, researcher, associate teacher, etc.) | Associate Professor |
| Field of research | Software engineering, Information systems |
| Function | |
| INFORMATION ON EDUCATION – Highest degree earned | |
| Degree | Ph.D. |
| Institution | Technische Universität Wien |
| Place | Vienna, Austria |
| Date | 28/08/1997 |
| INFORMATION ON ADDITIONAL TRAINING | |
| Year | 2009. |
| Place | Paderborn, Germany |
| Institution | Fakultät für Elektrotechnik, Informatik und Mathematik, Universität Paderborn |
| Field of training | Software engineering |
| MOTHER TONGUE AND FOREIGN LANGUAGES | |
| Mother tongue | Croatian |
| Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent) | German<br>5 |
| Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent) | English<br>4 |
| Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent) | Russian<br>3 |
| Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent) | Slovak<br>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) | Information Systems Design, University of Mostar FSR, 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. Dragicevic, Srdjana; Celar, Stipe; Turic, Mili. Bayesian network model for task effort estimation in agile software development. // *Journal of systems and software*. 127 (2017) ; 109-119.<br>2. Celar, Stipe; Mudnic, Eugen; Seremet, Zeljko. State-of-the-art of messaging for distributed computing systems // *Procedia Engineering* / Katalinic, B. (ur.). Mostar : Elsevier & DAAAM, 2016. 298-307.<br>3. Vicković, Linda; Gotovac, Sven; Čelar, Stipo. Simulation-Based Performance Analysis of the ALICE Mass Storage System. // *International journal of simulation modelling*. 15 (2016) , 1; 70-82.<br>4. Celar, Stipe; Stojkic, Zeljko; Seremet, Zeljko; Marusic, Zeljko; Zelenika, Danijel. Classification of test documents based on handwritten student id's characteristics // *Procedia Engineering*, Volume 100-2015 / B. Katalinic (ur.). Beč : Elsevier, 2015. 782-790.<br>5. Dragičević, Srđana; Čelar, Stipo. Method for Elicitation, Documentation and Validation of Software User Requirements (MEDoV) // Proceedings of 18th IEEE International Symposium on Computers and Communications (ISCC 2013). 2013, IEEE, 2013, 956-961. |
| Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most) | 1. Čelar, Stipe; Turić, Mili; Dragičević, Srdjana; Veža, Ivica. Digital Learning Factory at FESB – University of Split // *ZBORNIK RADOVA YU INFO 2016* / Prof. dr. Miodrag Ivković (ur.). Beograd : Društvo za informacione sisteme i računarske mreže, 2016. 001-006.<br>2. Klarin, Karmen; Čelar Stipo. Knowledge representation in the ontological engineering using conceptual modeling and graph- based reasoning // Contemporary Issues in Economy and Technology - CIET 2016. Split : University of Split, University Department of Professional Studies, 2016. S-153-S-164.<br>3. Klarin, Karmen; Čelar, Stipo. Modeling information resources and application using ontological engineering // WSCAR 2015 / Rachid Sammouda (ur.). Rim, Italy : IEEE, 2015. 1-6.<br>4. Klarin, Karmen; Čelar, Stipo. Ontology-based knowledge management approach for information system development // Proceedings of Papers / George Paunovic (ur.). Beograd : IEEE, 2013. 805-808. |
| Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most) | 1. INSENT – INovative Smart ENTerprise (HRZZ-1355), 2014 – 2018 (znanstveni projekt HRZZ)<br>2. Plan-PRO, Softver za planiranje proizvodnje, 2015 – 2016 (tehnologijski projekt, SDŽ)<br>3. VENIO FIN – Programsko rješenje za računovodstvo i financije primjenom .NET tehnologija, 2014 – 2015 (tehnologijski projekt, SDŽ)<br>4. PIVIS Projekt – Informatizacija MIB Pivac, 2010 - danas (stručni projekt) |

| | |
|---|---|
| | 5. VENIO indicium – start up i spin off, 2011 – danas, (stručni projekt) |
| 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? | In October 1995. Prof. Stipe Čelar graduated in philosophy at the University of Zagreb. |
| PRIZES AND AWARDS, STUDENT EVALUATION | |
| Prizes and awards for teaching and scholarly/artistic work | 1. In 1994 Prof. Stipe Čelar won a scholarship "Bertha von Suttner" from the Ministry of Science and Research of the Republic of Austria for his Ph.D research at the Department of Intelligent Manufacturing Systems at the Vienna University of Technology (TU Wien), Austria.<br>2. In 2009 received the Jubilee Gold Medal of DAAAM International Vienna |
| 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 | Advanced computer architecture<br>Embedded 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<br>Impulse electronics |

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

| COMPETENCES FOR THE COURSE | |
|---|---|
| Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme) | • Linear Control Systems, Graduate study programme,<br>• Practicum of Automatic Control, Graduate study programme,<br>• Multimedia Systems, Graduate study programme,<br>• Signals and Systems in Biomedical Engineering, Postgraduate (PhD) study programme |
| Authorship of university/faculty textbooks in the field of the course | Faculty textbook:<br>Tamara Grujić: "Osnove signala i sustava – Predavanja sa zadacima", Interna skripta, FESB, Split, 2009. |
| Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most) | Scientific papers published in international journals cited by CC or SCI-Expanded:<br><br>1. Grujić Tamara; Kuzmanić Skelin, Ana; Čić, Maja. Design, Development and Testing of a Low-Cost sEMG System and Its Use in Recording Muscle Activity in Human Gait. // *Sensors*. 14 (2014) , 5; 8235-8258<br><br>2. Kuzmanić Skelin, Ana; Grujić, Tamara; Bonković, Mirjana. Visual Peoplemeter: A Vision-based Television Audience Measurement System. // *Advances in Electrical and Computer Engineering*. 14 (2014) , 4; 73-80<br><br>3. Stančić, Ivo; Grujić, Tamara; Panjkota Ante. Design, Development, and Evaluation of Optical Motion-Tracking System Based on Active White Light Markers. // *IET science measurement & technology*. 7 (2013) , 4; 206-214<br><br>4. Stančić, Ivo; Grujić, Tamara; Bonković, Mirjana. New Kinematic Parameters for Quantifying Irregularities in the Human and Humanoid Robot Gait. // *International Journal of Advanced Robotic Systems*. 9 (2012) ; 215-1-215-8<br><br>5. Grujić Šupuk, Tamara; Bajd, Tadej; Kurillo, Gregorij. Assessment of Reach-to-Grasp Trajectories Toward Stationary Objects. // *Clinical biomechanics*. 26 (2011) , 8; 811-818 |
| Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most) | |
| Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most) | 1. Project: "Advanced Methods of 3D Visualization - Towards Virtual Tourism and Cultural Heritage Digitalization of Town of Split", 2015-2016.<br>Tamara Grujić is project researcher.<br>2. Project: Biomechanics of Human Movements, Control and Rehabilitation", 2007-2014.<br>Tamara Grujić was project researcher.<br>3. Program: Biomechanics of Human Movements – BioPok, 2007-2014.<br>Tamara Grujić was project researcher. |

| | |
|---|---|
| The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences? | Tamara Grujić, from the time of employment at the FESB (the year 2000) continuously lead a range of courses at The Undergraduate Study in Electrical Engineering and Information Technology, Undergraduate Study in Computer Science, Graduate Study in Automation and Systems, and Postgraduate (Ph.D.) Study in Electrical Engineering and Information Technology.<br>Also, she is giving lectures as a visiting professor, at The Undergraduate Study of Physiotherapy, at the Department of Health Studies, University of Split, Croatia, and at The Faculty of Mechanical Engineering and Computer Science, University of Mostar, Bosnia and Herzegovina. Total so far she held more than 5,000 hours of lectures, auditory and laboratory exercises, as an research assistant (2000-2007), and as professor (2007 - ) |
| PRIZES AND AWARDS | |
| Prizes and awards for teaching and scholarly/artistic work | |
| Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated) | Results of student evaluation taken in the last five years for the course "Signals andSystems": 4.13 / 5<br><br>Evaluation organizer: University of Split |

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

| COMPETENCES FOR THE COURSE | |
|---|---|
| Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme) | |
| Authorship of university/faculty textbooks in the field of the course | |
| Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most) | 1. Krstinić, Damir; Kuzmanić Skelin, Ana; Milatić, Ivan, Laser Spot Tracking Based on Modified Circular Hough Transform and Motion Pattern Analysis, Sensors, Vol. 14, no. 11, 2014., pp. 20112-20133<br>2. Jakovčević, Toni; Stipaničev, Darko; Krstinić, Damir, "Visual spatial-context based wildfire smoke sensor", Machine vision and applications (ISSN 1387-8092), Vol. 24(2013), No. 4, pp. 707-719, 2013.<br>3. Šerić, Ljiljana; Krstinić, Damir; Braović, Maja; Milatić, Ivan; Mirčevski, Aljoša; Stipaničev, Darko, "Holonic Multi Agent System for Data Fusion in Vehicle Classification", in Proc. Of 10th KES International Conference, KES-AMSTA 2016.; pp-151-161; Puerto de la Cruz, Tenerife, Spain, June 15. - 17. 2016.<br>4. Stipaničev, Darko; Šerić, Ljiljana; Krstinić, Damir; Bugarić, Marin, "Wildfire video observers network with phyisical an d virtual sensors", 10th EARSel Forest Special Interest Group Workshop – Sensors, Multi-Sensor Integration, Large Volumes: New Oportunities and Chalenges in Forest Fire Research, Limassol, Cyprus, November 2. - 5. 2015.<br>5. Štula, Maja; Krstinić, Damir; Šerić, Ljiljana, "Intelligent forest fire monitoring system", Information System Frontiers (ISSN 1387-3326), Vol. 14(2012), No. 3; pp- 725-739, 2012. |
| Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most) | |
| Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most) | |
| The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences? | |
| PRIZES AND AWARDS, STUDENT EVALUATION | |
| Prizes and awards for teaching and scholarly/artistic work | |

| | |
|---|---|
| Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated) | Digital image processing and analysis:<br>• 2015/2016 – overall average 4.7<br>• 2014/2016 – overall average 4.6<br>• 2013/2014 – overall average 4.6<br>• 2012/2013 – overall average 4.7<br>• 2011/2012 – overall average 4.6 |

| | |
|---|---|
| First and last name and title of teacher | **Josip Lörincz, Ph.D., Assistant Professor** |
| The course he/she teaches in the proposed study programme | 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,<br>• Computing,<br>• Electrical engineering,<br>• Telecommunications and informatics,<br>• Energy-efficient networking and computing,<br>• 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:**<br>• Introduction of new course on graduate study: Network and mobile operating systems, Ships local computer networks<br>• 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<br>• Extension of existing laboratory exercises with new content for next courses on graduate study: Wireless communication networks, IP communications, Engineering graphics and presentation<br>**Establishment and organization of new faculty laboratories:**<br>• 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:**<br>• Internal script: Network and mobile operating systems<br>• Internal script: Local and access networks<br>• Internal script: Ships local computer networks<br>• Internal script: Ships local computer networks<br>**Authorship of internal laboratory exercise manuals:**<br>• Manual for laboratory exercise: Network and mobile operating systems<br>• Manual for laboratory exercise: Wireless communication networks<br>• Manual for laboratory exercise: Local and access networks<br>• 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):**<br>Josip Lorincz, **„***Optimizing energy consumption of wireless access networks”*, Lambert Academic Publishing, Germany, 2012, str. 210<br>**Scientific papers published in international scientific journals:**<br>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<br>**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<br><br>**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<br><br>**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<br><br>**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<br><br>**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<br><br>**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<br><br>**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<br><br>**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<br><br>**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.<br><br>**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<br><br>**13.** J. 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<br>**Scientific papers published on international scientific conferences with international review:**<br>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)<br>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)<br>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)<br>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.<br>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<br>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:**<br>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:<br>• Green networking (HZZ- Croatian Science Foundation)<br>• Doctoral research visit on green networking project (UKF – Unity Through Knowledge Fund))<br>Participation in international scientific projects as project researcher:<br>• Establish Pan-European Information Space to Enhance seCurity of Citizens – EPISECC ( EU FP7: Work programme 2013, Cooperation, Theme 10: Security)<br>• Increasing the LIFEtime of TELecommunication networks (LIFETEL) – University of Rome (La Sapienza)<br>Participation in domestic education projects as project participant:<br>• Modernising doctoral education through implementation of Croatian qualification framework (MODOC) – EU IPA program BGUE 04 06, Human resources development |

<table>
<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:<ul><li>Modernising doctoral education through implementation of Croatian qualification framework (MODOC) – EU IPA program BGUE 04 06, Human resources development</li></ul>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><ul><li>Yearly award of Okrug County for scientific/research work and promotion of science in 2013.</li><li>Award of Faculty of electrical engineering, mechanical engineering and naval architecture (FESB) for the notable scientific and research results in 2013.</li><li>Award „Vera Johanides“ for 2012. of Croatian Academy of engineering (Academia Scientiarum Tehnicarum Croatica)</li><li>Award of Faculty of electrical engineering, mechanical engineering and naval architecture (FESB) to the most successful scientific novices in 2011.</li></ul></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).<br>Note on grading scale: global index evaluating overall course on scale 1-5<br><table><tr><td>Course/average grade</td><td>Global index<br>2011/12</td><td>Global index<br>2012/13</td><td>Global index<br>2013/14</td><td>Global index<br>2014/15</td><td>Global index<br>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 | **Jadranka Marasović, Ph.D., Full Professor** |
| The course he/she teaches in the proposed study programme | Optimization methods<br>Computer games programming |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | Split, Zagrebačka 21 |
| Telephone number | 385 021 305 830 (institution) |
| E-mail address | jmar@fesb.hr |
| Personal web page | / |
| Year of birth | 1955. |
| Scientist ID | 080633 |
| Research or art rank, and date of last rank appointment | Senior Research Scientist, 09. July 2007. |
| Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment | Full professor, 01. March 2009. |
| Area and field of election into research or art rank | Technical science, field of electrical engineering |
| INFORMATION ON CURRENT EMPLOYMENT | |
| Institution where employed | Faculty of Electrical Engineering, Machine Engineering and Naval Architecture, University of Split |
| Date of employment | 04. May 1978. |
| Name of position (professor, researcher, associate teacher, etc.) | Professor |
| Field of research | Science and Education |
| Function | / |
| INFORMATION ON EDUCATION – Highest degree earned | |
| Degree | Doctor of science |
| Institution | Faculty of Electrical Engineering, Machine Engineering and Naval Architecture, University of Split |
| Place | Split |
| Date | 11. July 1997. |
| INFORMATION ON ADDITIONAL TRAINING | |
| Year | / |
| Place | / |
| Institution | / |
| Field of training | / |
| MOTHER TONGUE AND FOREIGN LANGUAGES | |
| Mother tongue | Croatian |
| Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent) | English (excellent -5) |
| Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent) | Italian (sufficient-2) |
| Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent) | |
| COMPETENCES FOR THE COURSE | |
| Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme) | **Undergraduate studies:**<br>• Measurements and Process Control<br>• Industrial Process Control |

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

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

| | |
|---|---|
| First and last name and title of teacher | **Ivo Mateljan, Ph.D., Full Professor** |
| The course he/she teaches in the proposed study programme | Programming languages and compilers |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | J. Rodina 4, 21215 Kaštel Lukšić |
| Telephone number | +395 21 305 860 |
| E-mail address | ivo.mateljan@fesb.hr |
| Personal web page | marjan.fesb.hr/~mateljan/ |
| Year of birth | 1953 |
| Scientist ID | 76394 |
| Research or art rank, and date of last rank appointment | Scientific Adviser, 2007 |
| Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment | Senior Full Professor, 2011 |
| Area and field of election into research or art rank | Technical Sciences, Electrical engineering |
| INFORMATION ON CURRENT EMPLOYMENT | |
| Institution where employed | Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture |
| Date of employment | 1/1/1977 |
| Name of position (professor, researcher, associate teacher, etc.) | Professor |
| Field of research | Programming, Virtual Instrumentation, Electroacoustics |
| Function | Head of Electroacoustic Laboratory |
| INFORMATION ON EDUCATION – Highest degree earned | |
| Degree | PdD |
| Institution | University of Zagreb, Faculty of Electrical Engineering |
| Place | Zagreb, Croatia |
| Date | 1992. |
| INFORMATION ON ADDITIONAL TRAINING | |
| Year | |
| Place | |
| Institution | |
| Field of training | |
| MOTHER TONGUE AND FOREIGN LANGUAGES | |
| Mother tongue | Croatian |
| Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent) | English (4) |
| COMPETENCES FOR THE COURSE | |
| Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme) | Programming, OOP, Electronic circuit |
| Authorship of university/faculty textbooks in the field of the course | Ivo Mateljan: Programiranje jezikom C, book published by University of Split, 2010.<br>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.<br><br>2. Sikora M., Mateljan I., Bogunovic, N.: *Beam Tracing with Refraction,* Archives of Acoustics Vol.37, 2012.<br><br>3. Mateljan I., Sikora M.: *Estimation of loudspeaker drivers parameters*, Proc. of 5th Congress of the Alps Adria Acoustics Association Zadar, 2012.<br><br>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 | |
| 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** | **Eugen Mudnić, Ph.D., Assistant Professor** |
|---|---|
| The course he/she teaches in the proposed study programme | Grid computing systems |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | Vinogradska 41, 21000 Split, HR |
| Telephone number | +385 21 305848 |
| E-mail address | emudnic@fesb.hr |
| Personal web page | |
| Year of birth | 1968. |
| Scientist ID | 248856 |
| Research or art rank, and date of last rank appointment | Research scientist, 9/7/2009 |
| Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment | Assistant professor, 19/10/2016 |
| Area and field of election into research or art rank | Technical Sciences, Field - Computing systems |
| INFORMATION ON CURRENT EMPLOYMENT | |
| Institution where employed | Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture |
| Date of employment | 01/05/2001 |
| Name of position (professor, researcher, associate teacher, etc.) | Assistant professor |
| Field of research | High performance computing systems, Discrete event simulations |
| Function | |
| INFORMATION ON EDUCATION – Highest degree earned | |
| Degree | PhD |
| Institution | Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture |
| Place | Split |
| Date | 16/07/2007. |
| INFORMATION ON ADDITIONAL TRAINING | |
| Year | 2005-2007. |
| Place | Geneva, Switzerland |
| Institution | CERN |
| Field of training | Grid computing 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 (5) |
| Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent) | German (2) |
| Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent) | |

| COMPETENCES FOR THE COURSE | |
|---|---|
| Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme) | Introduction to distributed computing systems, 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) | 1. Čelar, Stipe; Mudnic, Eugen; Seremet, Zeljko. State-of-the-art of messaging for distributed computing systems / Proceedings of the 27th DAAAM International Symposium / Mostar : Elsevier & DAAAM, 2016. 0298-0307<br>2. Abelev, B. ...; Antičić, Tome; Gotovac, Sven; Mudnić, Eugen; Planinić, Mirko; Poljak, Nikola; Simatović, Goran; Šuša, Tatjana; Vicković, Linda; et al. Technical Design Report for the Upgrade of the ALICE Inner Tracking System. / Journal of physics. G, Nuclear and particle physics. 41 (2014) ; 087002-1-087002-181<br>3. Abelev, B. ...; Antičić, Tome; Gotovac, Sven; Mudnić, Eugen; Planinić, Mirko; Simatović, Goran; Šuša, Tatjana; Vicković, Linda; et al. Upgrade of the ALICE Experiment: Letter Of Intent. / Journal of physics. G, Nuclear and particle physics. 41 (2014) ; 87001-1-87001-164.<br>4.Čelar, Stipo; Vicković, Linda; Mudnić, Eugen. Evolutionary measurement-estimation method for micro, small and medium-sized enterprises based on estimation objects. / Advances in production engineering & management (apem). 7 (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) | CERN-ALICEexperiment - ALICE collaboration group of University of Split (O2-CWG 3 group). |
| 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 | **Josip Musić, Ph.D ., Assistant Professor** |
| The course he/she teaches in the proposed study programme | Programming mobile robots and drones |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | Ruđera Boškovića 32, Split |
| Telephone number | + 385 (0)21 305 829 |
| E-mail address | jmusic@fesb.hr |
| Personal web page | http://marjan.fesb.hr/~jmusic |
| Year of birth | 1980 |
| Scientist ID | 272932 |
| Research or art rank, and date of last rank appointment | Senior research associate (February 2013) |
| Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment | Assistant professor (July 2014) |
| Area and field of election into research or art rank | Technical sciences, Electrical engineering |
| INFORMATION ON CURRENT EMPLOYMENT | |
| Institution where employed | Faculty of electrical engineering, mechanical engineering and naval architecture, University of Split |
| Date of employment | September 2014 |
| Name of position (professor, researcher, associate teacher, etc.) | Assistant professor |
| Field of research | Robotics and automatization |
| Function | / |
| INFORMATION ON EDUCATION – Highest degree earned | |
| Degree | PhD |
| Institution | Faculty of electrical engineering, mechanical engineering and naval architecture, University of Split |
| Place | Split |
| Date | 28.04.2010. |
| INFORMATION ON ADDITIONAL TRAINING | |
| Year | 2012 |
| Place | Glasgow, Scotland, UK |
| Institution | School of Computing, University of Glasgow |
| Field of training | human-computer interaction (HCI), signal processing |
| | |
| Year | 2008 |
| Place | Glasgow, Scotland, UK |
| Institution | Department of Computing, University of Glasgow |
| Field of training | human-computer interaction (HCI), signal processing |
| | |
| Year | 2005. |
| Place | Ljubljana, Slovenia |
| Institution | Faculty of electrical engineering, University of Ljubljana |
| Field of training | robotics, biomechanics |
| MOTHER TONGUE AND FOREIGN LANGUAGES | |
| Mother tongue | Croatian |
| Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent) | English (5) |
| Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent) | Italian (2) |

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

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

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

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

| | |
|---|---|
| First and last name and title of teacher | **Vladan Papić, Ph.D., Full Professor** |
| The course he/she teaches in the proposed study programme | Computer graphics |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | Makarska 2, 21000 Split |
| Telephone number | (021) 305649 |
| E-mail address | vpapic@fesb.hr |
| Personal web page | www.fesb.hr/~vpapic |
| Year of birth | 1968 |
| Scientist ID | 227412 |
| Research or art rank, and date of last rank appointment | Scientific Adviser, 20/4/2010 |
| Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment | Senior Full Professor, 17/12/2015 |
| Area and field of election into research or art rank | Technical Sciences, Field Computer science |
| INFORMATION ON CURRENT EMPLOYMENT | |
| Institution where employed | Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture |
| Date of employment | 1/7/20097 |
| Name of position (professor, researcher, associate teacher, etc.) | Professor |
| Field of research | Computer Vision, Expert Systems |
| Function | Vice-dean for bussines |
| INFORMATION ON EDUCATION – Highest degree earned | |
| Degree | PhD |
| Institution | Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture |
| Place | Split |
| Date | 12/2/2002 |
| INFORMATION ON ADDITIONAL TRAINING | |
| Year | |
| Place | |
| Institution | |
| Field of training | |
| MOTHER TONGUE AND FOREIGN LANGUAGES | |
| Mother tongue | Croatian |
| Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent) | English (5) |
| Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent) | Italian (2) |
| Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent) | |

| COMPETENCES FOR THE COURSE | |
|---|---|
| Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme) | Computers in technical systems (PMF, Informatika i tehnička kultura, Undergraduate study programme, 2002-2009.)<br>Electronics (PMF, Informatika i tehnička kultura, Undergraduate study programme 2002 – 2009.)<br>Systems theory (FESB, EIT, Undergraduate study programme, 2009-), Computer graphics ((FESB, Computing, Undergraduate study programme, 2003-) |
| Authorship of university/faculty textbooks in the field of the course | V.Papić, Lectures in electronics, University textbook, 2005. (in Croatian)<br>V. Papić, Computer graphics, Faculty textbook, 2013. (in Croatian) |
| Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most) | 1. J. Musić, T. Marasović, V. Papić, I. Orović, S. Stanković, Performance of compressive sensing image reconstruction for search and rescue, IEEE Geoscience and Remote Sensing Letters, Volume 13, Issue 11, November 2016, Pages 1739-1743.<br>2. J. Musić, I. Orović, T. Marasović, V. Papić, S. Stanković, Gradient Compressive Sensing for Image Data Reduction in UAV Based Search and Rescue in the Wild, Mathematical Problems in Engineering, Volume 2016, 2016.<br>3. I. Orović, V. Papić, C. Ioana, X. Li, S. Stanković, Compressive Sensing in Signal Processing: Algorithms and Transform Domain Formulations, Mathematical Problems in Engineering, Volume 2016, 2016.<br>4. T. Marasović, V. Papić, V. Zanchi, LMNN metric learning and fuzzy nearest neighbour classifier for hand gesture recognition, Journal on Multimodal User Interfaces, Volume 9, Issue 3, 27 August 2015, Pages 211-221.<br>5. T. Marasović, V. Papić, J. Marasović, Motion-based gesture recognition algorithms for robot manipulation, International journal of advanced robotic systems. 12 (2015) , 51; 1-13. |
| Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most) | - |
| Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most) | 1. »Technology transfer infrastructure in the Croatian Adriatic region« - TTAdria (IPA IIIc), 2013-2015.<br>2. "Computer intelligence for recognition and support of human activities " (RIPrePAkt) (FESB), 2013-. (lead researcher).<br>3. „Search and rescue system prototype based on image processing " (FESB - Statim d.o.o.), 2014-. (lead researcher)<br>4. „Advanced methods of 3D virtualization – towards virtual turism and digitalization of cultural heritage“ (FESB – Neir d.o.o.), 2015-. (researcer).<br>5. International bilateral project Croatia- ”Compressive sensing and superresolution in surveillance systems based on optical sensors and UAVs ", Contract with MZOS RH and MZT Republike Crne Gore, 2015-2016. (researcher) |
| The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences? | |

| PRIZES AND AWARDS, STUDENT EVALUATION | |
|---|---|
| Prizes and awards for teaching and scholarly/artistic work | Mentor of best student (Marko Trninić) in field of social and humanistic scienses (annual award HRZZ, 2010). |
| Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated) | 4.7/5 |

| | |
|---|---|
| First and last name and title of teacher | **Joško Radić, Ph.D., Associate Professor** |
| The course he/she teaches in the proposed study programme | Digital Communications |
| 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) | 1. Šolić, Petar; Radić, Joško; Rožić, Nikola. Energy Efficient Tag Estimation Method for ALOHA-based RFID systems. // IEEE sensors journal. 14 (2014) , 10; 3637-3647.<br>2. 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 (članak, znanstveni).<br>3. 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.<br>4. 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) | 3. Look into the Future.<br>4. 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?-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 | **Mladen Russo, Ph.D., Assistant Professor** |
| The course he/she teaches in the proposed study programme | 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<br>Ljubljana, Slovenija, 2016.<br><br>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.<br><br>Stella, Maja; Russo, Mladen; Begušić, Dinko. Fingerprinting based localization in heterogeneous wireless networks // Expert systems with applications, 41 (2014), 15; 6738-6747.<br><br>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.<br><br>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.<br><br>Primorac, Sanja; Russo, Mladen. Android Application for Sending SMS Messages with Speech Recognition Interface // Proceedings of the 35th International Convention MIPRO, 2012.<br><br>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.<br><br>Advanced Interface for Simpler Human-Computer Interaction, SDŽ, project leader Mladen Russo, Ph.D., 2015. – 2017.<br><br>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 | **Marjan Sikora , Ph.D., Assistant Professor** |
| The course he/she teaches in the proposed study programme | Geographic information systems<br>Programming languages and compilers |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | Gajeva 17, 21000 Split |
| Telephone number | 0914305859 |
| E-mail address | sikora@fesb.hr |
| Personal web page | www.fesb.hr/~sikora / |
| Year of birth | 1972. |
| Scientist ID | 238690 |
| Research or art rank, and date of last rank appointment | Research Scientist, 3/2015. |
| Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment | Assistant Professor, 3/2013. |
| Area and field of election into research or art rank | Technical Sciences, Computer Sciences, Information Systems |
| INFORMATION ON CURRENT EMPLOYMENT | |
| Institution where employed | Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture |
| Date of employment | 3/2006. |
| Name of position (professor, researcher, associate teacher, etc.) | Professor |
| Field of research | Computer Science |
| Function | Assistant Professor |
| INFORMATION ON EDUCATION – Highest degree earned | |
| Degree | PhD |
| Institution | University of Zagreb |
| Place | Zagreb |
| Date | 2010. |
| INFORMATION ON ADDITIONAL TRAINING | |
| Year | 2015.-2016. |
| Place | Online |
| Institution | Stanford University |
| Field of training | Automata, Compilers |
| 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) | French (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) | Programming, Object oriented programming<br>Geographic Information Systems<br>Languages and compilers |
| 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) | - M. Sikora, H. Mihanović, I. Vilibić Paleo-coastline of the Central Eastern Adriatic Sea, and paleo-channels of the Cetina and Neretva rivers during the last glacial maximum, Acta Adriatica, Vol. 55, pp. 3-18, 2014.<br>- M.Sikora, I. Mateljan, A Method for Speeding up Beam-tracing Simulation Using Thread-level Parallelization, Engineering with Computers, (DOI) 10.1007/s00366-013-0316-z, Vol., pp. 679-688, 2013.<br>- M.Sikora, I. Mateljan, N. Bogunović, Beam Tracing with Refraction, Archives of Acoustics, Vol. 37, No. 3, pp. 301-316, 2012.<br>- M. Sikora, I. Mateljan, Multithreaded beam tracing, Proceedings of 5rd Congress of Alps Adria Acoustics Association (AAAA 2012), Petrčane (Hrvatska), 12-14. rujan 2012., CD Proceedings<br>- M.Sikora, I. Mateljan, N. Bogunović, Beam Division in Acoustic Simulation of Non-Homogenous Environments, Automatika, Vol. 52, No. 4, pp. 339-352, 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) | - Visualization of wind-power plant, cooperation with PhD Antonio Šarolić<br>- Study on use of GIS in Split city management, City of Split, 2012.<br>- TGM - TIN & Grid Maker – Software for Digital Elevation Models, OBALA d.o.o. Split, 2011. |
| 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) | 4,7/5; 5/5 |

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

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

| | |
|---|---|
| First and last name and title of teacher | **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.<br><br>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.<br><br>Stella, Maja; Russo, Mladen; Begušić, Dinko. GSM-Based Approach for Indoor Localization // World Academy of Science, Engineering and Technology. 2013. 195-199.<br><br>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.<br><br>Advanced Interface for Simpler Human-Computer Interaction, SDŽ, project leader Mladen Russo, Ph.D., 2015. – 2017.<br><br>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<br>Digital image processing and analysis |
| 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<br>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<br>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) | Comutational intelligence (1995-today)<br>Exoert systems and artificial intelligence (1995-2004)<br>Introduction to Artificial intelligence (2004-2005)<br>Artificial intelligence (2005-today)<br>Artificial intelligence and Expert systems - Postgraduate (1991-1995)<br>Artificial intelligence and Knowledge engineering - Postgraduate (1995-2005)<br>Intelligent systems - Postgraduate (2005 - today)<br>Computer image processing (1995-1997)<br>Digital image processing and analysis (2008-danas)<br>Advanced digital image processing and analysis - Postgraduate (2005 - today) |
| Authorship of university/faculty textbooks in the field of the course | D.Stipaničev, Lj.Šerić, Introduction to Artificial intelligence, internal textbook<br>D.Stipaničev, Lj.Šerić, Fuzzy Systems, internal textbook |
| Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most) | 1. Štula, Maja; Stipaničev, Darko; Maras, Josip. **Distributed Computation Multi-agent System** // *New generation computing*. **31** (2013) , 3; 187-209<br>2. M.Stula, D.Stipanicev, Lj.Seric, Intelligent Modeling with Agent Based Fuzzy Cognitive Maps, **International journal of Intelligent Systems ,** Vol.25, 2010, pp.981-1004<br>3. D.Stipaničev, J.Efstathion, Reasoning in planning, decision making and control: intelligent robots, vision, natural language, u knjizi B.Souček IRIS Group, **"Fuzzy, Holographic and Parallel Intelligence"**, J.Wiley & Sons, Nwe York, 1992, pp.93-132<br>4. M.Stula, D.Stipanicev, Lj.Seric, D.Krstinic, Fuzzy Cognitive Map for decision support in image post-processing, **Proc. of IWSSIP 2011**, Sarajevo , 2011. 311-314<br>5. D.Stipaničev, J.Efstathion, Qualitative reasoning and fuzzy set theory,**Proc. Int. AMSE Conf. "Signals and Systems"**, Brighton (UK), July 1989, AMSE Press, Vol.1., pp.17-26 |
| 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)<br>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) | 4,6/5 |

| | |
|---|---|
| First and last name and title of teacher | **Matko Šarić, Ph.D, Assistant Professor** |
| The course he/she teaches in the proposed study programme | Advanced algorithms |
| 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<br>• Signals and systems, undergraduate study of electrical engineering and information technology<br>• Algorithms, , undergraduate study of compter 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<br>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<br>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<br>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<br>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.)<br>• 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 | **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<br>Name of the study programme in which the course is offered: Automation and Systems, Electrical Engineering, Computer Engineering, Telecommunications and Computer Science, Computer Science<br>The level of the study programme: Graduate study<br>2. Course name: Intelligent Systems |

| | |
|---|---|
| | Name of the study programme in which the subject is taught: Electrical Engineering and Information Technology<br>The level of the study programme: Postgraduate study<br>3. Course name: Web intelligence and large data sets<br>Name of the study programme in which the subject is taught: Electrical Engineering and Information Technology<br>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.<br>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.<br>2) Šerić Ljiljana, Stipaničev Darko, Štula Maja. Engineering of holonic multi agent intelligent forest fire monitoring system. AI communications, 26 (2013), 3; 303-316.<br>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.<br>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.<br>5) Ukić Nenad, Maras Josip, Šerić Ljiljana.<br>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<br>HOLISTIC – Adriatic Holistic Forest Fire Protection , IPA, 2014- in progres<br>Wind Risk Prevention Projekt – ECHO, Civil Protection<br>Automatic vehicle classification based on computer vision and data fusion |
| The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences. | |

| PRIZES AND AWARDS, STUDENT EVALUATION | |
|---|---|
| Prizes and awards for teaching and scholarly/artistic work | 20 best junior reasearchers, 2013 |
| Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated) | |

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

| | |
|---|---|
| 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. Stanković, Rade; Štula, Maja; Maras, Josip. Evaluating fault tolerance approaches in multi- agent systems. // Autonomous agents and multi-agent systems. 31 (2017) , 1; 155-177<br>2. Štula, Maja; Maras, Josip; Mladenović, Saša. Continuously self-adjusting fuzzy cognitive map with semi-autonomous concepts. // Neurocomputing. 232 (2017) ; 34-51<br>3. Markić, Ivan; Štula, Maja; Maras, Josip. Intelligent Multi Agent Systems for Decision Support in Insurance Industry // / Biljanović, Petar (ur.). Rijeka : Croatian Society for Information and Communication Technology, Electronics and Microelectronics - MIPRO, 2014. 1368-1373<br>4. Šerić, Ljiljana; Stipaničev, Darko; Štula, Maja. Engineering of holonic multi agent intelligent forest fire monitoring system. // Ai communications. 26 (2013) , 3; 303-316<br>5. Štula, Maja; Stipaničev, Darko; Maras, Josip. Distributed Computation Multi-agent System. // New generation computing. 31 (2013) , 3; 187-209 |
| Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most) | 1. Golčić, Hrvoje; Skelić, Ivana; Štula, Maja. Razvoj, implementacija i korištenje dodataka za osobe s oštećenjem vida u Moodle sustavu, 2015. (brošura).<br>2. Golčić, Hrvoje; Skelić, Ivana; Štula, Maja. Accessibility Issues Faced By Blind and Visually Impaired Persons in the Field of Studying and Education // Proceedings of CIET 2014 / Plazibat, Bože ; Kosanović, Silvana (ur.).Split : University of Split, 2014. S-187-S-198 |
| Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most) | IPNAS (Inteligentni Protupožarni NAdzorni Sustav) sustav, stručni<br>DICES – Distributed Component-based Embedded Software Systems, UKF<br>Agentski orijentirani inteligentni sustavi nadzora i zaštite okoliša, MZOŠ |
| The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?-pedagoške kompetencije? | |
| PRIZES AND AWARDS, STUDENT EVALUATION | |
| Prizes and awards for teaching and scholarly/artistic work | |
| Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated) | |

| | |
|---|---|
| First and last name and title of teacher | **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.<br>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<br>2. Veža, Ivica; Mladineo, Marko: SUSTAINABILITY THROUGH PRODUCTION NETWORKS. Management and Production Engineering Review. 4 (2013), 4; 33-39<br>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<br>4. Takakuwa, Soemon; Veža, Ivica: Technology Transfer and World Competitiveness. Procedia Engineering. 69 (2014); 121-127<br>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) | 3. 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.<br>4. Čelar, Stipe; Turić, Mili; Dragičević, Srdjana; Veža, Ivica. Digital Learning Factory at FESB – University of Split , ZBORNIK RADOVA YU INFO 2016, 2016. 001-006<br>5. 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<br>6. 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) | 5. 2008 – 2013 Project TEMPUS-2008-IT-JPCR 144 959, Master Study Program in Product Lifecycle Management with Sustainable Production |

| | |
|---|---|
| | 6. 2011-2014 LEONARDO DA VINCI Project “LOPEC - Logistics personnel excellence by continuous self-assessment”, FESB Split, University of Reutlingen<br>7. 2013-2016 Network of Innovative Learning Factories NIL, “System - Learning Factory“, FESB, Split, University of Reutlingen<br>8. 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<br>9. 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 |

| | |
|---|---|
| First and last name and title of teacher | **Linda Vicković, Ph.D., Associate Professor** |
| The course he/she teaches in the proposed study programme | Business intelligence |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | Put sv. Lovre 55d |
| Telephone number | +385 21 305 849 |
| E-mail address | Linda.Vickovic@fesb.hr |
| Personal web page | http://marjan.fesb.hr/~linda/ |
| Year of birth | 1973. |
| Scientist ID | 242565 |
| Research or art rank, and date of last rank appointment | Scientific associate, 31/3/2011 |
| Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment | Associate Professor, 22/9/2017 |
| Area and field of election into research or art rank | Technical Sciences, Computing |
| INFORMATION ON CURRENT EMPLOYMENT | |
| Institution where employed | FESB |
| Date of employment | 1.5.1997. |
| Name of position (professor, researcher, associate teacher, etc.) | Assistant professor |
| Field of research | Scientific research and teaching |
| Function | |
| INFORMATION ON EDUCATION – Highest degree earned | |
| Degree | PhD |
| Institution | FESB |
| Place | Split |
| Date | 18. 7. 2007. |
| 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<br>5 |
| Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent) | |
| Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent) | |

| COMPETENCES FOR THE COURSE | |
|---|---|
| Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme) | Algorithms and Data Structures, Professional study programme,<br><br>Software engineering, Professional 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. L. Vicković, S. Gotovac, S. Čelar, Simulation-Based Performance Analysis of the ALICE Mass Storage System, International journal of simulation modelling. 15 (2016), 1; 70-82<br>2. A. Pinjuh, L. Vickovic, D. Cavar, MapReduce-based face detection in images, Proceedings of the 27th DAAAM International Symposium , DAAAM International, 2016. 658-663.<br>3. S. Čelar, L. Vicković, E. Mudnić, Evolutionary measurement-estimation method for micro, small and medium-sized enterprises based on estimation objects, Advances in production engineering & management (APEM). 7 (2012), 2; 81-92.<br>4. S. Čelar, M. Turić, L. Vicković, Method for personal capability assessment in agile teams using personal points, 22nd Telecommunications Forum, IEEE, 2014. 1134-1137 |
| 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) | 4.5/5<br><br>4.5/5 |

| | |
|---|---|
| First and last name and title of teacher | **Damir Vučina, Ph.D., Full Professor** |
| The course he/she teaches in the proposed study programme | Neural networks and genetic algorithms |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | FESB, R. Boškovića 32, 21000 Split |
| Telephone number | 021 305 969 |
| E-mail address | vucina@fesb.hr |
| Personal web page | |
| Year of birth | 1962 |
| Scientist ID | 129716 |
| 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, 2005 |
| Area and field of election into research or art rank | Technical Sciences, Fundamental Technical Sciences |
| INFORMATION ON CURRENT EMPLOYMENT | |
| Institution where employed | Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture |
| Date of employment | 1985 |
| Name of position (professor, researcher, associate teacher, etc.) | Professor |
| Field of research | Numerical methods in engineering and optimization |
| Function | Head of group for modeling and computer-aided analysis |
| INFORMATION ON EDUCATION – Highest degree earned | |
| Degree | PhD |
| Institution | Fakultet strojarstva i brodogradnje |
| Place | Zagreb |
| Date | 1993 |
| INFORMATION ON ADDITIONAL TRAINING | |
| Year | Fulbright grant, Columbia University New York<br>Several courses at CISM Italy |
| 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 (5) |
| Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent) | |
| COMPETENCES FOR THE COURSE | |
| Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme) | Computer.aided analysis<br>Optimization methods<br>Programming<br>Graduate courses |

| | |
|---|---|
| Authorship of university/faculty textbooks in the field of the course | D. Vučina, 'Metode inženjerske numeričke optimizacije', Sveučilište u Splitu, FESB 2005<br>Damir Vučina, 'Primjena računala u inženjerskoj analizi', FESB, 2007 |
| Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most) | **p1.** Ćurković, M.; Vučina, D. 3D Shape acquisition and integral compact representation using optical scanning and enhanced shape parameterization. Advanced engineering informatics. 28 (2014) , 2; 111-126, IF 2.086.<br>**p2.** Vučina, D.; Ćurković, M.; Novković, T. CLASSIFICATION OF 3D SHAPE DEVIATION USING FEATURE RECOGNITION OPERATING ON PARAMETERIZATION CONTROL POINTS. // Computers in industry. 65 (2014) , 6; 1018-1031. IF 1.457.<br>**p3.** Milas, Zoran; Vučina, Damir; Marinić-Kragić, Ivo. MULTI-REGIME SHAPE OPTIMIZATION OF FAN VANES FOR ENERGY CONVERSION EFFICIENCY USING CFD, 3D OPTICAL SCANNING AND PARAMETERIZATION. // Engineering Applications of Computational Fluid Mechanics. 8 (2014), 3; 407-421. IF 0.921.<br>**p6.** Vučina, D.; Lozina, Ž.; Pehnec, I. Ad-Hoc Cluster and Workflow for Parallel Implementation of Initial-Stage Evolutionary Optimum Design. Structural and multidisciplinary optimization. 45 (2012) , 2; 197-222. IF 1.488.<br>**p5.** Vučina, D.; Lozina, Ž.; Pehnec, I. Computational procedure for optimum shape design based on chained Bezier surfaces parameterization. Engineering applications of artificial intelligence. 25 (2012) , 3; 648-667. IF 1.665. |
| Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most) | s.a. |
| Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most) | s.a.. |
| 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? | continuously |
| PRIZES AND AWARDS, STUDENT EVALUATION | |
| Prizes and awards for teaching and scholarly/artistic work | 1. Columbia University, New York, USA, 1986- 1987, dobitnik US Fulbright stipendije<br>2. Sveučilište u Splitu, za tehničke znanosti, 2014 |
| 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) | excellent |

**Ivan Zoraja, Ph.D., Associate Professor**

## 3.4. Optimal number of students

The admission quote for the first year of studies is 100.

## 3.5. Estimate of costs per student

Annual costs of studies per student amount to HRK 35,000.00

## 3.6. Plan of procedures of study programme quality assurance

<table>
<tr><td colspan="2">In keeping with the European standards and guidelines for internal quality assurance in higher education institutions (according to “Standards and Guidelines of Quality Assurance in the European Higher Education Area”) on the basis of which the University of Split defines procedures for quality assurance, the proposer of the study programme is obliged to draw up a plan of procedures of study programme quality assurance.</td></tr>
<tr><td colspan="2">Documentation on which the quality assurance system of the constituent part of the University is based:</td></tr>
<tr><td colspan="2">• Regulations on the quality enhancement system of FESB</td></tr>
<tr><td colspan="2">• Quality Assurance Handbook of the constituent part</td></tr>
<tr><td colspan="2">Description of procedures for evaluation of the quality of study programme implementation:<br>• 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<br>• If procedure is described in an attached document, name the document and the article.</td></tr>
<tr><td>Evaluation of the work of teachers and part-time teachers</td><td>• Student evaluation of quality of instruction and teaching activities conducted through student survey (printed questionnaires)<br>• Survey is organised and conducted by the Quality Enhancement Committee of the Faculty (Committee)<br>• Survey results are processed automatically at the University<br>• Survey is conducted each semester<br>• The Committee presents cumulative results of the survey at the sessions of the Faculty Council. The report is published at the Faculty web site.<br>All procedures are conducted in accordance with the Regulations on organisation and role of the quality assurance system of the University of Split, Regulations on procedure of student evaluation of the quality of teachers and teaching of the University of Split and Regulations on the quality enhancement system of FESB.</td></tr>
</table>

| | |
|---|---|
| Monitoring of grading and harmonization of grading with anticipated learning outcomes | Committee for study programmes in Graduate university study programme in Computing is monitoring the harmonisation of grading and learning outcomes.<br>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<br>• Evaluation is conducted using an on-line questionnaire which the students complete in each year of study, except the final year<br>• 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)<br>• Survey results are processed automatically at the University<br>• Survey is conducted every year<br>• 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<br>• 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<br>• Analysis of pass rate by study programmes is carried out by the University in cooperation with the Committee<br>• Analysis by courses and study programmes is carried out by the Faculty Management Board<br>• 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<br>• Evaluation is conducted using an on-line questionnaire which the students complete following the completion of studies<br>• 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)<br>• Survey results are processed automatically at the University<br>• 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<br>• 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<br>• Self-evaluation is carried out every 5 years<br>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<br>• Visits to the faculty are organised for high-school students from Split and the wider region<br>• Participation at University fairs<br>• Public media presentations |