JOSIP JURAJ STROSSMAYER UNIVERSITY OF OSIJEK

FACULTY OF ELECTRICAL ENGINEERING, COMPUTER SCIENCE AND INFORMATION TECHNOLOGY OSIJEK

Proposal for Amendments

to the Undergraduate University Study Programme in Computer Engineering

Osijek, 2022

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1. INTRODUCTION

The undergraduate university study programme in Computer Engineering has been carried out at the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek since the academic year 2005/2006.

Taking into account the interests and the needs of the job market, the broader social community, student interests, as well as scientific promotion of staff who could participate in the teaching process, we have decided to propose amendments to the study programme.

These amendments would not cause a change in the number of students enrolled in the undergraduate university study programme in Computer Engineering; instead, students would be divided into two elective modules:
PRRI – Computer Engineering
PRPI – Software Engineering

1.1. Basic information about the higher education institution (name and address of the higher education institution, phone number, email address, web address).

Name of the higher education institution:
Josip Juraj Strossmayer University of Osijek
Faculty of Electrical Engineering, Computer Science and Information Technology Osijek
Address:
Kneza Trpimira 2b
31 000 Osijek

Phone:
+385 31 224 600

Email address:
ferit@ferit.hr

Web address:
http://www.ferit.unios.hr

1.2. Name of the body that authorised the launch of amendments to the study programme (e.g. management boards, teachers in higher education institution councils, etc.)? Attach proof thereof.

The Faculty Council of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek, Josip Juraj Strossmayer University of Osijek, adopted the "Proposal for Amendments to the Undergraduate University Study Programme in Computer Engineering" at its 242nd (electronic) session held on 7 May 2020 (the Faculty Council decision is attached in Appendix 7.1).

1.3. List of teachers who participated in the drafting of the study programme proposal. Add their titles and scientific fields they are elected in.

Željko Hocenski, PhD, Full Professor with Tenure
Technical Sciences/Computer Engineering

Goran Martinović, PhD, Full Professor with Tenure
Technical Sciences/Computer Engineering

Drago Žagar, PhD, Full Professor with Tenure
Technical Sciences/Electrical Engineering

Robert Cupec, PhD, Full Professor
Technical Sciences/Computer Engineering

Dražen Slišković, PhD, Full Professor
Technical Sciences/Fundamental Technical Sciences

Kruno Miličević, PhD, Full Professor
Technical Sciences/Electrical Engineering

Josip Job, PhD, Associate Professor
Technical Sciences/Computer Engineering

Tomislav Keser, PhD, Associate Professor
Technical Sciences/Computer Engineering

Danijel Topić, PhD, Associate Professor
Technical Sciences/Electrical Engineering

Ivan Aleksi, PhD, Assistant Professor
Technical Sciences/Computer Engineering

Damir Filko, PhD, Assistant Professor
Technical Sciences/Computer Engineering

Tomislav Matić, PhD, Assistant Professor
Technical Sciences/Computer Engineering

Ratko Grbić, PhD, Assistant Professor
Technical Sciences/Computer Engineering

2. INSTITUTIONAL REQUIREMENTS

2.0. The study programme proposal must contain a comparability analysis of the proposed study programme with related accredited study programmes in the Republic of Croatia and other countries in the European Union, which must contain minimum institutional requirements.

The proposed undergraduate university study programme in Computer Engineering is largely based on the current undergraduate university study programme, which preserves the initial comparability with the quality of related accredited study programmes in the Republic of Croatia and the European Union countries.
The study programme is comparable in terms of content and qualifications to undergraduate university study programmes conducted at Croatian universities:

- **Undergraduate university study programme in Computing at the Faculty of Electrical Engineering and Computing, University of Zagreb (https://www.fer.unizg.hr/studiji/fer3/racunarstvo). The learning outcomes of the courses in the proposed undergraduate study programme are largely comparable to the learning outcomes of the following courses:**
  - Digital Electronics, V. Glavinić; M. Mikuc; Z. Kalafatić
  - Linear Algebra, A. Aglić Aljinović; I. Brnetić; N. Elezović; A. Nakić; D. Vlah; D. Žubrinić
  - Mathematical Analysis 1, I. Brnetić; M. Bukal; T. Burić; L. Horvat Dmitrović; J. Milišić; M. Pašić; D. Žubrinić; A. Žgaljić Keko
  - Introduction to Programming, G. Gledec; V. Sailor; S. Zakošek
  - Communication Skills, P. Pale
  - Physics, S. Ilijić; S. Pleslić; A. Babić; A. Sušac; Ž. Bosniak; V. Gomzi
  - Mathematical Analysis 2, T. Burić; L. Horvat Dmitrović; D. Kovačević; M. Pašić; T. Šikić; I. Velčić; A. Žgaljić Keko
  - Algorithms and Data Structures, I. Botički; M. Domazet-Lošo; V. Mornar; M. Šikić
  - Object-Oriented Programming, M. Kušek; K. Pripužić; B. Milašinović; M. Randić
  - Fundamentals of Electrical Engineering, B. Blašković; M. Randić; M. Dadić; B. Trkulja; D. Pintar; M. Vranić
  - Management in Engineering, V. Bilas; Ž. Car; H. Pandžić; Ž. Štih; B. Trkulja
  - Basic Design Principles, F. Vukić
  - Probability and Statistics, A. Aglić Aljinović; I. Brnetić; N. Elezović; M. Krnić; I. Velčić
  - Computer Architecture, M. Kovač; J. Knezović; D. Hofman
  - Information Theory, A. Bažant; Ž. Ilić; I. Pandžić; M. Vuković
  - Databases, M. Baranović; Z. Skočir; S. Zakošek; L. Brkić
  - Operating Systems, M. Golub; D. Jakobović; L. Jelenković
  - Tools for Digital Design, M. Vučić
  - Fundamentals of Electronics, A. Barić; V. Čeperić; M. Koričić; I. Krois; M. Poljak

  Fundamentals of Signal Processing, B. Jeren; D. Petrinović; T. Petković
  Embedded Systems, D. Petrinović; M. Vučić; H. Mlinarić; H. Džapo

- **Undergraduate university study programme in Computing at the Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture, University of Split (https://nastava.fesb.unist.hr/nastava/studiji/313/god/1). The learning outcomes of the courses in the proposed study programme are largely comparable to the learning outcomes of the following courses:**
  - Electrical Engineering, S. Vujević, D. Lovrić
  - Mathematics 1, J. Barić
  - Introduction to Computers and Programming, M. Bonković, A. Kuzmanić Skelin

- Electronics, T. Betti, I. Marasović
- Physics 1, N. Godinović
- Mathematics 2
- Programming, D. Vučina, D. Sedlar
- Object-Oriented Programming, M. Sikora
- Data Structures, L. Vicković
- Communication Skills, N. Sirković
- Algorithms, M. Šarić
- Digital Computer Architecture, S. Gotovac
- Databases, V. Papić
- Signals and Systems, T. Grujić
- Operating Systems, S. Gotovac
- Internet Programming, M. Štula
- Computer Networks, J. Ožegović
- Information System Design, M. Štula
- Engineering Economics, J. Vasilj
- Signal Processing, D. Begušić

- **Undergraduate university study programme in Electronics and Computer Engineering (semesters 5 and 6) at the Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture, University of Split (https://nastava.fesb.unist.hr/nastava/studiji/313/god/1). In addition to courses already mentioned in relation to the study programme in Computing conducted at the same institution, the courses in the proposed study programme are largely comparable to the learning outcomes of the following courses:**
  - Computer Architecture, S. Gotovac
  - Electronic Circuits, I. Marinović
  - Computer Networks, J. Ožegović
  - Internet Programming, D. Stipaničev, Lj. Šerić, M. Bugarić
  - Simulation Modelling, J. Marasović
  - Digital Signal Processing, D. Begušić

In addition, this study programme is comparable to study programmes carried out at European universities (for a more detailed comparison, see 3.21):

- TU Kaiserslautern: https://www.uni-kl.de/studiengang/22783/Electrical_and_Computer_Engineering_Bachelor_of_Science?lang=en
- University of Oxford: http://www.ox.ac.uk/admissions/undergraduate/courses-listing/computer-science#
- University of Cambridge: https://www.undergraduate.study.cam.ac.uk/courses/computer-science
- École Polytechnique Fédérale de Lausanne: https://www.epfl.ch/schools/ic/education/bachelor/computer-science/
- Technische Universität Wien: https://informatics.tuwien.ac.at/bachelor-ue033534-de
- Eindhoven University of Technology: https://www.tue.nl/en/education/bachelor-college/bachelor-computer-science-and-engineering/
- Universität Bremen: https://www.dbs.uni-bremen.de/en/study-programs/study-career-fields/mathematics-engineering-production/detail/study/informatik-bachelor-1/
- FH Krems University of Applied Science: https://www.fh-krems.ac.at/en/study/bachelor/full-time/informatics/

The study programmes are entirely comparable because they last for three years, students acquire the same number of ECTS credits (180), and the academic title Bachelor of Computer Engineering is entirely comparable in both the Republic of Croatia and the European Union countries. Comparability is also evidenced by successful incoming and outgoing mobility within the framework of Erasmus+ mobility programmes (see 3.24.), which will be continued because the basic assumptions of compliance with the Bologna Process have not changed.

In addition to other teachers of the Faculty, the quality of the teaching process is ensured by a total of 45 teachers and associates affiliated with the following five departments, who will teach most of the classes:

- **Department of Software Engineering**, which consists of the Chair of Programming Languages and Systems and the Chair of Visual Computing;
- **Department of Computer Engineering and Automation**, which consists of the Chair of Computer Engineering and the Chair of Automation and Robotics;
- **Department of Core Courses**, which consists of the Chair of Mathematics, Physics and Mechanical Engineering and the Chair of Humanities and Social Sciences;
- **Department of Electromechanical Engineering**, which consists of the Chair of Fundamentals of Electrical Engineering and Measurements, the Chair of Electric Machines and Power Electronics, and the Electric Machines and Hybrid Electric Drives Laboratory;
- **Department of Communications**, which consists of the Chair of Radiocommunications and Telecommunications, the Chair of Electronics and Microelectronics, the Chair of Multimedia Systems and Digital Television, and the Laboratory for High Frequency Measurements.

Within these departments, high-quality computer, measuring, and simulation equipment is provided in a series of teaching laboratories that have already been established and that will be used for teaching purposes. These laboratories are constantly evolving and they include the Computer Graphics and Mathematical Image Processing Laboratory, the Automation and Robotics Laboratory, the Digital Electronics and Computer Architecture Laboratory, the Computer Systems Design Laboratory, the Computer System Reliability and Diagnostics Laboratory, the Artificial Intelligence Laboratory, and the Programming Languages and Systems Laboratory (see 7.2).

It should be emphasised that the Commission for Quality Enhancement and Assurance in Higher Education at the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek continuously monitors student work and assessment, student surveys of the teaching process and teaching staff, as well as other action plans and ongoing activities aimed at improving the quality of education.

This comparison of the proposed undergraduate university study programme in Computer Engineering leads to a conclusion that this study programme is highly comparable to related study programmes, which will certainly result in better student mobility between the University of Osijek and other Croatian universities and the majority of European universities.

2.1. Has the higher education institution adopted a strategy for its development and individual strategies or action plans, and does it disclose annual reports on their implementation?

The Strategy of Josip Juraj Strossmayer University of Osijek for the period 2011-2020 was adopted at the joint session of the Senate of Josip Juraj Strossmayer University of Osijek and the University Council that was held on 19 December 2011, and the amendments were adopted in December 2014.

The Development Strategy of the Faculty of Electrical Engineering Osijek for the period 2016-2020 was adopted at the 184th regular session of the Faculty Council held on 26 January 2016.

The Development Strategy, *inter alia*, consolidates individual action plans for the teaching process, scientific research, professional development activities, a quality assurance system, and resource development, and provides detailed road maps to all activities.

It is continuously monitored and analysed whether the tasks aimed at achieving the set strategic goals are fulfilled, and the Faculty Council ensures the implementation of the Strategy, *inter alia*, by adopting the plan and report submitted by the Commission for Quality Enhancement and Assurance in Higher Education, and the Dean's Annual Report on the work and operation of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek.

2.2. Describe how the higher education institution has defined and published its standards and regulations on the assessment of the learning outcomes (examination procedures) achieved within the study programmes it carries out, including verification methods related to quality assurance, impartiality, transparency, procedures in cases of appeals and other relevant areas.

The Ordinance on Studies and Studying at Josip Juraj Strossmayer University of Osijek regulates in more detail the rules of assessment of the achieved learning outcomes, i.e. examination procedures (written and oral exams, practical part of the exam, prerequisites, examination periods, a number of exam attempts, etc.), a grade appeal procedure, an exam retake procedure, content, format, and manner of examination record keeping, ensuring transparency in exams, the right to access exam results, and other related matters. The Ordinance on Studies and Studying at Josip Juraj Strossmayer University of Osijek is published on the website of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and is therefore available to the public, especially to current students and aspiring students.

Based on the Criteria for Monitoring and Assessing Students Studying under the Bologna Process of 20 November 2007, the Student Evaluation Criteria were created and published on the Faculty website, https://www.ferit.unios.hr/studenti/dokumenti-o-studijima-i-studiranju/ (under STUDENT EVALUATION CRITERIA 2017/2018).

The latest version was adopted at the 203rd session of the Faculty Council of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek, which was held on 26 September 2017. Pursuant to that version, every teacher is obliged to establish student evaluation criteria for each course in the manner prescribed in the documents.

The examination criteria for each individual course are clearly stated and displayed on related course pages on the Loomen e-learning platform as well as on the Faculty website: https://www.ferit.unios.hr/studiji/studijski-programi-i-predmeti

The learning outcomes for all courses of undergraduate and graduate university study programmes as well as the undergraduate university study programme of the Faculty were adopted at the 175th regular session of the Faculty Council held on 10 March 2015, within the framework of the Decision on the Compliance of the Study Programmes with the Act on Scientific Activity and Higher Education. In addition to the learning outcomes, the passing thresholds and the share in the final grade are precisely defined for each activity.

An important part of quality assurance is the University student survey, which is conducted pursuant to Josip Juraj Strossmayer University of Osijek guidelines. The survey is filled out by full-time students of all

years of study. The survey is usually conducted at the end of the academic year. Through survey questions, students evaluate courses, the criteria for assessing student knowledge and work, teacher availability and attitude towards students. The management of the Faculty analyses survey results and takes necessary actions as needed, while aggregated results are presented at the Faculty Council. The Commission for Quality Enhancement and Assurance in Higher Education prepares and sends individual results to each lead instructor, who are obliged to review these survey results with their assistants. The results of student surveys are used to verify the fulfilment of necessary conditions laid down by the Rector's Conference for the evaluation of teaching and professional activity in the process of appointing teachers to scientific-teaching and teaching titles.

In addition, the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek conducts a Faculty ECTS survey, by means of which, through student self-evaluation, student academic workload is evaluated, i.e., the number of working hours spent on mastering individual activities in the course, and thus passing the exam. It is also evaluated to what extent the teachers taught content provided for by the study programme and how much the individual forms of teaching contributed to the successful adoption of the learning outcomes. These data are compared with the data on the exam pass rate obtained for all courses in all study programmes.

Additional Faculty surveys are as follows:

- a survey of the postgraduate study programme, in which the students evaluate their supervisors, the Vice-Dean for Science and Postgraduate Studies, the Student Administration Office and the quality of information about the study programme, as well as the procedures and processes they encounter in this study programme;
- a survey for graduates i.e., alumni who evaluate their former teachers, the quality of course delivery and how much the Faculty has helped them in getting the desired employment and status within the company;
- a survey for employers who evaluate the quality of graduates employed in their companies and provide further feedback on the direction in which the Faculty should develop, particularly regarding the study programmes carried out by the Faculty; and
- a survey on professional services in which students evaluate their satisfaction with services provided by the Student Administration Office, the Vice-Dean for Education and Student Affairs Office, the Library, and the IT support service.

Furthermore, at its 234th regular session held on 5 November 2019, the Faculty Council of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek adopted the Quality Enhancement and Assurance Handbook for Higher Education, which describes the basic procedures and forms that are necessary to systematically monitor the compliance of activities with the "Standards and Guidelines for Quality Assurance in the European Higher Education Area". The Handbook describes, *inter alia*, the quality enhancement and assurance system, activities in the process of quality assurance and enhancement, as well as quality indicators defined as a quality enhancement measure which are an integral part of internal evaluation adopted by the Faculty Council at the end of the academic year, among which are:

- Number of candidates applying for the study programme/Admission quota;
- Number of students enrolled in the first year of study/Number of graduates per year;
- Total number of students/Number of repeater students;
- Total number of students enrolled in university study programmes/Number of teachers appointed to scientific-teaching titles;
- Total number of students enrolled in professional study programmes/Number of teachers appointed to teaching titles;

- Number of students enrolled in a higher year of study/Number of students enrolled in the first year of study;
- Number of students enrolled in the postgraduate study programme;
- Number of foreign students enrolled in the first year of the postgraduate study programme/Total number of students enrolled in the first year of the postgraduate study programme;
- Number of doctoral theses defended;
- Number of research papers published in journals indexed in the Web of Science database/Number of teachers appointed to scientific-teaching titles;
- Citation of papers indexed in the Web of Science database;
- Total impact factor of papers/Number of research papers published in journals indexed in the Web of Science database;
- Number of research papers in the five-year period published in journals that, according to their impact factor, belong to the top 25% of journals within the corresponding subject category (Q1)/Number of research papers published in journals indexed in the Web of Science database in the five-year period;
- Number of competitive research projects approved for funding/Number of competitive research project applications (Croatian Science Foundation, UKF, FP7, Horizon2020);
- Contracted funds for competitive research projects;
- Number of other research projects approved for funding/Number of applications for other research projects (IPA, PoC, contracts with partners from the industry, etc.);
- Contracted funds for other research projects;
- Number of researchers who spent at least two weeks at foreign institutions/Total number of teachers appointed to scientific titles, assistants, postdoctoral researchers and research assistants;
- Outgoing teacher mobility/Number of teachers appointed to teaching and scientific-teaching titles;
- Incoming teacher mobility/Number of teachers appointed to teaching and scientific-teaching titles.

2.3. How do you ensure student participation in all processes related to the quality assurance of the higher education institution?

Within the Faculty Council of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek, there are 10 student representatives elected by the Student Union. During the decision-making in the Faculty Council, student representatives can exercise a suspensive veto on matters of particular interest to students, such as changes in the study system, quality assurance, proposing study programmes, implementation of syllabi and issues related to student standards.

The student representative is a member of the Ethics Committee, the Committee for Awarding Students, and the Disciplinary Board. The student representative is also appointed to the Working Group for Learning Outcomes and participates in the work of the aforementioned bodies, especially when it comes to revising old or creating new quality-related documents.

In addition to their representatives, students can directly participate in the processes related to quality assurance at the higher education institution, primarily by completing the University Student Survey and the Survey on ECTS Credits, as well as the Survey on Professional Services.

Based on these surveys, in the case of unfavourable results, the Faculty management defines measures to increase quality in the respective cases. Also, the results of the University Student Survey are used for the evaluation of teaching and professional activities in the appointment process to scientific-teaching and teaching positions required by the Rector's Conference.

2.4. How do you ensure the participation of labour market representatives in the development of the higher education institution?

The management of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek has expressed its interest in strengthening the connection between the industry and the activities organised by the Faculty. Increasing collaboration with the surrounding economy is one of the goals outlined in the draft of the Development Strategy of the Faculty of Electrical Engineering 2016–2020.

Therefore, scientific and professional conferences are organised, and interested experts are always invited to participate, e.g., the International Conference on Smart Systems and Technologies (https://sst-conference.org/). Additionally, occasional presentations by the economy and other entities are organised, involving discussions with students and faculty (panel discussions).

The Faculty of Electrical Engineering, Computer Science and Information Technology Osijek makes efforts to establish a link between employers and students through a career day called DOVIK (Open Doors and Career Day), which is organised every year on the third Wednesday of March. The purpose of the event is to present high school and university students with:

• Everything the Faculty offers (primarily through demonstrations in laboratories),
• Everything that companies offer, i.e., where they can find employment after completing their studies, presented through 15-minute company presentations or interesting demonstrations of activities that companies engage in.

A portal for FERIT students and employers, called STUP (https://stup.ferit.hr/), has been established. STUP, which connects our students and employers, was launched on 1 May 2016. Through this portal, companies can directly inform students about opportunities for:

• Employment
• Scholarships
• Completion of their final papers/Master's theses in the company
• Practical training
• As well as publish all other non-commercial content and activities of interest to our students.

Additionally, companies have access to data on students interested in collaboration, and the Faculty informs companies about academic and extracurricular activities they can engage in. The Faculty of Electrical Engineering, Computer Science and Information Technology Osijek also organises and hosts guest lectures held by companies, which employers find highly beneficial and willingly participate in. Hence, at the end of academic year 2018/2019, the statistics on STUP were as follows:

• 386 companies using the portal, of which
• 63 companies offered practical training
• 259 practical training positions were available, and 187 students completed their practical training in 56 companies.

The connection between the Faculty and labour market representatives is also evident in the awarding of the best students on the occasion of the Faculty Day. For example, in 2019, companies such as DICE – Digital Innovation Center, Ericcson Nikola Tesla, CETITEC, TEO Belišće, Xylon, HOPS, Siemens, Institut RT-RK, Span, Sedam IT, awarded our students.

Faculty teachers are actively engaging in other scientific and professional projects involving collaboration with the industry. As a result, collaboration agreements were signed with the following companies: Državni

zavod za mjeriteljstvo (*State Office for Metrology*), Sokol d.o.o., Centar za poduzetništvo, BIOS, MONO, Osijek Danas, Span d.o.o., HEP d.d., Končar – Institut za elektrotehniku d.d (*Končar-Electrical Engineering Institute*)., Adacta d.o.o., Končar – elektronika i informatika d.o.o (*Končar-Electronics and Informatics*)., Siemens, Danieli-Systec d.o.o., VACON AT, Osijek Software City, RT-RK Novi sad, Orqa d.o.o.

Additionally, five representatives of the labour market (including the president of the FERIT Alumni Club) are members of the Commission for Quality Enhancement and Assurance in Higher Education, which periodically provides recommendations for study programmes in light of labour market trends.

2.5. How is the information system for collecting, managing, processing, and reporting on statistical data related to the organisation and implementation of study programmes, and those necessary for quality assurance, structured?

The Higher Education Institutions Information System (ISVU) enables, among other things:

- Generation of ad-hoc reports on student performance, exam pass rates;
- Review of entered data based on specific criteria (e.g., top 10% of students, average exam grades);
- Drawing up reports (periodically required by the Ministry of Science and Education, the University, etc.).

ISVU is a solution for coordinated digitalisation of all higher education institutions in the Republic of Croatia. It is primarily an application for the digitalisation of student-related activities at a higher education institution, allowing the management of databases related to students, teachers, courses, curricula, enrolments, and exams. Additionally, the application supports standard activities of any higher education institution, such as student enrolments, exam registrations, grade entries, issuance of certificates and documents, and it automatically generates summary reports.

Study programmes are also defined through MOZVAG (a module for higher education institutions of the Agency for Science and Higher Education). The MOZVAG system is a standalone web application that facilitates the preparation and assessment of teaching staff and material conditions for the implementation of the study programmes.

In addition, the Faculty has a system called “Mrkve” in which teachers enter reports on conducted classes, which are automatically compared with the syllabus implementation plan. The “Mrkve” system is also linked to the schedule of classes and exams, which is digitally accessible on the Faculty's website: https://www.ferit.unios.hr/studenti/raspored-nastave-i-ispita&odabir. This schedule includes information on the division of students into smaller groups for various forms of instruction, such as laboratory exercises, etc.

Furthermore, the Faculty utilises the "Mak" system, which facilitates the process of conducting final and Master's exams (including theses) from assigning topics to the automated generation of final reports and forms, as well as grading of students. Through "Mak", it is possible to monitor student progress through the final/Master's exam process, document submission and retrieval, file submissions, as well as evaluation by mentors, the Commission for Master's Exams, and the Committee for Master’s Theses and Final Papers. The system also contains a repository of necessary documents and forms, serves as an information hub for students and teachers, and more.

The Faculty's website is linked to the LMS (Learning Management System) called Loomen (https://loomen.carnet.hr), where announcements and materials needed for classes across all courses and study programmes are posted for students to access throughout the academic year.

2.6. How are the standards and regulations of the higher education institution defined and published regarding the periodic review of study programmes that involve external experts?

External experts are involved in the process of re-accreditation of the University every five years. The reaccreditation procedure at the Faculty of Electrical Engineering, Computer Science, and Information

Technology Osijek was conducted in May 2018. The Accreditation Council of the Agency appointed an expert panel that included external experts. The reaccreditation was carried out based on the prepared self-evaluation, the Ordinance on the Content of Licence and Conditions for Issuing Licence for Performing Higher Education Activity, Carrying Out a Study Programme and Re-accreditation of Higher Education Institutions, as well as the Ordinance on Conditions for Issuing Licence for Scientific Activity, Conditions for Re-accreditation of Scientific Organisations and Content of Licence. The process was also based on Criteria for the Assessment of Quality of Higher Education Institutions within Universities of the Agency for Science and Higher Education.
Based on the re-accreditation evaluation (June 2018) and improvement recommendations, a Commission for the Development of a Quality Improvement Action Plan was established at the Faculty. The initial version of the Action Plan, created by the aforementioned Commission, was thoroughly analysed at a Quality Commission meeting. The final Action Plan was adopted at the 229th regular session of the Faculty Council held on 11 June 2019.

2.7. How are the standards and regulations for safeguarding students' rights defined and published, especially with regard to informing students, receiving and resolving student complaints, and procedures for protecting students' rights? How are the individuals responsible for students' rights issues (such as the Vice-Dean for Education, Student ombudsmen, Office for Student Affairs, etc.) designated?

Standards and regulations for the protection of students' rights, particularly with regard to informing students, receiving and resolving student complaints, and procedures for protecting students' rights, are defined by the Ordinance on Studies and Studying at Josip Juraj Strossmayer University of Osijek.
A Student Union has been established at the Faculty. The Student Union is a student-elected representative body that protects the interests of students, participates in decision-making processes in the Faculty Council, and represents students in the higher education system. The Student Union has a Statute, adopted by the Faculty Council upon the proposal of the Student Union. The Statute of the Student Union determines the working methods, bodies, composition, election procedures and jurisdiction of each body of the Student Union. It also specifies how the Student ombudsman is appointed, how student representatives are elected to the Faculty bodies, the responsibility of the bodies and members of the Student Union for not fulfilling the tasks entrusted to them related to the work of the Student Union, as well as other matters important for the functioning of the Student Union.
The Student Union elects 10 student representatives to the Faculty Council. During decision-making in the Faculty Council, student representatives have the right of a suspensive veto on matters of particular interest to students such as modifications in the study system, study quality assurance, amendments to study programmes and the implementation of syllabi, and issues related to student standards. The Faculty Council re-examines the issue after the suspensive veto, at the earliest within 8 days. In the repeated decision-making process, the decision is made by a simple majority from the total number of voting members of the Faculty Council, with no suspensive veto power.
The Student ombudsman is appointed by the Assembly of the Student Union upon the proposal of the President of the Student Union. The Student ombudsman receives complaints from students related to their rights, discusses them with the relevant bodies of the Faculty, advises students on how to exercise their rights, and may participate in disciplinary proceedings against students to protect their rights.
The Vice-Dean for Education and Student Affairs is appointed by the Faculty Council upon the proposal of the Dean.
The Disciplinary Board for students consists of a president and two members, one of whom is a student. The Faculty Council appoints and dismisses the president and one member, along with their deputies from the ranks of the teaching staff. Additionally, the Student Union appoints and dismisses one member and their deputy from the ranks of students.

According to the Ordinance on Studies and Studying at Josip Juraj Strossmayer University of Osijek, Article 70, published at https://www.ferit.unios.hr/dokumenti/fakultet/dokumenti/Pravilnik%20o%20studijima%20i%20studiranju.pdf, a student who is not satisfied with the received grade can, within 48 hours after the oral exam/oral part of the exam, or after the announcement of the written exam results, submit a request for retaking the exam before the Examination Committee.

2.8. How are the standards and regulations for the continuing professional development of all higher education institution employees in their respective fields defined and published, and how are reports on their implementation submitted?

Standards and regulations for continuing professional development of all higher education institution employees in their respective fields are defined by the Regulations on Promotion into Scientific Titles, Scientific-teaching and Artistic-teaching Titles, Teaching, Assistant and Professional Titles, and corresponding job positions at Josip Juraj Strossmayer University of Osijek, adopted by the Senate of Josip Juraj Strossmayer University of Osijek and published on the websites of the Faculty and the University.

The Expert Committee for Assessing the Rector's Conference Criteria is a standing expert body of the Faculty Council which assesses the compliance with the requirements prescribed by the Rector's Conference regarding teaching and professional activities in the process of appointing faculty members to scientific-teaching and teaching titles. Also, it prepares reports on the verification of the requirements for these appointments.

With the aim of ensuring the quality of pedagogical, psychological and methodological skills for teaching at a higher education level, the Faculty provides all teachers with the opportunity to attend pedagogical-psychological and didactic-methodological training when they are first appointed to a scientific-teaching position. In addition to pedagogical-psychological and didactic-methodological training, continuing education of teachers and associates of the Faculty is ensured through scientific and professional lectures periodically held at the Faculty, as well as through institutional support for visits to foreign scientific and research institutions, conferences, workshops, and other forms of scientific and professional development.

Once a year, education and training records are collected for all employees of the Faculty with the aim of monitoring and planning. Based on the data collected through the form (Appendix IV of the FERIT Quality Manual) that employees submit to the Commission for Quality Enhancement and Assurance in Higher Education, the Commission submits a report to the Dean of the Faculty. The education and training records are used for strategic planning of education and lifelong learning of the Faculty staff. Therefore, the Commission creates two documents each year, i.e. an Education and Training Plan for the next year and a Report on Education and Training for the previous calendar year.

2.9. How is the quality of work of all professional services at the higher education institution ensured, and how is a report on this submitted?

Through regular communication among employees and professional services, the quality of work provided by professional services is analysed and improved, and, if necessary, appropriate measures are taken.

An important aspect of informing all employees is certainly the Intranet system where all relevant decisions, minutes and documents are published, making it easier for employees to perform their assigned tasks more efficiently.

Moreover, a survey is conducted to evaluate the performance of all professional services within the higher education institution (see 2.2).

3. GENERAL INFORMATION ABOUT THE STUDY PROGRAMME

3.1. Name of the study programme
Undergraduate university study programme in Computer Engineering

3.2. Provider of the study programme
Josip Juraj Strossmayer University of Osijek, Faculty of Electrical Engineering, Computer Science and Information Technology Osijek

3.3. Type of the study programme
University study programme

3.4. Level (1-professional/2-specialist graduate professional or 1-university undergraduate/2-graduate university/3-postgraduate specialist or postgraduate university)
1- undergraduate university

3.5. Scientific or artistic area
Technical Sciences

3.6. Scientific or artistic field
Computer Engineering

3.7. Scientific or artistic branch
2.09.01 architecture of computer systems
2.09.02 information systems
2.09.03 information processing
2.09.04 artificial intelligence
2.09.05 process computing
2.09.06 software engineering

3.8. Admission requirements
Candidates who have completed a four-year high school education and passed national high school leaving exam are eligible to enrol in the undergraduate university study programme in Computer Engineering. Based on high school grades and high school leaving exam results, a ranking list of applicants will be made.

3.9. Duration of the study programme
Undergraduate university study programme lasts for three years (six semesters) and the student is required to earn a minimum of 180 ECTS credits.

3.10. Academic/professional title awarded upon completion of the study programme
Upon completion of the undergraduate university study programme in Computer Engineering, a student is awarded the academic title of **University Bachelor of Computer Engineering (Baccalaureus/Baccalaurea).**

3.11. If you are proposing a specialist graduate professional study programme, attach a document on the accredited professional study programme in the same scientific or artistic field.
A specialist graduate professional study programme is not being proposed.

3.12. If you are proposing a graduate university study programme, attach a document on the accredited undergraduate university study programme in the same scientific or artistic field.
A graduate university study programme is not being proposed.

3.13. If you are proposing a postgraduate specialist study programme, attach a document on the accredited graduate university or integrated undergraduate and graduate study programme in the same scientific or artistic field.
A postgraduate specialist study programme is not being proposed.

3.14. If you are proposing a postgraduate university study programme, attach a document on the accredited graduate university or integrated undergraduate and graduate study programme in the same scientific or artistic field.
A postgraduate university study programme is not being proposed.

3.15. Analyse the compliance of the study programme with the strategic goals of the higher education institution
The developmental strategy of the Faculty of Electrical Engineering Osijek 2016-2020 was adopted at the 184th session of the Faculty Council held on 26 January, 2016. The study programme is fully aligned with the mission and vision of the Faculty.

3.15.1 Mission
The mission of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek is to create new knowledge through the implementation of scientific, developmental and technological research that meet the needs of the economy. Through the system of undergraduate, graduate and postgraduate study programme, the mission is to educate experts and scientists in the fields of electrical engineering, computer science and information and communication technology who will contribute to the social and economic development of Croatia.

One of the main strategic goals is to ensure a high quality of student education and lifelong training in the fields of electrical engineering, computer science and information and communication technology by connecting education, research and cooperation with the economy.

3.15.2 Vision
The Faculty of Electrical Engineering, Computer Science and Information Technology Osijek strives to strengthen its position as an internationally recognised educational and research institution by constantly improving the quality of study programmes and harmonising them with European and world trends, as well as the economy needs. It also encourages research in accordance with the criteria of scientific excellence in the fields of electrical engineering, computer science and information and communication technology.

3.16. Specify the competencies that the student acquires upon completion of the proposed study programme and jobs he/she is trained for
Upon completion of the undergraduate university study programme in Computer Engineering at the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek, students are trained for the following jobs in the field of computer engineering and other related scientific fields, depending on the elective module:

Elective module Computer Engineering
- Specify, design and implement computer systems;
- Install, apply and maintain common operating systems, software and hardware;
- Programme in object-oriented languages;
- Applying the principles of advanced communication technologies to design and implementation in a wide field of computer engineering;

- Design, manage and maintain computer networks;
- Efficiently apply tools for constructing and documenting hardware and software;
- Develop graphic and dialog user interfaces;
- Configure and apply standard properties and functions in database systems;
- Use high-level programming languages;
- Design and maintain web presentations using standard tools and web functions;
- Implement input/output programming using standard protocols and bus systems, which are used in control systems;
- Design basic digital hardware and systems using VHDL;
- Design and evaluate requirements and selection of built-in computer systems based on application requirements;
- Design hardware of built-in computer systems using CAD tools;
- Use programming tools and environments for software and hardware development;
- Recognise the causes of electromagnetic compatibility problems in electronic devices;
- Use programming tools to implement machine learning methods and algorithms;
- Participate in the development of a complex computer programme;
- Use principles of digital signal processing;
- Use processes and mechanisms in computer networking, as well as perform the role of a network administrator.

Elective module Software Engineering:

- Specify, design and implement computer systems;
- Use the basic principles and methods of solving problems in electrical engineering and electronics
- Use the basics of mathematical logic and language, the theory of sets, graphs and networks, as well as mathematical structures, algorithms and the complexity of algorithms with the aim of applying them in algorithmic solving of computer problems;
- Design basic digital hardware and systems;
- Apply, maintain and implement operating systems in current programming systems in suitable programming environments, tools and languages;
- Programme in higher procedural and object-oriented programming languages;
- Configure and apply standard properties and functions in database systems;
- Analyse and design formal languages, grammars and automata with the aim of applying it in the development of software;
- Apply modern technologies and tools for developing web applications on the user and server side;
- Apply modern technologies and tools for developing mobile applications;
- Apply machine learning procedures and specific applications;
- Apply the principles of data analysis, and procedures of computer intelligence and machine learning for the analysis of data of different volume, level of structure, credibility, speed and business value in suitable environments;
- Effectively apply tools for designing and documenting system and application programme support;
- Develop a high-quality code by applying appropriate methods, tools and principles of software engineering;
- Develop software support using more advanced language-independent object-oriented programming concepts such as reuse, layered design, s.o.l.i.d. principles, and formal patterns;
- Use information theory, advanced communication technologies and cyber security principles to the design and implementation of networked software systems;
- Design graphic and dialog user interfaces;
- Design and maintain web presentations using standard tools and web functions.

3.17. Describe the mechanism of ensuring the vertical mobility of students in the national and international area of higher education. If it is the first level of professional or university study programmes, please indicate which specialist graduate professional study programmes or graduate university study programmes one could take at the proposing institution and/or at another university in the Republic of Croatia.

The existing configuration of study programmes (Figure 1) was created, on the one hand, by the adaptation of the existing programmes that were carried out before the adoption of programmes aligned with the Bologna Declaration, while, on the other hand, similar programs from the corresponding European faculties were taken into account.

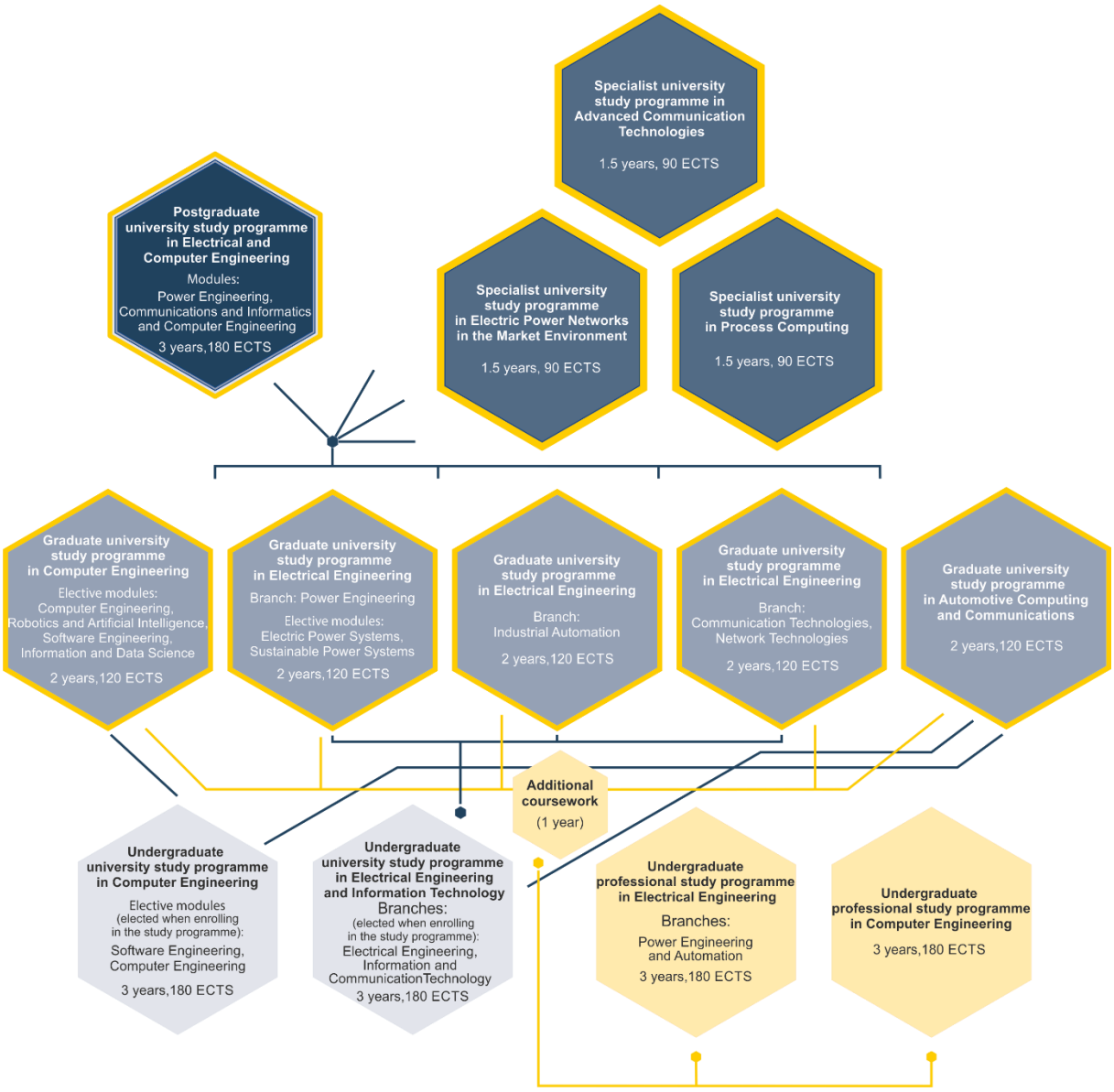

Figure 1. Vertical studying scheme at the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek

Bachelor degree holders who complete the undergraduate university study programme in Computer Engineering are eligible to enroll in the graduate university study programme in Computer Engineering and the graduate university study programme in Automotive Computing and Communications at the Faculty (see Figure 1), but also at related faculties of other universities in Croatia and abroad according to the admission requirements of the respective institution. By passing differential exams, they can also enrol in the graduate university study programme in Electrical Engineering at FERIT.

The outgoing and incoming student international mobility can be carried out during their studies through the Erasmus+ mobility programme between the Faculty and about 60 foreign higher education institutions. Also, mobility takes place through IAESTE and other mobility programmes.

3.17.1 List of courses and/or modules students can enrol in other study programmes
Every academic year, students have the option to choose elective courses offered at Josip Juraj Strossmayer University of Osijek. For example, in the academic year 2019/2020, a total of 51 courses from 17 University constituent units were offered. The list is available at the following link: http://www.unios.hr/wp-content/uploads/2022/07/izborni-kolegiji-22-23.pdf

3.17.2. List of courses and/or modules, which can be taught in a foreign language
The list of courses and/or modules which can be taught in a foreign language is in chapter 4.4. A total of 36 courses can be taught in the English language.

3.17.3. Criteria and conditions for the transfer of ECTS credits
The Faculty organises and carries out the Erasmus International Mobility Programme. The Erasmus International Mobility Programme enables students to spend one part of their studies at a foreign higher education institution and/or undergo practical training, which significantly contributes to their independence, cultural enrichment, proficiency in foreign languages and ability to work in multicultural environments. Implementation and basic principles of incoming and outgoing student mobility, students' rights and obligations, rights and obligations of the University Committee for the Erasmus International Mobility Programme and the institutional Erasmus coordinator, as well as other questions relevant for the implementation of the mobility programme have been specified in the Regulations on the Erasmus Mobility Programme. On the recommendation of the Erasmus coordinator, the Committee for Education and Student Affairs lays down the criteria and conditions for ECTS recognition for students participating in the Mobility Programme.

3.18. Explain how the proposed professional/university study programme relates to fundamental and modern skills and the profession.
The proposed undergraduate university study programme in Computer Engineering is based on the institutional insights, numerous conversations with colleagues from other Croatian and foreign universities and the need to innovate and modernise teaching content as well as meet the economy and society requirements. The undergraduate university study programme in Computer Engineering at the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek is based on modern professional programmes of Croatian and European universities: it is fully comparable in terms of content and qualifications to the programmes of other Croatian and certain European universities.

The undergraduate university study programme in Computer Engineering is divided in two elective modules: Computer Engineering and Software Engineering.

Elective module Computer Engineering educates students in the fields of computer engineering, digital systems, architecture and design, networking of computer systems, embedded computer systems,

automation, robotics and process computing, artificial intelligence and databases, i.e. it provides highly skilled engineers able to keep up with the technological development and apply the acquired knowledge in solving engineering problems.
The curriculum of the elective module in Computer Engineering is based on applying and improving methods in the fields of artificial intelligence, machine learning based on data obtained from sensors, and automated systems with the application of robots and computer vision. Among the objectives of the elective module is the application of advanced systems for processing data obtained by cameras, 3D sensors and other sensors with applications in industry, robotics, agriculture and medicine.
In addition, teaching contents are associated with the fields of computer system architecture, design and engineering of digital hardware, systems and computer networks, embedded computer systems, development of software support for embedded computer systems, testing of computer systems, quality of software support with the application in the economy.

The novelty of the proposed study programme is the new content of the *Fundamentals of Electrical Engineering* course, which would now contain topics from the broader field of electrical engineering due to the orientation towards the architecture and functioning of computer systems and the application of computer systems with an emphasis on embedded computer systems in various forms of technical systems. *Digital Electronics* is in semester 2 to enable students to get the fundamental knowledge as early as possible and introduce new courses in upcoming semesters. Course *Electronics* will have new content according to the needs of the elective module. A new course introduced in semester 5 is *Computer Systems Development Technology* with the aim of introducing the technologies for designing and developing computer systems using modern tools. *Introduction to Machine Learning* is a new course in semester 6 with the aim of introducing the principles and methods in machine learning and the related applications.

Elective module Software Engineering aims to educate students in the field of software engineering, which in a professional sense and from the point of view of skills needed in the labour market includes: an algorithmic way of thinking and an approach to solving complex engineering problems from various fields based on the mathematical principles of computing; use of advanced algorithms and data structures of appropriate levels of complexity; effective use, administration and programming of system software support using advanced operating principles of current operating systems and associated development and programming environments for advanced computer architectures, embedded and distributed service systems and networked environments; use of current procedural and object-oriented programming languages and technologies in appropriate environments for implementing and realising functional and effective programming solutions and systems; application of principles of software engineering, and advanced software architectures, design patterns and templates for modeling, development, implementation, testing and maintenance of software support; development and programming of web and mobile applications on the user and server side including appropriate databases; application of artificial intelligence and machine learning procedures for the development of learning models on data from different sources; use of principles of data analysis, appropriate computer infrastructure, platforms, software environments and cloud computing services to create systems and software solutions for analysing data of various ranges, dynamics and structure using machine learning and statistical procedures; application of the principles of automata and formal languages for modeling and development of computer and programming systems; application of knowledge in cryptography and cryptanalysis, and advanced security principles to achieve a high level of cyber security of computer and software systems.

The introduction of the elective module in Software Engineering enables the acquisition of the aforementioned knowledge and skills. In addition to the current courses, *Software Engineering, Introduction to Machine Learning, Basics of Data Analysis, Basics of Automata and Formal Languages* and *Cyber Security* are introduced.

3.19. Connection with the local community (economy, civil society, etc.

The connection of the study programme with the needs of the local community is partially described under 2.4, which outlines the involvement of representatives from the labour market in the development of the Faculty.

The study programme is expected to meet the needs of the local community, i.e. reduce the unemployment rate (see 3.20).

Namely, the analysis of the labour market in Croatia shows that experts who complete the undergraduate university study programme in Computer Engineering, even with the high unemployment rate, are employed much faster. Computer Engineering has proven to be one of the developmental foundations of of every society, and the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek is the institution that educates the highest number of experts in this field in Eastern Croatia, which is the basis of the future successful education of computer engineering experts, as well as the employment of highly educated staff, economic growth and development on a regional and national level.

The proposed undergraduate university study programme in Computer Engineering includes the design, development, testing and maintenance of modern hardware and software. Considering the numerous companies in Osijek, surrounding area and Croatia, which deal with the aforementioned activities, as well as industry, local self-government and civil society, the study programme is closely related to the needs of the labour market. Namely, with the introduction of elective modules, the modernisation of existing ones and the introduction of new courses, the fields of computer and software engineering are covered. Numerous companies, which primarily deal with the development of software in modern computer environments and data processing of all forms for business, industrial, and all other applications of interest to the local community and the global market, have lately been founded or moved in Osijek. There are also companies involved in the development, design and implementation of solutions for automation and process management. By completing one of the aforementioned elective modules, computer engineering graduates would have an appropriate level of knowledge and competence in the specified areas, hence the local community would benefit from them. Conversations with companies, students and graduates indicate a great interest in such a study programme.

The elective modules perfectly fit into the re-industrialisation plan of Osijek, Slavonia and Croatia and complement the ever-growing IT sector with the necessary knowledge of robotics and intelligent systems as well as programming and computer engineering. It is a study oriented to the application of computers and appropriate software in the management of various types of processes that appear in industrial and agricultural production, transport, medicine and other areas. Its curriculum is complex so that it educates not only professionals, but also innovative personnel, who are highly needed in Croatia. Production in Europe (and Croatia) cannot be competitive if it is not highly automated. Educating experts in the fields of robotics, intelligent systems, software engineering and data analysis who will be able to keep up with global technological trends and apply the latest technologies in production is of the utmost importance for increasing the competitiveness of Croatian export capacities on the European and global markets.

The elective modules should primarily provide students with knowledge and skills in the fields of application and design of hardware, subsystems and computer systems, computer system components and structures, i.e. the elective module in Computer Engineering puts the emphasis on hardware, computer architecture and computer systems, while the elective module in Software Engineering emphasises the design of computer and software systems, components and software structures and appropriate software solutions and data analysis procedures in software engineering. Given the existing production companies in Slavonia, Baranja and Croatia, a special emphasis is put on design of built-in

computer systems for transport, domestically produced trains, automotive industry for foreign manufacturers, manufacturing of computer-controlled machines, machine tools, etc. for the elective module in Computer Engineering. The elective module in Software Engineering focuses on software support for business, financial, biomedical, transport and other systems, which by adapting software support, principles of software engineering, web and mobile solutions, service computing and data analysis, enable a good user experience and efficient programming environments for solving demanding problems. Some courses deal with signal processing and its application to digital signal processors. There are companies interested in developing algorithms for DSP in the field of digital television, image processing, robotics, manipulators and in the automotive industry for automated control, foreign equipment manufacturers.

The trend of using service-oriented computer and programming environments and data analysis procedures is increasing because it increases the functionality, adaptability and interoperability of complex solutions, thus the need for educated and skilled personnel in this subsector increases. This refers in particular to highly educated experts who work on designing smart application software solutions. There is a great need for developers and experts in web technologies, as well as mobile app developers who design and use information available on the Internet, enable data analysis, interactivity and presentation of multimedia content. In doing so, remote computer resources, applications and data warehouses are used. In addition to communication technologies and good computer network support, it is necessary to have an appropriate level of specialised skills in software support for doing so. The study is connected to the needs of the local community for specialists in computer and software engineering to work in interdisciplinary environments.

The study programme in Computer Engineering is a modern study programme that meets the developmental and societal challenges. Such a study will provide graduates with competencies that will make them competitive on the labour market. The curriculum is aligned with the needs of the local community. All competencies in the field of computer engineering, including specialised areas, are connected to all areas of work and living, as well as to strategic areas essential for the sustainability of the local community. The elective modules educate future specialists in computer programming, which is the leading generator of employment in our local community. This field has not experienced a decrease in the employment rate even in the recession and it is expected for the demand to continue. The study programme in Computer Engineering meets the challenges of new technologies and their applications, the demand for new competencies and human resources with the aim of raising the employment rate and economic growth.

The undergraduate university study programme in Computer Engineering, elective modules Computer Engineering and Software Engineering, provides well-rounded education of experts in this field. Bachelor degree holders will, with their additional competencies, be able to deal with complex problems and apply new technologies in computer engineering and ICT sector. They can be work in various fields ranging from large systems to small companies. Upon completion of the undergraduate university study programme in Computer Engineering, graduates can continue their education at the graduate university study programme in Computer Engineering, graduate university study programme in Automotive Computing and Communications, as well as other related graduate university study programmes.

3.20. Analysis of the students' employability after the completion of the study programme, which includes the opinion of at least three organisations related to the labour market (for example, professional associations, employers and their associations, unions, public services) on the adequacy of the expected learning outcomes obtained upon completion of the study programme for the needs of the labour market.

Based on the official data from the Croatian Employment Service (CES) obtained in early January 2020, the unemployment rate has been low lately. It should be noted that almost all students who have completed the undergraduate university study programme in computer engineering enrol in graduate university study programmes upon which that enter the labour market.
Based on the survey conducted by the Commission for Quality Enhancement and Assurance in Higher Education in April 2020, it is evident that about 84% of fifth-year students are employed, and approximately 50% of employed students have at least 2-year work experience. Some of these employed students plan to stay at their current workplaces.

Table for the undergraduate university study programme in Computer Engineering:

The number of students enrolled in the undergraduate university study programme in Computer Engineering					
2015	2016	2017	2018	2019	Total
145	135	135	130	140	655

Newly registered unemployed graduates under the age of 39 at CES						Newly registered unemployed graduates under the age of 39 at CES who got a job in 6 months					
2015	2016	2017	2018	2019	Total	2015	2016	2017	2018	2019	Total
8	8	9	13	12	50	1	3	3	6	1	14

Table for the graduate university study programme in Computer Engineering:

The number of students enrolled in the graduate university study programme in Computer Engineering					
2015	2016	2017	2018	2019	Total
65	69	55	60	72	321

Newly registered unemployed graduates under the age of 39 at CES						Newly registered unemployed graduates under the age of 39 at CES who got a job in 6 months					
2015	2016	2017	2018	2019	Total	2015	2016	2017	2018	2019	Total
1	2	0	1	0	4	1	0	2	0	0	3

Note: the actual number of unemployed graduates is slightly higher than listed above. Namely, when applying to CES, entering the name of the educational institution and the graduation year are not mandatory.

The positive opinion of at least three organisations related to the labour market can be found in attachment 7.3.

3.21. Comparison of the study programme with foreign study programmes accredited in European Union countries

The University of Kaiserslautern has a Department of Computer Science, which cover the following:
- Computer graphics and visualisation
- Development of embedded systems
- Information and communication systems
- Intelligent systems

- Robotics
- Software engineering

Courses similar to the ones taught in the elective module in Computer Engineering are as follows:
- Computer Systems 1
- Computer Systems 2
- Fundamentals of Embedded systems
- Processor Architecture
- Build your own Supercomputer
- Intelligent Systems
- Virtual Prototyping and HW/SW Co-Design
- Fundamentals of Robotics
- Machine Learning

The University of Oxford, England, has a Department of Computer Science. The courses comparable to the ones taught in the elective module in Computer Engineering are as follows:
- Computer Architecture
- Intelligent Systems
- Machine Learning

The University of Cambridge, England, has a Department of Computer Science. The courses comparable to the ones taught in the elective module in Computer Engineering are as follows:
- Hardware Practical Classes
- Computer Design
- Computer Networking
- Artificial Intelligence
- Digital Signal Processing
- Comparative Architectures
- Computer Vision
- System on Chip Design

Ecole Polytechnique Fédérale de Lausanne, Switzerland, has a Department of Computer Science. The courses comparable to the ones taught in the elective module in Computer Engineering are as follows:
- Computer Vision
- Design technologies for integrated systems
- Pattern Classification and machine Learning
- Advanced Computer Construction
- Advanced Multiprocessor Architecture
- Industrial Automation
- Microelectronics for SoC

Technische Universtät Wien, Austria, has a Department of Software and Information Engineering. The courses comparable to the ones taught in the elective module in Software Engineering are as follows:
- Algorithms and Data Structures
- Introduction to Programming
- Object-oriented Programming (German)
- Operating Systems
- Distributed Systems
- Security in Systems Engineering
- Database Systems

- Data Analysis
- Web Engineering
- Software Engineering and Project Management
- Object-oriented Modelling

Eindhoven University of Technology, Eindhoven, the Netherlands has a joint Bachelor degree in Major Data Science. The courses comparable to the ones taught in the elective module in Software Engineering are as follows:

- Basics of Computer Science
- Programming
- Object-oriented Programming
- Databases
- Data Mining
- Perspectives of Data Science
- Business Analytics

Universtät Bremen, Germany has the undergraduate study programme in Informatics. The courses comparable to the ones taught in the elective module in Software Engineering are as follows:

- Algorithms and Graphs
- Software Engineering
- Operating Systems
- Databases
- Security of Computer Systems
- Introduction to Machine Learning
- Management of Data Analysis Systems

FH Krems University of Applied Science, Krems, Austria has the undergraduate study programme in Informatics. The courses comparable to the ones taught in the elective module in Software Engineering are as follows:

- Software Engineering
- Computer Systems
- Data Science and Current Technologies
- Security of Computer Systems

Faculty of Electrical Engineering and Computing, University of Zagreb has the undergraduate study programme in Computer Engineering. The courses comparable to the ones taught in the elective module in Software Engineering are as follows:

- Introduction to programming
- Object-oriented Programming
- Computer Architecture
- Algorithms and Data Structures
- Operating Systems
- Development of Software Support for web and Mobile Devices
- Introduction to Computing Theory
- Software Engineering
- Security of Computer Systems
- Introductiont Artificial Intelligence

From the comparison of the proposed undergraduate university study programme in Computer Engineering with the aforementioned, it can be concluded that there is a high level of compliance, which

ensures the exchange and flow of students and teachers between Josip Juraj Strossmayer University of Osijek and European universities.

3.22. Describe the previous experience of the proposer in performing the same or similar professional/university study programmes

Undergraduate university study programme in Computer Engineering has been carried out since the academic 2005/2006 year.

In forty-two years, more than 6,800 students have earned a diploma as follows:

- undergraduate professional study programme in Electrical Engineering: 1,065
- undergraduate university study programme in Electrical Engineering: 950
- undergraduate university study programme in Electrical Engineering and Information Technology: 1,047
- undergraduate university study programme in Computer Engineering: 758
- undergraduate professional study programme in Electrical Engineering: 1,056
- graduate university study programme in Electrical Engineering: 918
- graduate university study programme in Computer Engineering: 595
- graduate university study programme in Automotive Computing and Communications: 10
- postgraduate doctoral study programme in Electrical Engineering: 74

The amendments to the study programme were based on the need to modernise the teaching content and align it with the needs of the labour market, the exchange of experiences with local, national and international companies, discussions with colleagues from other (Croatian and foreign) universities and the results of the analysis and feedback received from our graduates.

3.23. If there are any, list the partners outside the higher education system (economy, public sector, etc.) who would participate in the proposed study programme

The proposed undergraduate university study programme in Computer Engineering at the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek is based on a better connection with the economy and technological development. Adjunct associates will participate in the teaching process, practical training and final papers with the cooperation already been established through the portal Stup (for details, see 2.4). Osijek Software City, which brings together the highest number of local ICT companies, supports the programme.

3.24. University encouraging international cooperation

The Faculty of Electrical Engineering, Computer Science and Information Technology Osijek has been cooperating with faculties, universities and research institutions in the country and abroad for a long time. This cooperation takes place through the outgoing and incoming student, teaching and non-teaching staff mobility as well as research, teaching and professional activities. The reasons for mobility exchanges are the exchange and hosting of teachers, scientific training of researchers, conducting research for doctoral theses, graduate theses and final papers, student internships, attending language courses, research on projects, and other activities. Additionally, there is a direct scientific, teaching and professional cooperation with colleagues abroad.

Since 1985, the Faculty, together with the Hochschule Bremen, University of Applied Science, has been a co-initiator of the conference Science for Practice, which is held alternately at the aforementioned institutions and at the Fachhochschule Würzburg - Schweinfurt, University of Applied Science, Pecs University, Polack Mihally College of Engineering, Pecs, Obuda University, Kando Kalman Faculty of Electrical Engineering, Budapest, and Subotica Technical College of Vocational Studies. In October 2014, the Faculty hosted the 32nd International Conference Science for Practice. There were about 60

participants and 40 presented papers. Also, the Faculty is a co-organiser of the international conference European Conference on Software Architecture (ECSA 2015), which took place in September 2015.

The Faculty is the organiser or co-organiser of several international and domestic conferences. It co-organised the 39th International Conference on Telecommunications and Signal Processing (TSP), which was held from 27 to 29 June 2016 in Vienna. Along with the Centre of Excellence for Computer Vision, (FER Zagreb), the Faculty co-organised the Fifth Croatian Computer Vision Workshop, which was held on 11 October 2016 in Osijek. It co-organised the 40th International Conference on Telecommunications and Signal Processing (TSP), which was held from 5 to 7 July 2016 in Athens.

In order to improve international cooperation and increase the international visibility of scientific work, the Faculty initiated the International Conference on Smart Systems and Technologies (SST). The first such conference was held from 12 to 14 October 2016 in Osijek, under the auspices of IEEE Region 8, IEEE Croatia Section, Croatian branch of CIGRE, i.e. in the period from 2016 to 2019, three more SST conferences were held.

Since 2015, the Faculty has been a partner institution in the Centre of Research Excellence for Data Science and Cooperative Systems, the first centre of excellence in the field of technical sciences in Croatia, whose purpose is to advance Croatian science and strengthen its inclusion in the European Research Area. The centre consists of two research units - Research in Data Science and Advanced Cooperative Systems Research (ACROSS). The former research unit brings together 49 scientists from nine collaborating institutions. The ACROSS research unit brings together 32 leading experts from 7 collaborating Croatian institutions.

Cooperation with the best scientists from Croatia in the field of data science will give the Faculty's scientists access to the latest research achievements and engage them in competitive scientific projects.

Important international cooperation was achieved by including the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek in the organisation of HIPEAC - European Network on High Performance and Embedded Architecture and Compilation in 2015. HIPEAC is an organisation of European researchers in the field of embedded and high-performance computers with the aim of encouraging collaboration between universities, industry, computer system designers and development tool manufacturers. This cooperation resulted in the Faculty's participation in the FP7 TETRACOM technology transfer project. The TETRACOM project connected 34 European universities and institutes with more than 50 sub-projects and 95 researchers.

The Faculty of Electrical Engineering, Computer Science and Information Technology Osijek has significant international cooperation with more than 80 reputable foreign research institutions. In the last five years, many projects have been initiated, applied for or are in the application process within the Danube Start, Erasmus Mundus Euroweb+, Erasmus+ KA 2, Interreg, COST and H2020 programs.

Currently, the Faculty cooperates with the following foreign universities: Austria (Karl-Franzens-Universitat Graz, Technische Universitat Wien), Belgium (KU Leuven), Bosnia and Herzegovina (University of Mostar; University of Tuzla; ETF Sarajevo of the University of Sarajevo) , Lithuania (Vilnius University), Hungary (Pecsi Tudomanyegyetem - University of Pecs; Budapesti Muszaki Foiskola - Budapest Tech;), Netherlands (Eindhoven University of Technology), Germany (Hochschule Albstadt-Sigmaringen, Albstadt; Hochschule Bremen - University of Applied Sciences, Fachbereich Elektrotechnik, Informatik, Bremen; Internationale Begegnungs-und Forschungszentrum für Informatik – Dagstuhl; Fachhochshule Giessen-Friedberg, University of Applied Sciences, Giessen; Universität des Saarlandes, Saarbrücken; Hochscule fur angewnadte Wissenschaften (FHWS), Wűrzburg, Schweinfurt), Poland (

Technical University of Lodz; University of Technology and Life Sciences, Bydgoszcz), Portugal (Instituto Politcnico do Porto), Romania (University Stefan Cel Mare Suceava; University Politehnica of Bucharest), USA (West Virginia University, Morgantown, WV), Serbia (University of Novi Sad, Faculty of Technical Sciences; Technical College of Vocational Studies, Subotica; University of Niš), Slovakia (Slovak University of Technology, Faculty of Electrical Engineering and Information Technology, Bratislava, Slovak University of Agriculture in Nitra, University of Žilina Faculty of Management Science and Informatics), Slovenia (University of Maribor, FERI Maribor; University of Maribor, FERI Maribor, Krško; University of Ljubljana; Institut Jožef Štefan, University of Primorske, Koper), Spain (Universitat Politecnica De Cataluya (UPC-Barcelona Tech); Universitat Politecnica De Cataluya (UPC-Barcelona Tech); Escola Universitaria d'Enginyeria), Sweden (Mälardalen Hogskola, Mälardalen University, Department of Computer Science and Electronics), Turkey (Suleyman Demirel University, Isparta), Great Britain (University of Glasgow - CRADALL), India (Indian Institute of Technology Indore; Woxen University), Italy (University of L'Aquila), France (Telecom Paris Tech), Ghana (University of Mines and Technology (UMat).

With the majority of the stated European institutions, the Faculty and the University have an Erasmus+ exchange mobility agreements signed, but they cooperate in research and professional projects.

Two teachers from Bosnia and Herzegovina (University of Mostar) and two teachers from Slovenia (University of Maribor) participate in the teaching process at the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek, i.e. the Faculty teachers also participate in the teaching process at those universities.

At the end of October 2018, the Joint PhD Cooperation Agreement was signed between Josip Juraj Strossmayer University of Osijek, realised through the cooperation of FERIT and the University of Ghent in Belgium. The doctoral thesis were supervised by Irena Galić, PhD, Full Professor (FERIT), Aleksandra Pižurica, PhD, Full Professor (University of Ghent) and Danilo Babin, PhD, Associate Professor (University of Ghent). It was done by Hrvoje Leventić, assistant at FERIT, and defended on 5 February 2019.

Incoming and outgoing mobility of students, teaching and non-teaching staff is important. In order to realise a mobility programme, institutions have to sign a contract. Mobility contributes to increasing the visibility, international cooperation and internationalisation of the Faculty. FERIT has signed Erasmus+ bilateral contracts with 54 partner institutions from 21 countries and multilateral cooperation agreements with 6 higher education institutions from the USA, Germany, Hungary and Serbia.

In addition to the Erasmus+ programme, students do their practical training organised by the student association IAESTE. Students and employees are also included in the CEEPUS programme.

As of 11 January 2019, the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek has been a member of the CEEPUS network CIII-HR-1302-02-1920 - Research and Education of Environmental Risks. The main coordinator of the CEEPUS network is the Faculty of Civil Engineering and Architecture Osijek, and the network gathers 15 institutions from 7 countries. The goal of the network is to train students to apply methods and current knowledge on natural hazards and risk assessment by integrating research and practical application on real building structures - special risk analysis and decision-making. Other current topics in the network are engineering design methodology, construction analysis, protection against harmful vibrations in constructions, computer-supported technologies in construction mechanics, application in engineering and education, renewable energy sources, energy efficiency, application of computer programmes and techniques in the aforementioned area etc.

During 2014, the Faculty and Josip Juraj Strossmayer University of Osijek have been included in the Erasmus Mundus mobility programme EUROWEB+ (European Research and Educational Collaboration with Western Balkans) with 18 other universities. Mobility between the EU and the countries of the so-called Western Balkans started in 2015. Also, the Faculty participates in several cross-border cooperation programmes, Erasmus+ projects, COST activities and other projects financed by the EU.

Systematic support during the application and implementation of mobility for students, teaching and non-teaching staff is provided by the Department for International and Interuniversity Cooperation of the University of Osijek and the Office for International Cooperation, Scientific and Professional Projects, the Erasmus coordinator and the Vice-Dean for International Cooperation at FERIT. In order to increase mobility, available funding programs for visits to foreign institutions, teaching, research and professional training and international networking are continuously presented.

Through Erasmus+ mobility, FERIT offers foreign students with the opportunity to study at the postgraduate university study programme and take 22 courses at undergraduate and graduate study programmes in English. One of the Faculty's strategic goals was to initiate a study programme in a foreign language. It is jointly done with the Faculty of Agriculture through the project *Development and establishment of a joint study-ICT in agricultural sciences* submitted to the public call *Internationalisation of higher education*.

Staff mobility refers to the stay of FERIT employees at a foreign host institution for the purpose of teaching, professional training (job-shadowing, i.e. monitoring the work of colleagues, conferences, seminars, workshops and courses), cooperating and participating in international projects and conferences. In the period from 1 October 2013 to 31 August 2019, 65 mobility of teaching staff and 20 mobility of non-teaching staff were realised in 50 foreign institutions in 16 countries. The purposes were teaching and/or professional training. In addition to outgoing staff mobility, incoming staff mobility, which includes the stay of foreign teaching and administrative staff at FERIT, is also extremely important. In the mentioned period, 51 foreign scientists and administrative staff from 12 countries stayed at FERIT. The increase in incoming mobility programmes in the 2018/2019 academic year is primarily a consequence of the cooperation and mobility of consortium members within the Erasmus+ E-ProfEng project. In the period from 1 October 2013 to 31 August 2019, a total of 89 FERIT students stayed abroad for the purpose of studying and professional training, while a total of 52 students stayed at FERIT in the same period. All outgoing and incoming teaching/non-teaching staff mobility programmes lasted up to three months, while all student Erasmus+ mobility programmes lasted more than three months.

3.25. If the study programme is in the fields of regulated professions, elaborate on how you determined compliance with the minimum training requirements prescribed by Directive 2005/36/EC of the European Parliament and the Council on the recognition of professional qualifications of 7 September 2005 and the Act on Regulated Professions and the Recognition of Foreign professional qualifications.

The study programme is not in the fields of regulated professions.

4. DESCRIPTION OF THE STUDY PROGRAMME

4.1. Provide a list of compulsory and elective courses with the number of contact hours required for their implementation and the number of ECTS credits.

See Appendix 7.4.

4.1.1. Description of all courses

See Appendix 7.5.

4.1.2. Course general information

See Appendix 7.4.

4.1.3. Course description

See Appendix 7.4.

4.2. Describe the structure of the study programme, study pace, requirements for enrolling in the next semester or trimester and requirements for enrolling in a particular course or group of courses.

The undergraduate university study programme in Computer Engineering is structured on a semester basis and consists of six semesters or three years of study.

When applying for the study programme, students can choose between two elective modules:
PRRI – Computer Engineering
PRPI – Software Engineering

The basis for the modified programme is the current undergraduate university study programme in Computer Engineering. Therefore, most of the compulsory courses of the current programme are in each semester of both elective modules as follows:

- in semester 1, out of seven compulsory courses of the existing programme, six courses are taught in both elective modules
- in semester 2, out of six compulsory courses of the existing programme, three courses are taught in both elective modules
- in semester 3, out of six compulsory courses of the existing programme, four courses are taught in each elective module
- in semester 4, all compulsory courses of the existing programme are compulsory in each elective module
- in semester 5, out of five compulsory courses of the existing programme, three courses are taught in each elective module
- in semester 6, out of four compulsory courses of the existing programme, one course is taught in each elective module as well as the Final paper.

According to the chosen elective module, the student enrols in other courses specific to the elective module as described below. Some courses, depending on competencies, can be repeated in both elective modules. Elective courses enable the student to work on his/her interests and major in a narrow field.

In the elective module Computer Engineering, the novelty is the new content of the *Fundamentals of Electrical Engineering* course, which would now contain topics from the broader field of electrical engineering due to the orientation towards the architecture and functioning of computer systems and the application of computer systems with an emphasis on embedded computer systems in various forms of

technical systems. *Digital Electronics* is in semester 2 to enable students to get the fundamental knowledge as early as possible and introduce new courses in upcoming semesters. Course *Electronics* will have new content according to the needs of the elective module. A new course introduced in semester 5 is *Computer Systems Development Technology* with the aim of introducing the technologies for designing and developing computer systems using modern tools. *Introduction to Machine Learning* is a new course in semester 6 with the aim of introducing the principles and methods in machine learning and the related applications.

Linear Algebra 2 is a new course that will deal with pattern recognition and data modelling. The aim of the course is to introduce students to the types of matrices and matrix factorisations that effectively solve practical problems and to give students a detailed insight into vector spaces and the most important results of the theory of linear operators.

According to the new proposal, the first semester consists of seven and the second semester of five courses in each elective module.

Semester 1:

	Course 1	Course 2	Course 3	Course 4	Course 5	Course 6	Course 7
PRRI Computer Engineering	Linear Algebra	Calculus I	Engineering Graphics and Documentation	Programming I	Physical Education I	Mathematical Basics of Computing	Fundamentals of Electrical Engineering
PRPI Software Engineering	Linear Algebra	Calculus I	Engineering Graphics and Documentation	Programming I	Physical Education I	Mathematical Basics of Computing	Fundamentals of Electrical Engineering and Electronics

Semester 2:

	Course 1	Course 2	Course 3	Course 4	Course 5	Course 6
PRRI Computer Engineering	Calculus II	Programming II	Physical Education II	Digital Electronics	Physics	Electronics
PRPI Software Engineering	Calculus II	Programming II	Physical Education II	Digital Electronics	Company Economics	Communication Skills

Semester 3:

	Course 1	Course 2	Course 3	Course 4	Course 5	Course 6
PRRI Computer Engineering	Physical Education III	Algorithms and Data Structures	Operating Systems	Object-oriented Programming	Databases	Linear Algebra II
PRPI Software Engineering	Physical Education III	Algorithms and Data Structures	Operating Systems	Object-oriented Programming	Databases	Linear Algebra II

Semester 4:

	Course 1	Course 2	Course 3	Course 4	Course 5	Course 6	Course 7
PRRI Computer Engineering	Communication Networks	Probability and Statistics	Signals and Systems	English Language I	Physical Education IV	Object-oriented Software Development Principles	Information Theory

PRPI Software Engineering	Communication Networks	Probability and Statistics	Signals and Systems	English Language I	Physical Education IV	Object-oriented Software Development Principles	Information Theory

Semester 5:

	Course 1	Course 2	Course 3	Course 4	Course 5
PRRI Computer Engineering	Computer Architecture	Basics of Web and Mobile Application Development	English Language II	Computer Systems Development Technology	Modelling and Simulation
PRPI Software Engineering	Computer Architecture	Basics of Web and Mobile Application Development	English Language II	Automation and Formal Languages	Software Engineering

In semester 6, students do their final papers and complete their studies.
Semester 6:

	Course 1	Course 2	Course 3	Course 4	Course 5
PRRI Computer Engineering	English Language III	Final Paper	Introduction to Machine Learning	Company Economics	Communication Skills
PRPI Software Engineering	English Language III	Final Paper	Introduction to Machine Learning	Basics of Data Analysis	Cyber Security

Note:

- In semesters 1, 2 and 3, students can enroll in optional courses.

4.2.1 Teaching calendar

The beginning and end of each academic year is defined by the Senate Decision on the teaching calendar, which is an integral part of the Teaching implementation plan.

4.2.2 Requirements for enrolment in the higher academic year

The requirements for enrolment in the higher year are determined by the University Ordinance on Studies and Studying and the Senate Decision on requirements for enrolment in the higher year of studies, and refer to:

- meeting requirements from the study programme
- earning a minimal number of ECTS credits

4.2.3 General and special study requirements

The general and special study requirements are defined by the University Statute and the Ordinance on Studies and Studying and refer to:

- acquiring student status (full-time students, guest students, special student status: athletes and top artists, extremely successful students)
- transfer of students from other related university study programmes
- resuming interrupted studies
- mobility within the University
- rights and obligations of students (e.g. the right to suspend obligations)
- student workload (European credit transfer system (ECTS))

- advancement during studies (enrolment in the higher year of study, dropping out of the enrolled course, repeating the year, certification of the semester and teacher's signature, exams and quizzes, objection to the evaluation, passing exams at another university)
- termination of the student status.

4.2.4 Student status

A student can enrol in the undergraduate university study programme in Computer Engineering as a full-time student.

4.3. List of courses and/or modules students can enrol in other study programmes

Students do not enrol in individual elective courses, but choose an elective module with respective courses.

4.4. List of courses and/or modules which can be taught in a foreign language

Linear Algebra, English
Calculus I, English
Engineering Graphics and Documentation, English
Programming I, English
Mathematical Basics of Computing, English
Fundamentals of Electrical Engineering, English
Fundamentals of Electrical Engineering and Electronics, English
Calculus II, English
Programming II, English
Digital Electronics, English
Physics, English
Electronics, English
Company Economics, English
Communication Skills, English
Algorithms and Data Structures, English
Operating Systems, English
Object-oriented Programming, English
Databases, English
Linear Algebra II, English
Calculus III, English
Probability and Statistics, English
Signals and Systems, English
English Language I, English
Object-oriented Software Development Principles, English
Information Theory, English
Computer Architecture, English
Basics of Web and Mobile Application Development, English
English Language II, English
Computer Systems Development Technology, English
Modelling and Simulation, English
Automata and Formal Languages, English
Software Engineering, English
English Language III, English
Introduction to Machine Learning, English
Basics of Data Analysis, English
Cyber Security, English

4.5. Describe the process of completing the study programme

The undergraduate university study programme in Computer Engineering is completed by passing all exams, writing and defending a Master's thesis.
With the thesis, a student must demonstrate the ability to apply the knowledge gained during the studies and show that they can successfully solve tasks relevant to their profession and suitable to the academic degree they have been awarded.
Details related to writing the Master's thesis are regulated by the Faculty's Regulations on Final Papers and Master's Thesis.

4.6. Write the conditions under which students who have interrupted their studies or lost the right to study in a specific study programme can continue their studies

The conditions under which students who have interrupted their studies or lost the right to study in a specific study programme can continue their studies are defined by the Statute, i.e., the Ordinance on Studies and Studying at the J.J. Strossmayer University of Osijek. The conditions for resuming interrupted studies are stipulated by Article 37, and the conditions for completing their studies are stipulated by Article 38 of the Ordinance on Studies and Studying at the Josip Juraj Strossmayer University in Osijek.

Continuation of interrupted studies (Article 37)

(1) A student who had a full-time status and then lost it due to interrupting their studies, may continue their education as a part-time student, provided that the study programme has not been significantly altered (more than 20%) from the one in which the student was enrolled.
(2) The applicant can submit a request to continue their studies if no more than three years have passed since the last academic year of study they were enrolled in and the submission of the request to continue their studies.
(3) A request for approval to continue interrupted studies is submitted to the professional council or the authorised body of the professional council on a specially prescribed form by the study programme provider, along with the index (record book) and appropriate documentation as prescribed by the study programme provider, before the enrolment deadline expires.
(4) Studies are continued based on the Decision on the Continuation of Interrupted Studies issued by the professional council or the authorised body of the professional council in accordance with the study programme. The decision takes into account recognised exams with grades and earned ECTS credits during the study period, as well as differential and additional exams in accordance with the study programme of the study programme provider where the student continues their education.

Completion of studies (Article 38)

(1) A person who has lost their full-time status must be allowed to complete their studies in such a way that deadlines are set from the first year of enrolment in the study programme as follows:
- for a short professional study programme within five (5) years,
- for an undergraduate university study programme and an undergraduate professional study programme within six (6) years,
- for a graduate university study programme and a specialist graduate professional study programme within four (4) years, and
- for an integrated undergraduate and a graduate university study programme within ten (10) years, in accordance with the study programme of the authorised scientific-teaching/artistic-teaching and teaching constituents for the organisation and implementation of studies.

(2) Individuals completing their studies as outlined in paragraph 1 of Article 38 are not eligible for student rights and are required to pay either the full amount or a portion of the tuition fee, as specified by the Senate Decision.

(3) A person completing their studies is required to submit a request to the professional council or the authorised body of the professional council on a specially prescribed form by the study programme provider, along with the index (record book) and appropriate documentation as prescribed by the study programme provider.
(4) The decision to approve the completion of studies is made by the professional council or the authorised body of the professional council.
(5) The decision made by the professional council or its authorised body shall encompass recognised exams, including grades and accumulated ECTS credits earned during the study period. Additionally, it shall cover differential and additional exams as required by the study programme of the institution where the study completion was authorised. The decision shall also specify the deadlines for completing the studies and for the payment of either a portion of or the entire tuition fee, as determined by the Senate Decision.

5. APPENDICES

5.1. Decision of the Faculty Council on the amendments to the study programme

SVEUČILIŠTE JOSIPA JURJA STROSSMAYERA U OSIJEKU
FAKULTET ELEKTROTEHNIKE, RAČUNARSTVA I INFORMACIJSKIH TEHNOLOGIJA OSIJEK
JOSIP JURAJ STROSSMAYER UNIVERSITY OF OSIJEK
FACULTY OF ELECTRICAL ENGINEERING, COMPUTER SCIENCE AND INFORMATION TECHNOLOGY OSIJEK
FERIT

KLASA: 003-06/20-01/03
URBROJ: 2158/80-01-20-64
Osijek, 12. svibnja 2020.

Na temelju članka 47. Statuta Fakulteta elektrotehnike, računarstva i informacijskih tehnologija Osijek – pročišćeni tekst, Fakultetsko vijeće Fakulteta elektrotehnike, računarstva i informacijskih tehnologija Osijek, na 243. sjednici Fakultetskog vijeća u akademskoj 2019./2020. godini) održanoj 12. svibnja 2020. godine, pod točkom 1. dnevnog reda, donijelo je sljedeću

ODLUKU

1. Prihvaća se Elaborat o izmjenama i dopunama studijskog programa preddiplomskog sveučilišnog studija Računarstvo koje su veće od 20%.
2. Ova Odluka i Elaborat o izmjenama i dopunama studijskog programa preddiplomskog sveučilišnog studija Računarstvo dostavljaju se Povjerenstvu za preddiplomske, diplomske i stručne studije Sveučilišta Josipa Jurja Strossmayera u Osijeku na daljnji postupak.
3. Ova Odluka stupa na snagu danom donošenja.

Dekan
FERIT
Prof. dr. sc. Drago Žagar

Dostaviti:
1. Povjerenstvo za preddiplomske, diplomske i stručne studije
2. Arhiva Fakultetskog vijeća
3. Arhiva

HR-31000 Osijek | Kneza Trpimira 2b | tel: +385 31 224 601, 224 602 | fax: +385 31 224 605 | www.ferit.hr
e-mail: ferit@ferit.hr | MB: 3392589 | OIB: 95494259952 | VAT ID: HR95494259952
FAKULTET ELEKTROTEHNIKE, RAČUNARSTVA I INFORMACIJSKIH TEHNOLOGIJA OSIJEK
Hrvatska poštanska banka: IBAN HR19 2390 0011 1000 1677 7 | Addiko Bank: IBAN HR6025000091 1013 7207 0

5.2. List of compulsory and elective courses with the number of active teaching hours required for their implementation and the number of ECTS credits

Table 1

LIST OF ELECTIVE MODULES/COURSES							
Year of study: 1							
Semester: 1							
Elective module	COURSE	LEAD INSTRUCTOR(S)	L	AE	S	ECTS	STATUS[1]
Computer Engineering	Linear Algebra	A. Katić, PhD, Assistant Professor	30	30	0	5	C
	Calculus I	T. Rudec, PhD, Assistant Professor	30	30	0	5	C
	Fundamentals of Electrical Engineering	Ž. Hederić, PhD, Full Professor M. Barukčić, PhD, Associate Professor	30	45	0	6	C
	Engineering Graphics and Documentation	T. Mrčela, PhD, Full Professor	30	15	0	3	C
	Programming I	G. Martinović, PhD, Full Professor	30	30	0	5	C
	Physical Education I	P. Kerže	0	30	0	1	C
	Mathematical Basics of Computing	T. Rudec, PhD, Assistant Professor	45	15	0	5	C
Software Engineering	Linear Algebra	A. Katić, PhD, Assistant Professor	30	30	0	5	C
	Calculus I	T. Rudec, PhD, Assistant Professor	30	30	0	5	C
	Fundamentals of Electrical Engineering	Ž. Hederić, PhD, Full Professor T. Matić, PhD, Associate Professor	30	45	0	6	C
	Engineering Graphics and Documentation	T. Mrčela, PhD, Full Professor	30	15	0	3	C
	Programming I	G. Martinović, PhD, Full Professor	30	30	0	5	C
	Physical Education I	P. Kerže	0	30	0	1	C
	Mathematical Basics of Computing	T. Rudec, PhD, Assistant Professor	45	15	0	5	C

[1]**Note:** For compulsory courses, use C; for elective, use E

LIST OF ELECTIVE MODULES/COURSES							
Year of study: 1							
Semester: 2							
Elective module	COURSE	LEAD INSTRUCTOR(S)	L	AE	S	ECTS	STATUS[2]
Computer Engineering	Calculus II	A. Katić, PhD, Assistant Professor	30	30	0	6	C
	Digital Electronics	Ž. Hocenski, PhD, Full Professor	30	45	0	6	C
	Electronics I	T. Matić, PhD, Associate Professor	45	45	0	6	C
	Programming II	Krešimir Nenadić, PhD, Associate Professor	30	30	0	5	C
	Physical Education II	P. Kerže	0	30	0	1	C
	Physics	M. Skender, PhD, Assistant Professor	45	15	0	6	C
Software Engineering	Calculus II	A. Katić, PhD, Assistant Professor	30	30	0	6	C
	Digital Electronics	Ž. Hocenski, PhD, Full Professor	30	45	0	6	C
	Business Economics	D. Crnjac-Milić, PhD, Full Professor	30	15	0	6	C
	Programming II	Krešimir Nenadić, PhD, Associate Professor	30	30	0	5	C
	Physical Education II	P. Kerže	0	30	0	1	C
	Communication Skills	J. Glavaš*, PhD, Associate Professor	30	15	0	6	C

[2]**Note:** For compulsory courses, use C; for elective, use E

LIST OF ELECTIVE MODULES/COURSES							
Year of study: 2							
Semester: 3							
Elective module	COURSE	LEAD INSTRUCTOR(S)	L	AE	S	ECTS	STATUS[3]
Computer Engineering	Linear Algebra II	A. Katić, PhD, Assistant Professor	30	30	0	5	C
	Physical Education III	P. Kerže	0	30	0	1	C
	Algorithms and Data Structures	A. Baumgartner, PhD, Associate Professor	45	30	0	6	C
	Operating Systems	G. Martinović, PhD, Full Professor	45	0	30	6	C
	Database	I. Lukić, PhD, Associate Professor	45	30	0	6	C
	Object-Oriented Programming	D. Blažević, PhD, Associate Professor	30	45	0	6	C
Software Engineering	Linear Algebra II	A. Katić, PhD, Assistant Professor	30	30	0	5	C
	Physical Education III	P. Kerže	0	30	0	1	C
	Algorithms and Data Structures	A. Baumgartner, PhD, Associate Professor	45	30	0	6	C
	Operating Systems	G. Martinović, PhD, Full Professor	45	0	30	6	C
	Database	I. Lukić, PhD, Associate Professor	45	30	0	6	C
	Object-Oriented Programming	D. Blažević, PhD, Associate Professor	30	45	0	6	C

[3]**Note:** For compulsory courses, use C; for elective, use E

LIST OF ELECTIVE MODULES/COURSES							
Year of study: 2							
Semester: 4							
Elective module	COURSE	LEAD INSTRUCTOR(S)	L	AE	S	ECTS	STATUS[4]
Computer Engineering	Communication Networks	K. Grgić, PhD, Associate Professor	45	30	0	6	C
	Probability and Statistics	R. Galić*, PhD, Full Professor	30	30	0	5	C
	Signals and Systems	I. Galić, PhD, Associate Professor	30	30	0	5	C
	English Language I	D. Božić Lenard, PhD, Postdoctoral Research Fellow	15	15	0	2	C
	Physical Education IV	P. Kerže	0	30	0	1	C
	Object-Oriented Software Development Principles	G. Martinović, PhD, Full Professor	30	45	0	5.5	C
	Information Theory	V. Križanović, PhD, Assistant Professor	45	30	0	5.5	C
Software Engineering	Communication Networks	K. Grgić, PhD, Associate Professor	45	30	0	6	C
	Probability and Statistics	R. Galić*, PhD, Full Professor	30	30	0	5	C
	Signals and Systems	I. Galić, PhD, Associate Professor	30	30	0	5	C
	English Language I	D. Božić Lenard, PhD, Postdoctoral Research Fellow	15	15	0	2	C
	Physical Education IV	P. Kerže	0	30	0	1	C
	Object-Oriented Software Development Principles	G. Martinović, PhD, Full Professor	30	45	0	5.5	C
	Information Theory	V. Križanović, PhD, Assistant Professor	45	30	0	5.5	C

[4]**Note:** For compulsory courses, use C; for elective, use E

LIST OF ELECTIVE MODULES/COURSES							
Year of study: 3							
Semester: 5							
Elective module	COURSE	LEAD INSTRUCTOR(S)	L	AE	S	ECTS	STATUS[5]
Computer Engineering	English Language II	D. Božić Lenard, PhD, Postdoctoral Research Fellow	30	15	0	3	C
	Computer Systems Development Technology	T. Keser, PhD, Associate Professor	45	30	0	7	C
	Modelling and Simulation	D. Vučinić*, PhD, Associate Professor	30	30	0	7	C
	Computer Architecture	Ž. Hocenski, PhD, Full Professor	30	45	0	7	C
	Basics of Web and Mobile Application Development	K. Nenadić, PhD, Associate Professor J. Balen, PhD, Assistant Professor	30	45	0	6	C
Software Engineering	English Language II	D. Božić Lenard, PhD, Postdoctoral Research Fellow	30	15	0	3	C
	Automation and Formal Languages	J. Job, PhD, Associate Professor	45	15	0	7	C
	Software Engineering	I. Galić, PhD, Associate Professor	30	30	0	7	C
	Computer Architecture	Ž. Hocenski, PhD, Full Professor	30	45	0	7	C
	Basics of Web and Mobile Application Development	K. Nenadić, PhD, Associate Professor J. Balen, PhD, Assistant Professor	30	45	0	6	C

[5]**Note:** For compulsory courses, use C; for elective, use E

LIST OF ELECTIVE MODULES/COURSES							
Year of study: 3							
Semester: 6							
Elective module	COURSE	LEAD INSTRUCTOR(S)	L	AE	S	ECTS	STATUS[6]
Computer Engineering	Business Economics	D. Crnjac-Milić, PhD, Full Professor	30	15	0	5	C
	Communication Skills	J. Glavaš*, PhD, Associate Professor	30	15	0	6	C
	Introduction to Machine Learning	Ratko Grbić, PhD, Assistant Professor	30	30	0	6	C
	English Language III	D. Božić Lenard, PhD, Postdoctoral Research Fellow	15	15	0	3	C
	Final paper		0	0	0	10	C
Software Engineering	Basics of Data Analysis	G. Martinović, PhD, Full Professor	30	30	0	6	C
	Cyber Security		30	30	0	5	C
	Introduction to Machine Learning	Ratko Grbić, PhD, Assistant Professor	30	30	0	6	C
	English Language III	D. Božić Lenard, PhD, Postdoctoral Research Fellow	15	15	0	3	C
	Final Paper		0	0	0	10	C

[6]**Note:** For compulsory courses, use C; for elective, use E

5.3. Description and general information about each course

General information		
Lead instructor(s)	Željko Hederić, PhD, Full Professor with Tenure Marinko Barukčić, PhD, Full Professor	
Course title	Fundamentals of Electrical Engineering	
Study programme	Undergraduate university study programme in Computer Engineering, elective module: Computer Engineering	
Course status	Compulsory	
Year of study	1	
ECTS credits and teaching methods	ECTS credits	5
	Number of classes (lectures + (auditory exercises + laboratory exercises + design exercises) + seminars)	45+30+15

1. COURSE DESCRIPTION		
1.1. Course objectives		
Introducing students to the basic laws of electromagnetism, quantities and units that describe electric and magnetic fields. To train students to analyze and solve electrical networks of DC and alternating currents and voltages in the molten state. To train students to connect simple electrical circuits and carry out measurements of basic electromagnetic quantities. To introduce students to the designs, methods of operation and application of basic types of electrical machines.		
1.2. Course enrolment requirements		
No special requirements.		
1.3. Expected learning outcomes		
Define basic physical quantities in electric and magnetic fields. Apply basic methods for solving linear electrical networks in the steady state. Use basic measuring equipment (ammeter, voltmeter, ohmmeter, oscilloscope). Perform measurements of basic electrical quantities in AC and DC electrical circuits. Distinguish and compare types of electrical machines. Understand the principle of operation, features and methods of application of the basic types of electrical machines (asynchronous, synchronous, DC, stepper motor).		
1.4. Course content		
Introducing students to the basic laws of electromagnetism, quantities and units that describe electric and magnetic fields. To train students to analyze and solve electrical networks of DC and alternating currents and voltages in the molten state. To train students to connect simple electrical circuits and carry out measurements of basic electromagnetic quantities. To introduce students to the designs, methods of operation and application of basic types of electrical machines.		
1.5. Types of classes	☒ lectures ☐ seminars and workshops ☒ auditory exercises ☐ distance learning ☐ field work	☐ individual exercises ☐ multimedia and network ☒ laboratory exercises ☐ design exercises ☐ working with a supervisor ☐ other _____

1.6. Comments	

1.7. Student obligations

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.8. Monitoring and assessment of student work

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.9. Assessment and evaluation of student work during classes and in the final exam

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance at lectures (L), auditory exercises (AE), laboratory exercises (LE), design exercises (DE)	2	1 ,2 ,5, 6	Lectures (L), laboratory exercises (LE), design exercises (DE)	Attendance tracking. Minimum attendance percentage: 70%.	0	5
Problem-solving exercises	1	1, 2	Revision exams (written exam)	Evaluation	15	30
Preparation for laboratory exercises (LE), results analysis, report writing	1	3, 4	Laboratory exercises (LE)	Preparation for LE, LE supervision, LE report assessment	10	20
Preparing for an oral exam and oral exam	1	1, 2, 5, 6	Oral exam	Evaluation	22	45

1.10. Obligatory literature (at the time of submitting a study programme proposal)

1. Kuzmanović, B. Fundamentals of Electrical Engineering I and II
2. Šehović, Felja, Tkalić Fundamentals of Electrical Engineering A Collection of Examples Part One
3. Felja, Korakin, A Collection of Tasks and Solved Examples from the Basics of Electrical Engineering, Part I and II
4. Hederić, Željko; Snježana Rimac-Drlje; Barukčić, Marinko Basics of Electrical Engineering I. Manual for Laboratory Exercises
5. Hederić, Željko; Barukčić, Marinko Fundamentals of Electrical Engineering II. Laboratory Practice Manual

1.11. Recommended additional literature (at the time of submitting a study programme proposal)

1. V. Pinter, Fundamentals of Electrical Engineering I and II, Technical Book, Zagreb, 1994.
2. B. Kuzmanović Collection of Tasks and Questions from the Basics of Electrical Engineering 1 and 2 Element, Zagreb, 2010.
3. M.Pužar, I.Mandić Fundamentals of Electrical Engineering I, lecture notes ETF, Osijek, 2010.
4. J. Edminister Electric Circuits Schaum
5. U.A.Bakshi, V.U.Bakshi Basic Electrical Engineering Technical Publications, 2009.

1.12. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*
Kuzmanović, B. Fundamentals of Electrical Engineering I and II Zagreb: Element, 2000.		70
Šehović, Felja, Tkalić Fundamentals of Electrical Engineering a Collection of Examples Part One Školska knjiga, Zagreb, 1992.		70
Felja, Koracin, Malić Collection of Problems and Solved Examples from the Basics of Electrical Engineering, Part I and II, 1991		70
1.13. Quality assurance methods ensuring the acquisition of knowledge, skills and competences		
Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).		

General information		
Lead instructor(s)	Željko Hederić, PhD, Full Professor Tomislav Matić, PhD, Associate Professor Marinko Barukčić, PhD, Full Professor	
Course title	Fundamentals of Electrical Engineering and Electronics	
Study programme	Undergraduate university study programme in Computer Engineering, elective module: Software Engineering	
Course status	Compulsory	
Year of study	1	
ECTS credits and teaching methods	ECTS credits	5
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	90

1. COURSE DESCRIPTION		
1.1. Course objectives		
Introduction of students to the fundamental laws of electromagnetism, quantities, and units that describe electric and magnetic fields. Equip students with the skills to analyze and solve electrical networks of direct and alternating currents and voltages in steady-state conditions. Train students to connect simple electrical circuits and conduct measurements of basic electromagnetic quantities. By successfully completing the course, students will be familiar with the basics of semiconductors and fundamental semiconductor components and will be equipped to apply semiconductor diodes and transistors in the design of electronic circuits.		
1.2. Course enrolment requirements		
There are no special requirements for enrolling in the course.		
1.3. Expected learning outcomes		
1. Define the basic physical quantities in electric and magnetic fields. 2. Apply basic methods for solving linear electric circuits in steady state. 3. Use fundamental measuring equipment (ammeter, voltmeter, ohmmeter, oscilloscope). 4. Measure basic electrical quantities in direct current (DC) and alternating current (AC) circuits. 5. Define and understand the physical properties of semiconductor materials. 6. Design electronic circuits based on semiconductor diodes and transistors. 7. Design basic logic circuits.		
1.4. Course content		
Electric field of a stationary charge. Electric potential, voltage, and capacitance. Electric current, resistance, and Ohm's law. Electrical networks of constant current, Kirchhoff's laws, real and ideal elements (sources, loads, instruments). Analysis of electrical networks with linear elements (mesh current method, node voltage method, Thevenin's and Norton's theorem). Magnetic field, inductance, and mutual inductance. Waveforms of current and voltage, transient states in first-order electrical circuits. Alternating currents and voltages, phasor transformation. Alternating current electrical networks, impedance, Kirchhoff's laws. Electric power and energy in alternating current networks. Faraday's law of induction, self-induction, and mutual induction. Physical principles of semiconductors. PN junction and metal-semiconductor junction. Semiconductor diodes: static characteristics, dynamic properties, types of semiconductor diodes. Bipolar junction transistor (BJT): static I-V characteristics, dynamic models. Unipolar transistor (JFET, MOSFET): static I-V characteristics, dynamic models. Basic circuits with bipolar transistors. Basic logic circuits.		
1.5. Types of classes	☒ lectures ☐ seminars and workshops	☐ individual exercises ☐ multimedia and network

	☒ auditory exercises ☒ distance learning ☐ field work	☒ laboratory exercises ☐ design exercises ☐ working with a supervisor ☐ other _____
1.6. Comments		

1.7. Student obligations

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.8. Monitoring and assessment of student work

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.9. Assessment and evaluation of student work during classes and in the final exam

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance at lectures (L), auditory exercises (AE), laboratory exercises (LE), design exercises (DE)	2	1, 2, 5, 6, 7	Lectures (L), laboratory exercises (LE), design exercises (DE)	Attendance tracking. Minimum attendance percentage: 70%.	0	0
Problem-solving exercises	1	2, 5, 6, 7	Revision exams (written exam)	Evaluation	15	30
Preparation for laboratory exercises (LE), results analysis, report writing	1	3, 4, 6, 7	Laboratory exercises (LE)	Preparation for LE, LE supervision, LE report assessment	10	20
Preparing for an oral exam and oral exam	1	1, 2, 5, 6	Oral exam	Evaluation	25	50

1.10. Obligatory literature (at the time of submitting a study programme proposal)

1. Kuzmanović, B. Osnove elektrotehnike I i II, Zagreb: Element, 2000.
2. Prasad, Rajendra Fundamentals of Electronic Engineering Cengage Learning, 2012.
3. Šehović, Felja, Tkalić Osnove elektrotehnike zbirka primjera prvi dio Školska knjiga, Zagreb, 1992.
4. Felja, Koračin, Malić Zbirka zadataka i rješenih primjera iz Osnova elektrotehnike, I. i II. dio 1991
5. Hederić, Željko; Snježana Rimac-Drlje; Barukčić, Marinko Osnove elektrotehnike I. Priručnik za laboratorijske vježbe ETF, Osijek, 2010.
6. Švedek, T. Poluvodičke komponente i osnovni sklopovi, Svezak I, Poluvodičke komponente Graphis, 2001., Zagreb
7. P. Biljanović Elektronički sklopovi Školska knjiga, Zagreb, 1989.

1.11. Recommended additional literature (at the time of submitting a study programme proposal)

1. V. Pinter Osnove elektrotehnike I i II Tehnička knjiga, Zagreb, 1994.
2. B. Kuzmanović Zbirka zadataka i pitanja iz Osnova elektrotehnike 1 i 2 Element, Zagreb, 2010.
3. M.Pužar, I.Mandić Osnove elektrotehnike I, lecture notes ETF, Osijek, 2010.
4. J. Edminister Electric Circuits Schaum
5. U.A.Bakshi, V.U.Bakshi Basic Electrical Engineering Technical Publications, 2009.

6. A.S. Sedra, K.C.Smith Microelectronic Circuits, 3. Edition Saunders College Publishing, New York, 1991.

1.12. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*
Kuzmanović, B. Osnove elektrotehnike I i II Zagreb: Element, 2000.	42	70
Šehović, Felja, Tkalić Osnove elektrotehnike zbirka primjera prvi dio Školska knjiga, Zagreb, 1992.	18	70
Felja, Koračin, Malić Zbirka zadataka i rješenih primjera iz Osnova elektrotehnike, I. i II. dio 1991	49	70
Švedek, T. Poluvodičke komponente i osnovni sklopovi, Svezak I, Poluvodičke komponente Graphis, 2001., Zagreb	15	70
P. Biljanović Elektronički sklopovi Školska knjiga, Zagreb, 1989.	9	70

1.13. Quality assurance methods ensuring the acquisition of knowledge, skills and competences

Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).

General information		
Lead instructor(s)	Anita Katić, PhD, Assistant Professor	
Course title	Linear Algebra	
Study programme	Undergraduate university study programme in Computer Engineering, elective modules: Computer Engineering and Software Engineering	
Course status	Compulsory	
Year of study	1	
ECTS credits and teaching methods	ECTS credits	5
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	30+(30+0+0)+0

2. COURSE DESCRIPTION		
1.14. Course objectives		
-		
1.15. Course enrolment requirements		
-		
1.16. Expected learning outcomes		
1. Graphically construct a linear combination of vectors and choose the appropriate computational operation from the vector space V3 when solving problem tasks. 2. Define matrices and perform basic arithmetic operations with matrices. 3. For a given relationship of points, lines, and planes in space, create equations whose solutions will yield the desired object or relationship. 4. For a given linear operator, to create the kernel and image, and if its domain and codomain are the same vector space, to determine the minimal polynomial and diagonalize the matrix. 5. Solve systems of linear equations using different methods and discuss the solutions.		
1.17. Course content		
Elements of mathematical logic. Vector space V3. Vector operations. Linearly dependent and independent vectors. Vector projection. Basis of a vector space. Coordinate system. Scalar, vector, and mixed products. Analytical geometry. Point, line, plane, and their mutual relationships. The concept of a matrix and elementary matrix transformations. Matrix operations. Vector space of matrices. The concept of a determinant and its properties. Calculating the value of a determinant. Rank of a matrix. Regular matrices. Inverse matrices. Systems of linear algebraic equations. Discussion of solutions. Methods for solving systems of equations. n-dimensional vector space. Basis and dimension of the vector space. Subspaces. Examples of vector spaces. The concept of a linear operator. Representation of a linear operator in a basis. Algebra. Minimal polynomial. Matrix similarity. Eigenvalues and eigenvectors of a matrix. Characteristic polynomial. Cayley – Hamilton theorem. Matrix diagonalization. Scalar product. Norm. Unitary spaces. Orthogonality. Gram-Schmidt process. Quadratic forms. Conic sections. Quadric surfaces.		
1.18. Types of classes	☒ lectures ☐ seminars and workshops ☒ auditory exercises ☐ distance learning ☐ field work	☐ individual exercises ☐ multimedia and network ☐ laboratory exercises ☐ design exercises ☐ working with a supervisor

		☐ other _____
1.19. Comments		

1.20. Student obligations

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.21. Monitoring and assessment of student work

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.22. Assessment and evaluation of student work during classes and in the final exam

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance at lectures (L), auditory exercises (AE),	2	2, 3, 4, 5	Lectures (L), laboratory exercises (LE), design exercises (DE)	Attendance tracking. Minimum attendance percentage: 70%.	0	5
Problem-solving exercises	1	1, 2, 4, 5	Revision exams (written exam)	Evaluation	20	40
Preparing for an oral exam and oral exam	1	1, 2, 3, 4, 5	Oral exam	Evaluation	25	50
Homework assignments	1	1, 2, 4, 5	Preparation for written knowledge assessment	Evaluation of solutions for a given problem	0	5

1.23. Obligatory literature (at the time of submitting a study programme proposal)

1. N. Elezović, A. Aglić, Linearna algebra, zbirka zadataka, Element, Zagreb, 2001
2. Lipschutz, Seymour, Linear algebra, Schaum's outlines, 1991
3. K. Horvatić, Linearna algebra, PMF Matematički odjel, Zagreb, 1995

1.24. Recommended additional literature (at the time of submitting a study programme proposal)

1. S. Kurepa, Uvod u linearnu algebru, Školska knjiga, Zagreb, 1990
2. L. Čaklović, Zbirka zadataka iz linearne algebre, Školska knjiga, Zagreb, 1979
3. R. Galić, Osnove linearne algebre, ETF, Osijek, 1994
4. N. Elezović, Linearna algebra, Element, Zagreb, 1995
5. N. Bakić, A. Milas, Zbirka zadataka iz linearne algebre, PMF Matematički odjel, Zagreb, 1995

1.25. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*

1.26. Quality assurance methods ensuring the acquisition of knowledge, skills and competences

Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).

General information		
Lead instructor(s)	Tomislav Rudec, PhD, Assistant Professor	
Course title	Calculus I (Differential Calculus)	
Study programme	Undergraduate university study programme in Computer Engineering, elective modules: Computer Engineering and Software Engineering	
Course status	Compulsory	
Year of study	1	
ECTS credits and teaching methods	ECTS credits	5
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	30+30+0+0+0

1. COURSE DESCRIPTION		
1.1. Course objectives		
1.2. Course enrolment requirements		
There are no special requirements for enrolling in the course.		
1.3. Expected learning outcomes		
1.discuss the properties of the given elementary function by knowing the properties and characteristic examples of elementary functions 2.construct a model for the decision on the convergence of the given sequence by knowing the properties and the characteristic examples of sequenceS 3.discuss the general characteristics of different elementary functions by comparing them 4.construct the form of a default function 5.construct a mathematical or physical problem model using differential calculus		
1.4. Course content		
1. Preliminaries. Real numbers, infimum and supremum, absolute value, intervals. Complex numbers. 2. Functions. Definition of a function. Basic properties. Composition of functions. Inverse function. Elementary functions (polynomial, rational, exponential, logarithm, trigonometric, cyclometric, hyperbolic and area functions). 3. Sequences of real numbers. Concept of a sequence, properties and convergence. Number e. 11 4. Limits and continuity of functions. Concept and properties of the limits of the function. Asymptotes. Continuity of functions. 5. Differential calculus. The derivative and the tangent. The derivative as velocity. Concept of the derivative. Derivative rules. The chain rule and the derivative of the inverse function. The derivative of elementary functions. Implicit differentiation. Parametric differentiation. Mean value theorem. Higher derivatives. Taylor's theorem. 6. Application of the differential calculus. Differential. Newton's method. L'Hôpital's rule. Examination of functions (monotonicity, minima and maxima, convexity, asymptotes). Sketching curves.		
1.5. Types of classes	☒ lectures ☐ seminars and workshops ☒ auditory exercises ☐ distance learning ☐ field work	☐ individual exercises ☐ multimedia and network ☐ laboratory exercises ☐ design exercises ☐ working with a supervisor

		☐ other _____
1.6. Comments		

1.7. Student obligations

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.8. Monitoring and assessment of student work

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.9. Assessment and evaluation of student work during classes and in the final exam

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance Lectures, Auditory exercises	1.2	1,2,3,4	Lectures (L), Auditory exercises (AL)	Attendance tracking. Minimum attendance percentage: 70%.	0	0
Practice – problem solving	1.1	1,3,4,5	Midterm exam	Evaluation of (written) exercises	20	40
Oral exam	1.7	1,2,3,4	Oral exam	Assessment of student's answers	25	50
Revision exams	1	1,2,4,5	Revision exams	Checking solutions	0	10

1.10. Obligatory literature (at the time of submitting a study programme proposal)

1. Galić, A; D.Crnjac Milić; Galić, I;.Katić, A. Matematika 1.Osijek: ETF Osijek, 2008.
2. Demidović, B.P. - Zadaci i riješeni primjeri iz više matematike s primjenom na tehničke nauke. Zagreb:Tehnička knjiga, 2003.
3. S. Kurepa, Matematička analiza 1 (diferenciranje i integriranje), Tehnička knjiga, Zagreb, 1989.

1.11. Recommended additional literature (at the time of submitting a study programme proposal)

1. S. Kurepa, Matematička analiza 2 (funkcije jedne varijable), Tehnička knjiga, Zagreb, 1990.

2. W. Rudin, Principles of Mathematical Analysis, Mc Graw-Hill, Book Company, 1964.

1.12. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*

1.13. Quality assurance methods ensuring the acquisition of knowledge, skills and competences

Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).

General information		
Lead instructor(s)	Anita Katić, PhD, Assistant Professor	
Course title	Calculus II	
Study programme	Undergraduate university study programme in Computer Engineering, elective modules: Computer Engineering and Software Engineering	
Course status	Compulsory	
Year of study	1	
ECTS credits and teaching methods	ECTS credits	6
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	30+(30+0+0)+0

1. COURSE DESCRIPTION		
1.1. Course objectives		
-		
1.2. Course enrolment requirements		
-		
1.3. Expected learning outcomes		
1. explain the meaning and application of a definite integral 2. for a given mathematical problem, create an integral, solve it and interpret the solution 3. for a given series of real numbers and series of functions, create a statement of convergence decisions 4. for a given, specific problem in mathematics or physics, design a mathematical model using basic forms of differential equations		
1.4. Course content		
1. Riemann integral. The integral as an area. Concept and properties of the Riemann integral. Integrability of monotonic and continuous functions. The mean value theorem for integral of the continuous function. Newton-Leibniz formulae. 2. Indefinite integral. Basic methods and techniques of integration (the method of substitution, integration by parts, integration of rational functions and integration of functions boiling down to integrals of rational functions, Euler substitution, binomial integral) 3. Application of integration. Area between two curves, surface and volumes of revolution, length of curve, work of power, moments, centre of mass. Improper integral. Numerical integration (trapezium and Simpsons rule). 4. Series of real numbers. Concept of series and convergence. Criteria of convergence. 5. Series of functions. Uniform convergence. Power series. Taylor series of elementary functions. Exponential and logarithm function. 6. Ordinary differential equations. Sources of ordinary differential equations. General and particular solution. Cauchy problem. Geometric point of view. Problem of sensitivity to a change of initial values. Some types of ordinary differential equations of the first order (exact, homogeneous, linear, Bernoulli equation). Examples and applications. 7. Ordinary differential equations of the second order. Some special types. Linear differential equation of the second order. Lagranges method of variation of the constant. Linear differential equation of the second order with constant coefficients. Examples and applications (harmonic oscillator).		
1.5. Types of classes	☒ lectures ☐ seminars and workshops ☒ auditory exercises ☐ distance learning ☐ field work	☐ individual exercises ☐ multimedia and network ☐ laboratory exercises ☐ design exercises ☐ working with a supervisor

		☐ other _____
1.6. Comments		

1.7. Student obligations

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.8. Monitoring and assessment of student work

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.9. Assessment and evaluation of student work during classes and in the final exam

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance at lectures (L), auditory exercises (AE), laboratory exercises (LE), design exercises (DE)	2	2, 3, 4	Lectures (L), laboratory exercises (LE), design exercises (DE)	Attendance tracking. Minimum attendance percentage: 70%.	0	0
Problem-solving exercises	3	1, 2, 3	Revision exams (written exam)	Evaluation of solutions for a given problem	25	50
Preparing for an oral exam and oral exam	0.7	1, 2, 3	Oral exam	Evaluation	20	40
Homework assignments	0.3	1, 2, 4	Preparation for written knowledge assessment	Evaluation	0	10

1.10. Obligatory literature (at the time of submitting a study programme proposal)

1. Demidović, B.P. Zadaci i riješeni primjeri iz više matematike s primjenom na tehničke nauke . Zagreb: Tehnička knjiga, 2003.
2. D. Jukić, R. Scitovski, Matematika I, Odjel za matematiku, Osijek, 2000.
3. I. Ivanšić, Fourierovi redovi. Diferencijalne jednadžbe, Odjel za matematiku, Osijek, 2000.

1.11. Recommended additional literature (at the time of submitting a study programme proposal)

1. W. Rudin, Principles of Mathematical Analysis, Mc Graw-Hill, Book Company, New York, 1964
2. S. Kurepa, Matematička analiza 1 (diferenciranje i integriranje), Tehnička knjiga, Zagreb, 1989
3. S. Kurepa, Matematička analiza 2 (funkcije jedne varijable), Tehnička knjiga, Zagreb, 1990
4. G.F.Simmons, J.S.Robertson, Differential Equations with Applications and Historical Notes, 2nd Ed., McGraw-Hill, Inc., New York, 1991
5. Schaum's outline series, McGRAW-HILL, New York, 1991

1.12. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*

1.13. Quality assurance methods ensuring the acquisition of knowledge, skills and competences		
Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).		

General information		
Lead instructor(s)	Dean Vučinić, PhD, Associate Professor	
Course title	Modelling and Simulation	
Study programme	Undergraduate university study programme in Computer Engineering, elective module: Computer Engineering	
Course status	Compulsory	
Year of study	3	
ECTS credits and teaching methods	ECTS credits	7
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	30+(15+15+0)+0

1. COURSE DESCRIPTION		
1.1. Course objectives		
1.2. Course enrolment requirements		
There are no special requirements for enrolling in the course		
1.3. Expected learning outcomes		
1. Understand the principles and importance of modelling. 2. Analyse, evaluate and plan the use of mathematical models in the development of technical systems. 3. Identify and relate the key features in modelling and simulation. 4. Evaluate and justify software engineering development models. 5. Design a dynamic system model, prepare it for implementation in MATLAB and simulate it in Simulink. 6. Apply adopted principles and mechanisms, and use acquired knowledge in modelling and simulation of domain specific real systems.		
1.4. Course content		
Model types. Process models. Physical limitations of modelling participation model. Mathematical models anticipative and incursive models. Models of electrical engineering components. Connectivity model. Approximation models and set theory. Qualitative and quantitative modelling aspects. Software engineering models. Hydrodynamic models. Unit process models laser processes. Bond graph modelling method. Scale models and analogies. Verbal models. Models and corresponding differential equations. Discretised solutions. Fluid dynamic models. Boundary problems and discretisation conditions.		
1.5. Types of classes	☒ lectures ☐ seminars and workshops ☒ auditory exercises ☐ distance learning ☐ field work	☐ individual exercises ☐ multimedia and network ☒ laboratory exercises ☐ design exercises ☐ working with a supervisor ☐ other _____
1.6. Comments		
1.7. Student obligations		
Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.		

1.8. Monitoring and assessment of student work

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.9. Assessment and evaluation of student work during classes and in the final exam

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance at lectures (L), auditory exercises (AE), laboratory exercises (LE), design exercises (DE)	2	1,2,3,4,5,6	Lectures (L), laboratory exercises (LE), design exercises (DE)	Attendance tracking. Minimum attendance percentage: 70%.	7	10
Problem-solving exercises	1.3	2,4,6	Revision exams (written exam)	Evaluation	15	30
Preparation for laboratory exercises (LE), results analysis, report writing	1	2,3,4,5	Laboratory exercises (LE)	Preparation for LE, LE supervision, LE report assessment	5	10
Preparing for an oral exam and oral exam	1.3	1,3,4,6	Oral exam	Evaluation	20	40
Homework	0.4	2,3,6	Homework	Evaluation of the solved tasks	3	10

1.10. Obligatory literature (at the time of submitting a study programme proposal)

1. Bungartz, Hans-Joachim; Zimmer, Stefan; Buchholz, Martin; Pflüger, Dirk .Modeling and Simulation: An Application-Oriented Introduction. Springer, 2014.

1.11. Recommended additional literature (at the time of submitting a study programme proposal)

1. Kramer/Neclau, Simulationstechnik, Springer Verlag, Wien, 1998.
2. Kuipers, B., Qualitative reasoning, Modelling ans Simulation, MIT Press, 1999.
3. Jović F, Flegar I, Slavek N., Modeliranje i simulacija, Skripta ETF Osijek, 2005.
4. Monself Y., Modelling and Siumulation of Coimplex Systems - Methods, Techniques aand Tools, SCS, European Publ. House, 1998.

1.12. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*

1.13. Quality assurance methods ensuring the acquisition of knowledge, skills and competences

Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).

General information		
Lead instructor(s)	Damir Blažević, PhD, Associate Professor	
Course title	Object-Oriented Programming	
Study programme	Undergraduate university study programme in Computer Engineering	
Course status	Compulsory	
Year of study	2	
ECTS credits and teaching methods	ECTS credits	6
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	30+(15+30+0)+0

1. COURSE DESCRIPTION		
1.1. Course objectives		
1.2. Course enrolment requirements		
1.3. Expected learning outcomes		
1. based on the given problem, create a computer program algorithm 2. recognize the organizational structure and select the elements for the object model 3. design and summarize user data types (classes) and derive the necessary objects from them 4. design the main program in an appropriate programming language that solves the given problem based on an object-oriented approach 5. recognize errors in the program code, correct them, create an executable version of the program and test the program's operation 6. independently plan and create computer programs that solve a given problem		
1.4. Course content		
Complexity of program support. Attributes of complexity, measurement of complexity. Decomposition, abstraction, hierarchy. Methods of analysis and design of program support. Object models. Types of programming paradigms. Elements of the object model. Data abstraction. Classes and models. Relationships between objects. Notation. Programming, language elements, the process of creating object-oriented programs. C++ programming language through examples. Details of object-oriented programming in C++. COM and DCOM		
1.5. Types of classes	☒ lectures ☐ seminars and workshops ☒ auditory exercises ☐ distance learning ☐ field work	☐ individual exercises ☐ multimedia and network ☐ laboratory exercises ☐ design exercises ☐ working with a supervisor ☐ other _____
1.6. Comments		
1.7. Student obligations		

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.8. Monitoring and assessment of student work

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.9. Assessment and evaluation of student work during classes and in the final exam

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance at lectures (L), auditory exercises (AE), laboratory exercises (LE), design exercises (DE)	2	1,2,3,4	Lectures (L), laboratory exercises (LE), design exercises (DE)	Attendance tracking. Minimum attendance percentage: 70%.	4	8
Problem-solving exercises	1	3,4,5,6	Revision exams (written exam)	Evaluation	16	32
Preparation for laboratory exercises (LE), results analysis, report writing	1	1,2,3,4	Laboratory exercises (LE)	Preparation for LE, LE supervision, LE report assessment	10	20
Preparing for an oral exam and oral exam	1.8	1,2,3,4,5,6	Oral exam	Evaluation	16	32
Problem solving	0.2	1,2,3,4,5,6	Homework	Homework grading	0	8

1.10. Obligatory literature (at the time of submitting a study programme proposal)

1. Grundler, D. .Primijenjeno računalstvo. Zagreb: Graphis, 2000.
2. Booch, Grady. Object-oriented Analysis and Design with Applications. Addison Wesley, Menlo Prk, Cal., 1994.
3. D. Grundler, Primijenjeno računalstvo, Graphis, Zagreb, 2000.

1.11. Recommended additional literature (at the time of submitting a study programme proposal)

1. L. Budin, Informatika za 1. razred gimnazije, Element, Zagreb, 1997.
2. D. Patterson, J. Hennessy, Computer Organization and Design: The Hardware / Software Interface (2nd Edition), Morgan Kaufmann Publ., San Francisco, 1997.
3. A.S. Tanenbaum, Structured Computer Organization, 7th ed., Prentice-Hall, New Jersey, 2005.
4. Grady Booch: Object-oriented Analysis and Design with Applications, Addison Wesley, Menlo Prk, Cal., 1994.
5. D. Fisher, Zbrika zadataka iz C-a, ETF Osijek (skripta), 1999.

1.12. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*

1.13. Quality assurance methods ensuring the acquisition of knowledge, skills and competences
Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).

General information		
Lead instructor(s)	Goran Martinović, PhD, Full Professor with Tenure	
Course title	Operating Systems	
Study programme	Undergraduate university study programme in Computer Engineering, elective modules: Computer Engineering and Software Engineering	
Course status	Compulsory	
Year of study	2	
ECTS credits and teaching methods	ECTS credits	5.5
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	45+(0+30+0)+0

1. COURSE DESCRIPTION		
1.1. Course objectives		
Understanding the mechanisms of operating systems. Advanced use of modern operating systems. Overview and basics of using programming tools for the development of more efficient system application programs, considering the possibilities provided by the operating system.		
1.2. Course enrolment requirements		
Requirements for enrolment in the second year of study fulfilled.		
1.3. Expected learning outcomes		
1. understand the principles, system and programming mechanisms of operating systems in actual computer systems 2. analyse and compare the applicability of the principles, mechanisms and algorithms on which the work of operating systems is based at the process and thread level, scheduling, inter-process communication, deadlock, input-output units, data storage and structuring, security and the platforms on which they are used 3. create more advanced system and application solutions in suitable programming environments and languages based on adopted principles, mechanisms and algorithms in operating systems 4. analyse, evaluate and plan the use of current operating systems of personal computers, mobile devices and computer systems in a broader sense according to the requirements of the environment and users 5. use current operating systems at an advanced user, administrative, system and programming level		
1.4. Course content		
Development and review of operating systems. System requirements on the operating system, system calls, APIs. Structure of operating systems. Processes and threads: properties, inter-process communication, scheduling. Deadlocks: deadlock detection and prevention algorithms. Memory management: sharing, virtual memory, paging, segmentation. Input-output units: properties, disks, system clock, user interface, network communication. File system: implementation methods, examples (FAT, NTFS, others). Introduction to system support of multiprocessor, multicomputer and distributed computer systems. Security of operating systems: encryption, user authorization, system attacks and protection mechanisms. Introduction to operating system design: programming tools, requirements for responsiveness, reliability and interface, performance evaluation. Overview of operating systems through examples: UNIX, Linux, Windows, mobile OSes (Android, iOS, Windows Phone).		
1.5. Types of classes	☒ lectures ☐ seminars and workshops ☐ auditory exercises	☐ individual exercises ☐ multimedia and network ☒ laboratory exercises ☐ design exercises

	☐ distance learning ☐ field work	☐ working with a supervisor ☐ other _____
1.6. Comments		

1.7. Student obligations

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.8. Monitoring and assessment of student work

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.9. Assessment and evaluation of student work during classes and in the final exam

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance at lectures (L), laboratory exercises (LE)	2.5	1, 2, 3, 4, 5	Lectures (L), laboratory exercises (LE)	Attendance tracking. Minimum attendance percentage: 70%.	3	6
Writing preparations for LV, analysis of results, and report writing	1	2, 3, 4, 5	Laboratory exercises (LE)	Evaluation of preparation for LV, supervision of implementation of LV, verification of written reports	12	24
Preparation for the oral exam and oral exam	1	1, 2, 4	Oral exam	Evaluation	20	40
Written exam and LV colloquium	1	1, 2, 3	Written exam and LV colloquium	Evaluation	15	30

1.10. Obligatory literature (at the time of submitting a study programme proposal)

1. Budin, L; Golub M; Jakobović, D; Jelenković, L. Operacijski sustavi. Zagreb: Element, 2011.
2. Tanenbaum, A.S. Modern Operating Systems (3rd Ed). Pearson, 3rd Ed., 2013.
3. S. Bjornander, C ++ Windows Programming, Packt Publishing, 2016.

1.11. Recommended additional literature (at the time of submitting a study programme proposal)

1. W. Stallings, Operating Systems, Internals and Design Principles, Pearson Education, 7th Ed., 2011.
2. S. Das, Your UNIX: The Ultimate Guide, McGraw-Hill Science, 2000.
3. C. Schroder, Linux Cookbook, O'Reilly, New York, 2004.
4. Microsoft Windows Team Staff, Microsoft Windows XP Professional Resource Kit, Microsoft Press, 2003.
5. C. Negus, C. Bresnahan, Linux Bible, John Wiley & Sons, 8th Ed., 2012.
6. J.M. Hart, Windows System Programming (3rd Ed.), Addison Wesley Professional, Boston, 2014.

1.12. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*
1. Budin, L; Golub M; Jakobović, D; Jelenković, L. Operacijski sustavi. Zagreb: Element, 2011.	10	90

2. Tanenbaum, A.S. Modern Operating Systems (3rd Ed). Pearson, 3rd Ed., 2013.	5	90
3. S. Bjornander, C ++ Windows Programming, Packt Publishing, 2016.	3	90
1.13. Quality assurance methods ensuring the acquisition of knowledge, skills and competences		
Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).		

General information		
Lead instructor(s)	Irena Galić, PhD, Associate Professor	
Course title	Signals and Systems	
Study programme	Undergraduate university study programme in Computer Engineering, elective modules: Computer Engineering and Software Engineering	
Course status	Compulsory	
Year of study	2	
ECTS credits and teaching methods	ECTS credits	5
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	30+(15+15+0)+0

1. COURSE DESCRIPTION		
1.1. Course objectives		
Students acquire the knowledge necessary for analysing and modelling signals and systems by mastering the subject.		
1.2. Course enrolment requirements		
Requirements for enrolment in the second year of study fulfilled.		
1.3. Expected learning outcomes		
1. Define and classify signals and systems and utilize concepts from signals and system theory. 2. Analytically solve and evaluate mathematical models of first and second-order continuous and discrete-time linear systems. 3. Model and evaluate dynamic systems in Simulink and program in MATLAB. 4. Define and describe the principle of superposition, superposition integral, superposition sum, convolution integral, and convolution sum. 5. Define Laplace and Z-transformations and apply and evaluate them in determining the response of linear time-invariant systems. 6. Interpret the four Fourier transforms (CTFS, CTFT, DTFS, DTFT) and their properties, and describe their applications.		
1.4. Course content		
Mathematical models of continuous-time (CT) and discrete-time (DT) signals and systems. Classification. Analysis of linear systems. Fourier transforms of CT and DT signals (FS, FT, DTFT, and DTFS). Frequency characteristics and filtering principles. Laplace and Z-transformations. Decomposition and realization of systems. Stability, controllability, and observability of systems. Sampling and signal reconstruction. Equivalence of CT and DT systems. Programs for system analysis and simulation.		
1.5. Types of classes	☒ lectures ☐ seminars and workshops ☒ auditory exercises ☐ distance learning ☐ field work	☐ individual exercises ☐ multimedia and network ☒ laboratory exercises ☐ design exercises ☐ working with a supervisor ☐ other _____
1.6. Comments		
1.7. Student obligations		

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.8. Monitoring and assessment of student work

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.9. Assessment and evaluation of student work during classes and in the final exam

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance at lectures (L), auditory exercises (AE), laboratory exercises (LE), design exercises (DE)	2	1	Lectures (L), laboratory exercises (LE), design exercises (DE)	Attendance tracking. Minimum attendance percentage: 70%.	0	2
Problem-solving exercises	1	1, 2, 4, 5	Revision exams (written exam)	Evaluation	15	30
Preparation for laboratory exercises (LE), results analysis, report writing	1	1, 3	Laboratory exercises (LE)	Preparation for LE, LE supervision, LE report assessment	12	18
Preparing for an oral exam and oral exam	1	1, 2, 4, 5, 6	Oral exam	Evaluation	25	50

1.10. Obligatory literature (at the time of submitting a study programme proposal)

1. B. P. Lathi. Linear Systems and Signals. Oxford University Press, 2004; ISBN: 0-19-515833-4

1.11. Recommended additional literature (at the time of submitting a study programme proposal)

1. A.V.Oppenheim, A.S.Willsky, Signale und Systeme, Arbeitsheft, VCH, Verlagsgesellschaft, Weinheim, 1989
2. Gabel i Roberts, Signals and Linear Systems, 3/e, J. Willey, 1987.
3. H. Babić. Signali i sustavi, Zavodska skripta, ZESOI, Fakultet elektrotehnike i računarstva Zagreb, 1996.

1.12. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*

1.13. Quality assurance methods ensuring the acquisition of knowledge, skills and competences

Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).

General information		
Lead instructor(s)	Drago Žagar, PhD, Full Professor with Tenure	
Course title	Information Theory	
Study programme	Undergraduate university study programme in Computer Engineering	
Course status	Compulsory	
Year of study	2	
ECTS credits and teaching methods	ECTS credits	5.5
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	45+(15+15+0)+0

1. COURSE DESCRIPTION		
1.1. Course objectives		
-		
1.2. Course enrolment requirements		
-		
1.3. Expected learning outcomes		
1. define basic concepts from the field of information theory 2. describe the basic elements of the communication system 3. assess the correctness of the application of theoretical foundations in solving tasks 4. create a simulation of the basic elements of the information system using a software tool 5. choose a suitable coding method for the given problem 6. propose an information system design for a simple problem 7. compare simple information systems		
1.4. Course content		
The nature of the information. Information sources and users. Appearance and information. Layers of information: statistical, syntactic, semantic, pragmatic and apobetical. Stock of information. Entropy. Entropy on the information channel. Codes. Markov chains. Syntactic view of information: rules and syntax forms. Semantic parameters: topicality, existence, availability, relevance and importance. Measuring the semantic vision of information: SIT. Languages of living nature. Bioinformatics. Signal and information. BT. Analytical and asymptotic signals. Noise and codes on an information channel: Shannon's theorem. Bayes' position and theorem. Optimal code. Encoding time. Complex data processing: selection, filtering, classification and presentation of data. Qualitative and quantitative type of information. Zeleznikar's theses. Information agents: independent, collective and social agent. Constructions of agents. Network agents.		
1.5. Types of classes	☒ lectures ☐ seminars and workshops ☒ auditory exercises ☐ distance learning ☐ field work	☐ individual exercises ☐ multimedia and network ☒ laboratory exercises ☐ design exercises ☐ working with a supervisor ☐ other _____
1.6. Comments		

1.7. Student obligations

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.8. Monitoring and assessment of student work

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.9. Assessment and evaluation of student work during classes and in the final exam

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENTMETHOD	POINTS	
					Min	Max
Attendance at lectures (L), auditory exercises (AE), laboratory exercises (LE), design exercises (DE)	1	1,2,3,4,5,6,7	Lectures (L), laboratory exercises (LE), design exercises (DE)	Attendance tracking. Minimum attendance percentage: 70%.	1	4
Problem-solving exercises	1.3	3,5,6	Revision exams (written exam)	Evaluation	16	32
Preparation for laboratory exercises (LE), results analysis, report writing	1.2	3,4,6	Laboratory exercises (LE)	Preparation for LE, LE supervision, LE report assessment	12	24
Preparing for an oral exam and oral exam	1.3	1,2,5,6,7	Oral exam	Evaluation	15	30
Seminar paper	0.7	5,6,7	Preparation and presentation of the seminar paper	Evaluation of seminars and presentations of results	6	10

1.10. Obligatory literature (at the time of submitting a study programme proposal)

1. V. Sinković, Informacija, simbolika i semantika, Školska knjiga, 1997., Zagreb
2. Gray, Robert M. .Entropy and Information Theory, Information Systems Laboratory Electrical Engineering Department Stanford University. New York, Springer-Verlag, 2013.
3. Ž. Pauše, Uvod u teoriju informacije, Školska knjiga, Zagreb, 1989.

1.11. Recommended additional literature (at the time of submitting a study programme proposal)

1. I. S. Pandžić i dr., Uvod u teoriju informacije i kodiranje, Element , Zagreb, 2007.
2. F. Jović, Teorija informacije - skripta, moodle.etfos.unios.hr, 2011.
3. V. Matković i V. Sinković, Teorija informacije, Školska knjiga Zagreb, 1984.

1.12. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*

1.13. Quality assurance methods ensuring the acquisition of knowledge, skills and competences

Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).

General information		
Lead instructor(s)	Radoslav Galić, PhD, Full Professor with Tenure, Emeritus Tomislav Rudec, PhD, Assistant Professor	
Course title	Probability and Statistics	
Study programme	Undergraduate university study programme in Computer Engineering	
Course status	Compulsory	
Year of study	2	
ECTS credits and teaching methods	ECTS credits	5
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	30+(30+0+0)+0

1. COURSE DESCRIPTION		
1.1. Course objectives		
1.2. Course enrolment requirements		
1.3. Expected learning outcomes		
Learning outcomes 1. design a problem model using basic counting rules and basic concepts from combinatorics 2. construct a model for calculating a probability problem by using the rules for calculating the probability of a union and intersection of an event, as well as conditional probability rule using total probability rule and Bayes theorem 3. design an expression to calculate a probability problem using the terms from the random variable's theory 4. in the analysis of the set statistical data group, create mathematical expressions using the basic statistics formulas 5. define and distinguish the basic concepts of statistical tests and apply the appropriate statistical tests on practical examples		
1.4. Course content		
Fundamentals of combinatorics. Algebra of events. Probability and properties. Random variable. Distribution function of a random variable. Discrete and continuous probability distributions (hypergeometric, binominal, Poisson, normal, uniform, exponential, Chi-squared, student`s t-distribution). Numerical properties of distributions. Two-dimensional probability distributions. Moments and correlations. Statistical set with parameters. Empirical and two-dimensional distributions. Correlation and regression analysis. Samples and numerical properties of samples. Parameter estimation. Interval estimation. Statistical hypothesis testing. Examples of statistical models, statistical thinking and application of statistical programmes. Writing a seminar paper.		
1.5. Types of classes	☒ lectures ☐ seminars and workshops ☒ auditory exercises ☐ distance learning ☐ field work	☐ individual exercises ☐ multimedia and network ☐ laboratory exercises ☐ design exercises ☐ working with a supervisor ☐ other _____

1.6. Comments	

1.7. Student obligations

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.8. Monitoring and assessment of student work

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.9. Assessment and evaluation of student work during classes and in the final exam

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance at lectures (L), auditory exercises (AE)	1.7	2,3,4,5	Lectures (L), auditory exercises (AE),	Attendance tracking. Minimum attendance percentage: 70%.	0	0
Problem-solving exercises	1.3	1,3,4,5	Revision exams (written exam)	Evaluation	20	40
Preparing for an oral exam and oral exam	1.5	1,2,4	Preparing for an oral exam and oral exam	Evaluation	25	50
Homework	0.5	1,2,3,5	Homework	Questions based on what was presented	25	50

1.10. Obligatory literature (at the time of submitting a study programme proposal)

1. Galić, R. Vjerojatnost i statistika. Osijek: ETF, 2013.
2. Montgomery, D.C. Applied Statistics and Probability for engineers. USA: Wiley, 2014.
3. R. Galić, Statistika, ETFOS, Osijek, 2004

1.11. Recommended additional literature (at the time of submitting a study programme proposal)

1. Pavlić, Statistička teorija i primjena, Tehnička knjiga, Zagreb, 2000.

2. Ž. Pauše, Uvod u matematičku statistiku, Školska knjiga, Zagreb, 1995.

3. Ž. Pauše, Vjerojatnost i stohastički procesi, Školska knjiga, Zagreb, 2004.

4. G. M. Clarke, D. Cooke, A Basic Course in Statistics, Arnold, London, 1992.

5. R. Galić, Vjerojatnost , ETFOS, Osijek, 2004

1.12. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*

1.13. Quality assurance methods ensuring the acquisition of knowledge, skills and competences

Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).

General information		
Lead instructor(s)	Goran Martinović, PhD, Full Professor with Tenure Alfonzo Baumgartner, PhD, Associate Professor	
Course title	Programming I	
Study programme	Undergraduate university study programme in Computer Engineering, elective modules: Computer Engineering and Software Engineering	
Course status	Compulsory	
Year of study	1	
ECTS credits and teaching methods	ECTS credits	5
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	30+(15+15+0)+0

1. COURSE DESCRIPTION		
1.1. Course objectives		
The goal of the course is to explain to students the basics of algorithmic thinking in the development of software solutions using the basic principles of software engineering. Train students to create programs using the procedural programming method. To acquaint students with different types of data, functions for data input and output, and different types of operators. Explain to the students program loops and commands for branching in the program. Show students the possibility of using 1D and 2D fields, explain the use of functions, working with memory, pointers, and ways of generating pseudo-random numbers.		
1.2. Course enrolment requirements		
Requirements for enrolment in the study programme fulfilled.		
1.3. Expected learning outcomes		
1. Recognize and interrelate the essential features of procedural programming and the structured program code. 2. Understand the algorithmic approach to solving problems and their writing in programming language using different data, control and structural elements. 3. Develop your own programming solution to the problem in a specific programming language and applying the basic principles of software engineering. 4. Test, analyse and fix the developed software solution to problems in the development environment.		
1.4. Course content		
Writing numbers and characters in the computer. Algorithmic approach to problem solving and complexity of algorithms. Basic language elements, lexical units, commands, program and basics of program architectures. Basic principles of software engineering. C programming language through examples: program structure, keywords, data types, constants and variables, operators, arithmetic and logical expressions, data input and output, branching and loops in the program, functions, fields and more complex data types, pointers. Working with strings. Preprocessor commands. Standard function libraries. Using standard functions: random numbers, timing, character strings. Examples of search and sort programs.		
1.5. Types of classes	☒ lectures ☐ seminars and workshops ☒ auditory exercises ☐ distance learning ☐ field work	☐ individual exercises ☐ multimedia and network ☒ laboratory exercises ☐ design exercises ☐ working with a supervisor

		☐ other _____
1.6. Comments		

1.7. Student obligations

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.8. Monitoring and assessment of student work

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.9. Assessment and evaluation of student work during classes and in the final exam

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance at lectures (L), auditory exercises (AE), laboratory exercises (LE)	2	1, 2, 3, 4	Lectures (L), laboratory exercises (LE)	Attendance tracking. Minimum attendance percentage: 70%.	3	6
Problem-solving exercises	1	2, 3, 4	Revision exams (written exam)	Evaluation	15	30
Preparation for laboratory exercises (LE), results analysis, report writing	1	1, 3, 4	Laboratory exercises (LE)	Preparation for LE, LE supervision, LE report assessment	12	24
Preparing for an oral exam and oral exam	1	1, 2, 3	Oral exam	Evaluation	20	40

1.10. Obligatory literature (at the time of submitting a study programme proposal)

1. J. Šribar, B. Motik, Demistificirani C++, 3. dopunjeno izdanje, 2010.
2. S.G. Kochan, Programming in C (Developer's Library), 4th Ed., Addison-Wesley Professional, 2014.
3. D. Kusalić, Napredno programiranje i algoritmi u C-u i C++-u, Element, 2014.

1.11. Recommended additional literature (at the time of submitting a study programme proposal)

1. D. Patterson, J. Hennessy, Computer Organization and Design: The Hardware / Software Interface (5th. Edition), Morgan Kaufmann Publ., 2013.
2. A.S. Tanenbaum, T. Austin, Structured Computer Organization (6th Ed.), Pearson, 2012.
3. R. Sedgewick, K. Wayne, Algorithms (4th Ed.), Addison-Wesley Professional, 2011.
4. B. Stroustrup, Programming: Principles and Practice Using C++ (2nd Ed.), Addison-Wesley Professional, 2014.

1.12. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*
1. J. Šribar, B. Motik, Demistificirani C++, 3. dopunjeno izdanje, 2010.	20	260
2. S.G. Kochan, Programming in C (Developer's Library), 4th Ed., Addison-Wesley Professional, 2014.	5	260

3. D. Kusalić, Napredno programiranje i algoritmi u C-u i C++-u, Element, 2014.	10	260
1.13. Quality assurance methods ensuring the acquisition of knowledge, skills and competences		
Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).		

General information		
Lead instructor(s)	Tomislav Rudec, PhD, Assistant Professor	
Course title	Mathematical Basics of Computing	
Study programme	Undergraduate university study programme in Computer Engineering	
Course status	Compulsory	
Year of study	1	
ECTS credits and teaching methods	ECTS credits	5
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	(45+(0+15+0)+0)

1. COURSE DESCRIPTION

1.1. Course objectives

The objective of the course is to introduce students to the basics of mathematical logic, mathematical language, set theory, graph theory and networks, with mathematical structures and complexity of algorithms with the aim of applying this knowledge in solving complex computational problem with an algorithmic approach.

1.2. Course enrolment requirements

Requirements for enrolment in the study programme fulfilled.

1.3. Expected learning outcomes

1. Understand the principles of mathematical logic, set theory, graph theory and networks.
2. Understand the mathematical structure and language when studying these structures.
3. Create an algorithm for a given problem using mathematical logic, set theory and graph and network theory.
4. Create algorithms using laws of basic mathematical structures.
5. Analyse the complexity of developed algorithms.
6. Apply the results of algorithm complexity analysis to improve algorithmic solutions.

1.4. Course content

Basics of mathematical language - theorems and proofs. Basics of mathematical logic. Traditional logic. Propositional calculus. Alphabet of propositional calculus. Semantics and Syntax. Connectives and implementation in programming languages. Basics of the set theory. Element, subset, partitive set, set operations. Empty set. Basic algebraic structures. Basics of the graph theory. Types of graphs. Methods of assignments. Paths, cycles, trees and walks in graphs. Problems in the graph theory. Basics of the network theory. Definitions and examples. Problems in the network theory and algorithms for solving. Search and sorting. The complexity of problem solving algorithms for the mentioned computing areas.

1.5. Types of classes	☒ lectures ☐ seminars and workshops ☒ auditory exercises ☐ distance learning ☐ field work	☒ individual exercises ☐ multimedia and network ☒ laboratory exercises ☐ design exercises ☐ working with a supervisor ☐ other _____

1.6. Comments	

1.7. Student obligations

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.8. Monitoring and assessment of student work

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.9. Assessment and evaluation of student work during classes and in the final exam

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance at lectures (L), laboratory exercises (LE),	1.5	1, 2, 3, 4, 5, 6	Lectures (L), laboratory exercises (LE), auditory excercises	Attendance tracking. Minimum attendance percentage: 70%.	3	5
Preparation for laboratory exercises (LE), solving laboratory exercises problems	1	3, 4, 5, 6	Laboratory exercises (LE)	Preparation for LE, LE supervision, LE report assessment	15	30
Preparing for an oral exam and oral exam	1.5	1, 2, 5, 6	Oral exam	Evaluation	17.5	35
Solving the tasks of the written exam	1	2, 3, 4	Written exam	Evaluation	15	30

1.10. Obligatory literature (at the time of submitting a study programme proposal)

1. D. Veljan, Kombinatorna i diskretna matematika, Algoritam, Zagreb, 2001.
2. O. Levin, Discrete Mathematics: An Open Introduction (2nd. Ed.), CreateSpace Independent Publishing Platform, 2016.
3. S. Epp, Discrete Mathematics with Applications (4th Ed.), Cengage Learning, 2010.

1.11. Recommended additional literature (at the time of submitting a study programme proposal)

1. M.W. Baldoni, C. Ciliberto, G.M.P. Cattane, Elementary Number Theory, Cryptography and Codes, Springer, 2009.
2. S.S. Skiena, The Algorithm Design Manual (2nd Ed.), Springer, 2009.
3. R. Graham, D.E. Knuth, O. Patashnik, Concrete Mathematics (2nd Ed.), Addison-Wesley, 2004.

1.12. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*
1. . D. Veljan, Kombinatorna i diskretna matematika, Algoritam, Zagreb, 2001.	1	100
2. O. Levin, Discrete Mathematics: An Open Introduction (2nd. Ed.), CreateSpace Independent Publishing Platform, 2016.	2	100
3. S. Epp, Discrete Mathematics with Applications (4th Ed.), Cengage Learning, 2010.	1	100

1.13. Quality assurance methods ensuring the acquisition of knowledge, skills and competences

Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).

General information

Lead instructor(s)	Krešimir Nenadić, PhD, Associate Professor	
Course title	Programming II	
Study programme	Undergraduate university study programme in Computer Engineering, elective modules: Computer Engineering and Software Engineering	
Course status	Compulsory	
Year of study	1	
ECTS credits and teaching methods	ECTS credits	5
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	L + AE + LE 30 + 0 + 30

1. COURSE DESCRIPTION

1.1. Course objectives

The goal of the course is, through the acquisition of theoretical knowledge and solving tasks, to train students to apply procedural programming languages in practice.

1.2. Course enrolment requirements

There are no special requirements for enrolling in the course

1.3. Expected learning outcomes

1. compare and/or explain by example complex data types, pointers, functions and file types
2. choose or design a suitable algorithm for solving problems using different data and structural elements
3. propose an appropriate data structure and efficient use of memory in solving a programming task
4. develop your own programming solution to a given simple problem

1.4. Course content

Definition, declaration. Data type conversion. Reach and durability. Qualifiers. Complex data types: fields, structures and unions. Data alignment and structure packing. Pointers: relation to fields, pointer arithmetic. Memory management. Exchange of parameters by value and address. Text and binary files, sequential and direct access. Organizing program code into multiple files. The process of translating the program code. Application of the C programming language on different computer platforms. Code portability.

1.5. Types of classes	☒ lectures ☐ seminars and workshops ☐ auditory exercises ☐ distance learning ☐ field work	☐ individual exercises ☐ multimedia and network ☒ laboratory exercises ☐ design exercises ☐ working with a supervisor ☐ other _____
1.6. Comments		

1.7. Student obligations

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.8. Monitoring and assessment of student work

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.9. Assessment and evaluation of student work during classes and in the final exam

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance at lectures (L), auditory exercises (AE), laboratory exercises (LE), design exercises (DE)	2	1	Lectures (L), laboratory exercises (LE), design exercises (DE)	Attendance tracking. Minimum attendance percentage: 70%.	0	10
Problem-solving exercises	1	5, 6	Revision exams (written exam)	Evaluation	10	20
Preparation for laboratory exercises (LE), results analysis, report writing	1	1, 2, 3, 5	Laboratory exercises (LE)	Preparation for LE, LE supervision, LE report assessment	10	20
Preparing for an oral exam and oral exam	1	1, 2, 3, 4, 5, 6	Oral exam	Evaluation	25	50

1.10. Obligatory literature (at the time of submitting a study programme proposal)

1. Šribar, J; .Motik B. Demistificirani C++, 3. dopunjeno izdanje
2. Motik, Šribar Demistificirani C++ (2. izd.)

1.11. Recommended additional literature (at the time of submitting a study programme proposal)

1. Kernighan, Ritchie The C Programming Language
2. D. E. Knuth The Art of Computer Programming, Vol. 2., Seminumerical Algorithms
3. de Chazal, E. English for Academic Purposes

1.12. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*

1.13. Quality assurance methods ensuring the acquisition of knowledge, skills and competences

Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).

General information		
Lead instructor(s)	Marina Skender, PhD, Assistant Professor	
Course title	Physics	
Study programme	Undergraduate university study programme in Computer Engineering, elective module: Computer Engineering	
Course status	Compulsory	
Year of study	1	
ECTS credits and teaching methods	ECTS credits	6
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	(45 + 30 + 15 + 0 + 0)

1. COURSE DESCRIPTION

1.1. Course objectives

The objective is to present and explain to students the fundamental concepts and laws of classical and modern physics in the field of mechanics, including fluid mechanics, heat and thermodynamics, and mechanical and electromagnetic oscillations and waves.
Additionally, the structure of matter will be discussed, as it provides an explanation for a multitude of natural phenomena and processes.
Next objective is to demonstrate to students the methodology for solving physical problems, which entails establishing connections between fundamental physical (and mathematical) knowledge and skills, and the significance of discussing the obtained solution.
The utilisation of computer simulations of select physical phenomena, coupled with the implementation of demonstration or group experiments, serves to illustrate the significance of experimental work, the interpretation of measurement outcomes, and the differentiation between theoretical and experimental results within the domain of physics.
This approach facilitates the training of students in the perception of physical content, thereby preparing them for the upgrade of knowledge in engineering disciplines and the pursuit of education in modern science and technology.

1.2. Course enrolment requirements

Requirements for enrolment in the study programme fulfilled.

1.3. Expected learning outcomes

It is expected that the student will be able to:
1. define kinematic and dynamic physical quantities when describing the motion of a single particle, many particles, a solid body, and a fluid
2. state Newton's laws of mechanics and the laws of conservation of energy, momentum and angular momentum
3. define thermodynamic physical quantities and explain thermal laws based on the kinetic-molecular theory
4. discuss the relations between the physical quantities and be able to define their mathematical and graphical representation
5. apply fundamental physical concepts and laws in the field of mechanics of particles and rigid bodies, fluid mechanics, oscillations and waves, heat and thermodynamics as well as in electromagnetic and modern physics
6. analyse and interpret the measurement results obtained in a laboratory and verify the validity of physical laws in the field of mechanics, fluid mechanics, heat and thermodynamics, oscillations and waves, optics, and modern physics
7. compare and contrast the theoretical results with the results of experimental research in physics

1.4. Course content

Introduction to physics (Physical quantities and measurement units. Mathematical concepts in physics). Kinematics of a particle. Forces and force fields in nature (Gravity, inertial and non-inertial systems). Newton's laws and application. solving the equations of body motion. Work, power, energy. Laws of moment and energy conservation (Collisions of two bodies). Mechanics of many particles - rigid bodies and fluids. Heat and thermodynamics (Kinetic-molecular theory of heat, Laws of thermodynamics, Heat transfer). Mechanical oscillations and waves (sound waves). Electromagnetic waves (laws of electromagnetism - Maxwell's equations; electromagnetic field, creation and propagation of electromagnetic waves). Spectrum of electromagnetic radiation. Geometrical and wave optics. Wave-particle nature of electromagnetic radiation and matter. The quantum nature of light. Atomic structure (atomic spectra).

1.5. Types of classes	☒ lectures ☐ seminars and workshops ☒ auditory exercises ☒ distance learning ☐ field work	☐ individual exercises ☐ multimedia and network ☒ laboratory exercises ☐ design exercises ☐ working with a supervisor ☐ other _____
1.6. Comments		

1.7. Student obligations

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.8. Monitoring and assessment of student work

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.9. Assessment and evaluation of student work during classes and in the final exam

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance at lectures (L), auditory exercises (AE), laboratory exercises (LE), design exercises (DE)	2, 5	1, 2, 3, 4, 5, 6, 7	Lectures (L), laboratory exercises (LE), design exercises (DE)	Attendance tracking. Minimum attendance percentage: 70%.	0	0
Problem-solving exercises	1		Revision exams (written exam)	Evaluation	20	40
Preparation for laboratory exercises (LE), results analysis, report writing	0,5		Laboratory exercises (LE)	Preparation for LE, LE supervision, LE report assessment	5	10
Preparing for an oral exam and oral exam	1		Oral exam	Evaluation	25	50

1.10. Obligatory literature (at the time of submitting a study programme proposal)

1. Kulišić, Petar. Mehanika i toplina.Zagreb: Školska knjiga, 2011.

2. Young, H.D; Freedman, R.A.; Ford, A. Lewis. Sears and Zemansky's University Physics with Modern Physics, 12th edition. Pearson Education, 2008.
3. 3. V. Henč-Bartolić, P. Kulišić, Valovi i optika, Šk. knjiga, Zagreb (1991.)
4. Kulišić, Petar; Lopac, Vjera, Elektromagnetske pojave i struktura tvari, Školska knjiga, 2003.
5. Ž. Mioković, Fizika 1, Priručnik za laboratorijske vježbe, Sveučilište „J.J. Strossmayera“ u Osijeku, ETF, 2013.

1.11. Recommended additional literature (at the time of submitting a study programme proposal)

1. P. Kulišić i dr., Riješeni zadaci iz mehanike i topline, Šk. knjiga, Zagreb (1985.)
2. V. Henč-Bartolić, P. Kulišić, Riješeni zadaci iz valova i optike, Šk. knjiga, Zagreb (1991.)
3. Lopac, Vjera, i dr. , Riješeni zadaci iz elektromagnetskih pojava i strukture tvari, Školska knjiga, 2003.
4. N. Cindro, Fizika 1, mehanika, valovi i toplina, Šk. knjiga, Zagreb (1991.)
5. Berkeley Physics Course, vol, 1, 4. Tehnička knjiga, Zagreb (1983.)

1.12. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*
1. Kulišić, Petar. Mehanika i toplina.Zagreb: Školska knjiga, 2011.	16	100
2. Young, H.D; Freedman, R.A.; Ford, A. Lewis. Sears and Zemansky's University Physics with Modern Physics, 12th edition. Pearson Education, 2008.	1	100
3. V. Henč-Bartolić, P. Kulišić, Valovi i optika, Šk. knjiga, Zagreb (1991.)	19	100
4. Kulišić, Petar; Lopac, Vjera, Elektromagnetske pojave i struktura tvari, Školska knjiga, 2003.	12	100
5. Ž. Mioković, Fizika 1, Priručnik za laboratorijske vježbe, Sveučilište „J.J. Strossmayera“ u Osijeku, ETF, 2013.	30	100

1.13. Quality assurance methods ensuring the acquisition of knowledge, skills and competences

Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).

General information		
Lead instructor(s)	Željko Hocenski, PhD, Full Professor with Tenure	
Course title	Digital Electronics	
Study programme	Undergraduate university study programme in Computer Engineering	
Course status	Compulsory	
Year of study	1	
ECTS credits and teaching methods	ECTS credits	6
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	30+(15+15+15)+0

1. COURSE DESCRIPTION		
1.1. Course objectives		
1.2. Course enrolment requirements		
1.3. Expected learning outcomes		
1. explain the terms and categories of digital electronics 2. determine and explain the functions of logic circuits 3. apply appropriate logic circuits and calculate their parameters 4. assemble a more complex logic circuits system and test it 5. design a digital system in VHDL based on the given requirements 6. test the parameters of the digital system and explain its function 7. demonstrate the functionality of the designed digital system		
1.4. Course content		
Digital circuit and system features. Historical development. Number systems and conversions. Digital arithmetic. Codes. Error detection and correction codes. Logic functions. Logic function simplification. Logic integrated circuits. Characteristics of TTL, CMOS and modern technologies. Combinatorial circuits: analysis and synthesis. Integrated logic circuit examples. Sequential circuits. State diagram. Flip-flop types and realisation. Asynchronous (ripple) and synchronous counters. Synchronous counters design. Register types. Memories. Semiconductor memories: bipolar and MOS. Static and dynamic RAM memories. ROM, PROM, EPROM, EEPROM memories. Memory programming. Programmable logic circuits: features, programming and applications. Simple displays. A/D and D/A conversion circuits. Digital design software tools. Equipment for the development and testing of digital circuits. Digital circuit reliability.		
1.5. Types of classes	☒ lectures ☐ seminars and workshops ☒ auditory exercises ☐ distance learning ☐ field work	☐ individual exercises ☐ multimedia and network ☒ laboratory exercises ☒ design exercises ☐ working with a supervisor ☐ other _____
1.6. Comments		

1.7. Student obligations

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.8. Monitoring and assessment of student work

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.9. Assessment and evaluation of student work during classes and in the final exam

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance at lectures (L), auditory exercises (AE), laboratory exercises (LE), design exercises (DE)	2,5	1, 2, 3, 4, 5, 6, 7	Lectures (L), laboratory exercises (LE), design exercises (DE)	Attendance tracking. Minimum attendance percentage: 70%.	3	5
Problem-solving exercises	1	3, 4, 5	Revision exams (written exam)	Evaluation	15	30
Preparation for laboratory exercises (LE), results analysis, report writing	1	2, 3, 4, 5, 6	Laboratory exercises (LE)	Preparation for LE, LE supervision, LE report assessment	8	25
Preparing for an oral exam and oral exam	0,5	3, 4, 5, 6, 7	Oral exam	Evaluation	7	10

1.10. Obligatory literature (at the time of submitting a study programme proposal)

1. Peruško, U.; Glavinić, V. Digitalni sustavi Školska knjiga, 2005.
2. Hocenski, Ž.; .Martinović, G. Digitalna elektronika - Zbirka zadataka ETF Osijek, 2010.
3. Pedroni, Volnei A. Circuit Design and Simulation with VHDL MIT Press, 2010.
4. U. Peruško Digitalna elektronika Školska knjiga, Zagreb, 1991.
5. Ž. Hocenski, G. Martinović, M. Antunović Digitalna elektronika - Priručnik za laboratorijske vježbe ETF Osijek, 2003

1.11. Recommended additional literature (at the time of submitting a study programme proposal)

1. D.C.Green Digital electronics Addison Wesley Longman, 1999.
2. J.M.Yarbrough Digital Logic, Applications and Design West Publishing Company, 1997.
3. R.L.Tokheim Digital Principles McGraw-Hill, 1988.
4. J.F.Wakerly Digital design, Principle and Practices Prentice Hall, 1994

1.12. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*

1.13. Quality assurance methods ensuring the acquisition of knowledge, skills and competences

Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).

General information		
Lead instructor(s)	Dominika Crnjac Milić, Full Professor	
Course title	Business Economics	
Study programme	Undergraduate university study programme in Computer Engineering, elective modules: Computer Engineering and Software Engineering	
Course status	Compulsory	
Year of study	3	
ECTS credits and teaching methods	ECTS credits	5
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	30+(15+0+0)+0

1. COURSE DESCRIPTION

1.1. Course objectives

To provide students with basic economic knowledge in the field of microeconomics.
To give students an understanding of how companies work, the benefits and problems of creating products and services and how they reach the customer or client.
Demonstrate to students the economic aspects of business performance of economic entities under market economy conditions.
Encourage students to adopt an entrepreneurial mindset.

1.2. Course enrolment requirements

Requirements for enrolment in the second year of study fulfilled.

1.3. Expected learning outcomes

1. use basic terms related to microeconomics
2. define the concept of production and know how to interpret the production function
3. define the term depreciation, calculate it using one of the methods for calculating depreciation and interpret the obtained result
4. define the term interest and interest account, and choose the method of calculation in the set tasks
5. explain the concept of costs and types of costs
6. explain the concept of investment calculation, apply certain methods of assessing the profitability of the investment and interpret the obtained results

1.4. Subject content

Introduction to business economics, Theory of production, Types of production costs, Cost dynamics, Demand and supply, Consumer behavior, Cost price calculations, Investment calculations, Business calculations, Business performance measures (economic measures of business performance, methods of determining business performance), Resource economics, Procurement, Logistics, Business plan, Business information systems, Entrepreneurship and entrepreneur (economic and social prerequisites for the establishment and successful operation of a company)

1.5. Types of classes	☒ lectures ☐ seminars and workshops ☒ auditory exercises ☒ distance learning ☐ field work	☐ individual exercises ☐ multimedia and network ☐ laboratory exercises ☐ design exercises ☐ working with a supervisor ☐ other _____

1.6. Comments	

1.7. Student obligations

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.8. Monitoring and assessment of student work

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.9. Assessment and evaluation of student work during classes and in the final exam

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance at lectures (L), auditory exercises (AE)	1	1,2,3,4,5,6	Lectures (L), auditory exercises (AE)	Attendance tracking. Minimum attendance percentage: 70%.	0	10
Solving tasks	0,6	3,4,6	Control tasks (written exam)	Checking of solved tasks	15	30
Preparation for oral exam and oral responding to questions	0,6	1,2,3,4,5,6	Oral exam	Checking the given answers	15	30
Writing a seminar of work (team work)	0.4	1	Creating a seminar paper (team work)	According to the instructions for writing the seminar paper, the content and written expression of the written form are evaluated.	0	15
Creation of a ppt presentation and oral presentation of the topic of the seminar paper	0.4	1	Creating a digital ppt presentations, and presentation of the topic seminar work	Listening to the presentation during the lesson	0	15

1.10. Obligatory literature (at the time of submitting a study programme proposal)

1. Karić, M., Ekonomika poduzeća, Ekonomski fakultet, Osijek, 2007.
2. Karić, M., Lacković, Z., Ekonomika elektrotehničkih poduzeća, Elektrotehnički fakultet u Osijeku, Osijek, 2003.
3. Samuelson P. A. , Nordhaus W. D. Ekonomija,19.izdanje, Mate d.o.o., Zagreb, 2011.

1.11. Recommended additional literature (at the time of submitting a study programme proposal)

1. Ravlić, P., Ekonomika poduzeća, Ekonomski fakultet, Zagreb, 1993.

2. A.Jelavić, P.Ravlić, A.Starčević, J.Šamanović, Ekonomika poduzeća, Ekonomski fakultet Zagreb, Sveučilište u Zagrebu, 1993

3. Pindyck, R.S., Rubinfeld, D. L., Mikroekonomija, Mate d.o.o., Zagreb, 2005.

4. Koutsoyiannis, A., Moderna Mikroekonomika, Mate d.o.o., Zagreb, 1996.

5. Gorupić, D. i D. Gorupić, Jr. (1990), Poduzeće, Informator, Zagreb, 1990.

6. Hamarić, S. i Sikavica, P., Ekonomika i organizacija poduzeća, Birotehnika, Zagreb, 1989.

7. Sikavica, P., Novak, M., Poslovna organizacija, Informator, Zagreb, 1993.

8. Karić, M., Mikroekonomika, Ekonomski fakultet, Osijek,2006.

9. Novak, B., Odlučivanje u financijskom upravljanju, Ekonomski fakultet u Osijeku, Osijek, 2002.

10. Crnković, L., Mesarić, J., Martinović, J., Organizacija i primjena računovodstva, Ekonomski fakultet u Osijeku, Osijek,2006.

11. Eraković A., Jurković M., Koprivčić Z., Mecner J., Mlikotin-Tomić D., Terek,D. Primjena zakona o trgovačkim društvima i zakona o sudskom registru, Zagreb, 1995.

12. Ž.Panian, K.Ćurko, Poslovni informacijski sustavi, Zagreb,2010.

13. P.Sikavica, F. Bahtijarević-Šiber, N. Pološki Vokić, Temelji menadžmenta, Zagreb,2008.

14. Ferenčak, I., Počela Ekonomike, Ekonomski fakultet, Osijek, 2003.

15. Štefanić, I., Inovativno poduzetništvo, Sveučilište Josipa Jurja Strossmayera u Osijeku, Osijek, 2015.

16. T.Ivančević, K.Perec, Osnove ekonomije, Visoka poslovna škola Zagreb, Zagreb, 2017.

http://www.vpsz.hr/media/files/Osnove_ekonomije.pdf

1.12. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*
Karić, M., Lacković, Z., Ekonomika elektrotehničkih poduzeća, Elektrotehnički fakultet u Osijeku, Osijek, 2003.	10	80
Samuelson P. A. , Nordhaus W. D. Ekonomija,19.izdanje, Mate d.o.o., Zagreb, 2011	1	80
Karić, M., Ekonomika poduzeća, Ekonomski fakultet, Osijek, 2007.	1	80

1.13. Quality assurance methods ensuring the acquisition of knowledge, skills and competences

Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).

General information		
Lead instructor(s)	Tomislav Matić, PhD, Associate Professor Davor Vinko, PhD, Assistant Professor	
Course title	Electronics I	
Study programme	Undergraduate study programme in Computer Engineering	
Course status	Compulsory	
Year of study	1	
ECTS credits and teaching methods	ECTS credits	6
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	45+(30+15+0)+0

1. COURSE DESCRIPTION		
1.1. Course objectives		
-		
1.2. Course enrolment requirements		
-		
1.3. Expected learning outcomes		
1. define and understand the physical properties of semiconductor materials, generation of free charge carriers, and current conduction in semiconductors 2. evaluate static and dynamic properties of the PN compound and the metal-semiconductor compound 3. define the principles of diode, bipolar and unipolar transistors operation based on current voltage characteristics and dynamic models 4. evaluate the operation of basic semiconductor power switches 5. evaluate the basic semiconductor optoelectronic components 6. design basic amplifiers with bipolar and unipolar transistors 7. evaluate the operation principles of amplifiers and comparators 8. design basic logic circuits		
1.4. Course content		
Basics of semiconductor physics. Charge carrier generation. Current flow mechanisms in semiconductor. PN and metal-semiconductor junctions: static and dynamic characteristics. Solid-state diodes: static and dynamic characteristics, types of solid-state diodes. Bipolar junction transistor (BT): working principle, static IU-characteristics, dynamic models, frequency dependence of parameters. Junction and MOS FET: working principle, static IU- characteristics, dynamic models, frequency dependence of parameters. Thyristors: working principle, classification. Basic bipolar and unipolar transistor amplifiers. Power amplifiers: A, AB and B-class. Operational amplifier. Comparators. Basic logic circuits.		
1.5. Types of classes	☒ lectures ☐ seminars and workshops ☒ auditory exercises ☐ distance learning ☐ field work	☐ individual exercises ☐ multimedia and network ☒ laboratory exercises ☐ design exercises ☐ working with a supervisor ☐ other _____

1.6. Comments	

1.7. Student obligations

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.8. Monitoring and assessment of student work

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.9. Assessment and evaluation of student work during classes and in the final exam

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance at lectures (L), auditory exercises (AE), laboratory exercises (LE)	0.8	1,3,5,7,8	Lectures (L), auditory exercises (AE), laboratory exercises (LE)	Attendance tracking. Minimum attendance percentage: 70%.	0	0
Problem-solving exercises	2.2	2,3,4,6	Revision exams (written exam)	Evaluation	20	40
Preparation for laboratory exercises (LE), results analysis, report writing	1	2,3,4	Laboratory exercises (LE)	Preparation for LE, LE supervision, LE report assessment	10	20
Preparing for an oral exam and oral exam	2	1,2,3,4,5,6,7,8	Oral exam	Evaluation	20	40

1.10. Obligatory literature (at the time of submitting a study programme proposal)

1. Švedek, T. Poluvodičke komponente i osnovni sklopovi, Svezak I, Poluvodičke komponente, Graphis, 2001., Zagreb
2. P. Biljanović, Elektronički sklopovi, Školska knjiga, Zagreb, 1989.

1.11. Recommended additional literature (at the time of submitting a study programme proposal)

1. A.S. Sedra, K.C.Smith, Microelectronic Circuits, 3. Edition, Saunders College Publishing, New York, 1991.

1.12. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*

1.13. Quality assurance methods ensuring the acquisition of knowledge, skills and competences

Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).

General information		
Lead instructor(s)	Ivica Lukić, PhD, Associate Professor	
Course title	Databases	
Study programme	Undergraduate university study programme in Computer Engineering, elective modules: Computer Engineering and Software Engineering	
Course status	Compulsory	
Year of study	2	
ECTS credits and teaching methods	ECTS credits	6
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	45+15+15+0+0

1. COURSE DESCRIPTION		
1.1. Course objectives		
The students will be presented the design of a business system from the real world to the database, using all phases of database development. Each phase of database development will be explained in detail, outlining the expected outcomes and specific challenges. Students will be shown data modelling using different models and the transformation from an entity-relationship model to a relational model. They will become familiar with relational algebra and SQL, acquiring skills for independently designing databases according to user requirements.		
1.2. Course enrolment requirements		
Requirements for enrolment in the study programme fulfilled		
1.3. Expected learning outcomes		
1. list the basic terms related to the database, and use the ER diagram to model the database 2. distinguish database models with an emphasis on the relational model, and build a relational database model from ER diagram 3. understand normal forms and sketch a normalized relational database schema using normal forms 4. create a database using SQL commands on different database management systems 5. evaluate and implement simple and complex SQL queries using relational algebra 6. create different solutions using SQL commands to ensure the security and integrity of the database and understand the connection between database integrity and business rules 7. organize work with transactions, create functions, stored procedures and views		
1.4. Course content		
Information system, business system model, database. Database management system. Development of information system. Development methods. Development phases. Data modelling. Conceptual data modelling. Entity-relationship models. Object models. Logical data modelling. Relational data model. Relational algebra. SQL language for working with relational databases. Integrity rules in the relational model. Data normalization. Network, hierarchical, and file models. Physical data modelling. Data management. Management functions. Computer-supported management.		
1.5. Types of classes	☒ lectures ☐ seminars and workshops ☒ auditory exercises ☐ distance learning ☐ field work	☐ individual exercises ☐ multimedia and network ☒ laboratory exercises ☐ design exercises ☐ working with a supervisor

		☐ other _____
1.6. Comments		

1.7. Student obligations

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.8. Monitoring and assessment of student work

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.9. Assessment and evaluation of student work during classes and in the final exam

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance at lectures (L), auditory exercises (AE), laboratory exercises (LE), design exercises (DE)	2.5	1, 2, 3, 4, 5, 6, 7	Lectures (L), laboratory exercises (LE), design exercises (DE)	Attendance tracking. Minimum attendance percentage: 70%.	3	5
Problem-solving exercises	2	2, 3, 4, 5	Revision exams (written exam)	Evaluation	25	50
Preparation for laboratory exercises (LE), results analysis, report writing	1	4, 5, 6, 7	Laboratory exercises (LE)	Preparation for LE, LE supervision, LE report assessment	8	15
Preparing for an oral exam and oral exam	1.5	1, 2, 3, 5	Oral exam	Evaluation	15	30

1.10. Obligatory literature (at the time of submitting a study programme proposal)

1. Hamilton, Bill. Programiranje SQL Server 2005. O'Reilly, 2006
2. Churcher, Clare. Beginning Database Design, 2nd Edition.New York, Apress, 2012.
3. D. Grundler, Primijenjeno računalstvo, Graphis, Zagreb, 2000.

1.11. Recommended additional literature (at the time of submitting a study programme proposal)

1. E. Codd, The Relational model for base Management, Addison Wesley, 1990.
2. L. Budin, Informatika za 1. razred gimnazije, Element, Zagreb, 1997.
3. J. Martin, Computer -base Organization, Prentice Hall, 1977.
4. M. Varga, Baze podataka, DRIP- Zagreb, 1994.

1.12. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*
Hamilton, Bill. Programiranje SQL Server 2005. O'Reilly, 2006	Online	90
Churcher, Clare. Beginning Database Design, 2nd Edition.New York, Apress, 2012.	Online	90
M. Varga, Baze podataka, DRIP- Zagreb, 1994.	2	90

1.13. Quality assurance methods ensuring the acquisition of knowledge, skills and competences
Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).

General information		
Lead instructor(s)	Alfonzo Baumgartner, PhD, Associate Professor	
Course title	Algorithms and Data Structures	
Study programme	Undergraduate university study programme in Computer Engineering	
Course status	Compulsory	
Year of study	2	
ECTS credits and teaching methods	ECTS credits	6
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	45+(15+15+0)+0

1. COURSE DESCRIPTION		
1.1. Course objectives		
1.2. Course enrolment requirements		
There are no special requirements for enrolling in the course.		
1.3. Expected learning outcomes		
1. describe basic terms related to algorithms and data structures 2. use basic linear and non-linear data structures: linked list, queue, stack, tree, graph 3. use known and important efficient algorithms for sorting and searching 4. write new algorithms by using a pseudocode or flow diagram 5. evaluate algorithms by using the basics of computational complexity theory		
1.4. Course content		
Algorithm, representation, computer implementation. Algorithm complexity. Errors caused by numeric data representation in a digital computer. Complex data structures: list, tree, graph; computer implementation. Searching and sorting algorithms. Random number generation by uniform, exponential and normal distribution. Generator evaluation, statistical tests. Recursive algorithms. Recursion, computer implementation, resource allocation.		
1.5. Types of classes	☒ lectures ☐ seminars and workshops ☒ auditory exercises ☐ distance learning ☐ field work	☐ individual exercises ☐ multimedia and network ☒ laboratory exercises ☐ design exercises ☐ working with a supervisor ☐ other _____
1.6. Comments		
1.7. Student obligations		
Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.		
1.8. Monitoring and assessment of student work		
Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and		

Information Technology Osijek and paragraph 1.9.

1.9. Assessment and evaluation of student work during classes and in the final exam

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance at lectures (L), auditory exercises (AE), laboratory exercises (LE), design exercises (DE)	2,5	1,4,5	Lectures (L), laboratory exercises (LE), design exercises (DE)	Attendance tracking. Minimum attendance percentage: 70%.	2	10
Problem-solving exercises	1	2,3,5	Revision exams (written exam)	Evaluation	15	30
Preparation for laboratory exercises (LE), results analysis, report writing	0,8	2,3,4	Laboratory exercises (LE)	Preparation for LE, LE supervision, LE report assessment	15	30
Preparing for an oral exam and oral exam	1,7	1,5	Oral exam	Evaluation	15	30

1.10. Obligatory literature (at the time of submitting a study programme proposal)

1. Cormen, Thomas H.; Leiserson, Charles E.; Rivest, Ronald L.; Stein, Clifford (2009) [1990]. Introduction to Algorithms (3rd ed.). MIT Press and McGraw-Hill. ISBN 0-262-03384-4.

2. D. E. Knuth, The Art of Computer Programming, Vol. 1., Fundamental Algorithms, Addison-Wesley, Reading, MA, 1997.

3. D. E. Knuth, The Art of Computer Programming, Vol. 2., Seminumerical Algorithms, Addison-Wesley, Reading, MA, 1998.

1.11. Recommended additional literature (at the time of submitting a study programme proposal)

1.12. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*

1.13. Quality assurance methods ensuring the acquisition of knowledge, skills and competences

Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).

General information		
Lead instructor(s)	Ivanka Ferčec, MA, Senior Lecturer	
Course title	English language I	
Study programme	Undergraduate university study programme in Computer Engineering	
Course status	Compulsory	
Year of study	2	
ECTS credits and teaching methods	ECTS credits	2
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	15+(15+0+0)+0

1. COURSE DESCRIPTION		
1.1. Course objectives		
-		
1.2. Course enrolment requirements		
There are no special requirements for enrolling in the course.		
1.3. Expected learning outcomes		
1. identify and describe the differences between general English and technical English based on selected texts and units 2. distinguish essential elements (keywords) in a more complex text and write shorter texts based on the given keywords 3. define and interpret professional terminology and use it to translate shorter texts 4. design and elaborate on diagrams, schemes, pictures and mathematical formulas 5. apply grammatical structures in written and oral communication 6. write a summary of the text, arguments and definitions		
1.4. Course content		
Academic English. What is engineering? Atom. Materials in electrical engineering. The electric circuit. Transistors. How transistors work. Tenses (form, use, adverbs of time). Making questions (yes-no questions, wh-questions). Adjectives and adverbs. The passive voice.		
1.5. Types of classes	☒ lectures ☐ seminars and workshops ☒ auditory exercises ☐ distance learning ☐ field work	☐ individual exercises ☐ multimedia and network ☐ laboratory exercises ☐ design exercises ☐ working with a supervisor ☐ other _____
1.6. Comments		
1.7. Student obligations		
Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.		
1.8. Monitoring and assessment of student work		

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.9. Assessment and evaluation of student work during classes and in the final exam

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance at lectures (L) and auditory exercises (AE)	0.7	1, 2, 3, 4, 5, 6	Lectures (L), auditory exercises (AE)	Attendance tracking. Minimum attendance percentage: 70%.	0	0
Problem-solving exercises	0.6	1, 2, 3, 4, 5, 6	Revision exams (written exam)	Evaluation	25	50
Preparation for the oral exam and answering questions	0.5	2, 3, 4, 5	Oral exam	Evaluation	20	40
Grammar exercises/shorter guided essays	0.1	2, 3, 4, 5, 6	Grammar exercises/shorter guided essays	Oral verification of solved tasks/grading essays	0	5
Active class participation	0.1	3, 4, 5	Active class participation in the form of explaining units, participating in and leading debates, graphical representation of units.	Active class participation evaluation/answers evaluation	0	5

1.10. Obligatory literature (at the time of submitting a study programme proposal)

1. Smith H.C.R. (2014) English for Electrical Engineering in Higher Education Studies. Reading: Garnet Publishing Ltd.
2. Bošnjak Terzić, B. Study Technical English 1, Školska knjiga, Zagreb, 2009.
3. Bartolić, Lj. Technical English in Electronics and Electrical Power Engineering, Školska knjiga, Zagreb, 1994.

1.11. Recommended additional literature (at the time of submitting a study programme proposal)

1. Murphy, R.: English Grammar in Use, CUP, Cambridge, 1995.

1.12. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*

1.13. Quality assurance methods ensuring the acquisition of knowledge, skills and competences

Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).

General information		
Lead instructor(s)	Yvonne Liermann-Zeljak, MA, Senior Lecturer Ivanka Ferčec, MA, Senior Lecturer	
Course title	English language II	
Study programme	Undergraduate university study programme in Computer Engineering	
Course status	Compulsory	
Year of study	2	
ECTS credits and teaching methods	ECTS credits	3
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	30+(15+0+0)+0

1. COURSE DESCRIPTION		
1.1. Course objectives		
-		
1.2. Course enrolment requirements		
There are no special requirements for enrolling in the course.		
1.3. Expected learning outcomes		
1. identify and describe the differences between general English and technical English based on selected texts and units 2. distinguish essential elements (keywords) in a more complex professional text as well as compose and interpret more complex professional texts 3. define and interpret professional terminology and use it to translate shorter texts 4. apply grammatical structures in written and oral communication 5. expand and adopt new communication patterns and critically reflect on a professional topic in a written and an oral form 6. present the given/selected professional topic in the given time		
1.4. Course content		
Computer users, computer architecture, peripherals: magnetic storage, optical storage, flash memory, former student, operating systems. Oral presentations. Comparing and contrasting. Function of an item. Relative clauses. Reduced relative clauses. Conditional clauses. Making questions. Question tags. Usage of sequence words.		
1.5. Types of classes	☒ lectures ☐ seminars and workshops ☒ auditory exercises ☐ distance learning ☐ field work	☐ individual exercises ☐ multimedia and network ☐ laboratory exercises ☐ design exercises ☐ working with a supervisor ☐ other _____
1.6. Comments		
1.7. Student obligations		
Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.		

1.8. Monitoring and assessment of student work

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.9. Assessment and evaluation of student work during classes and in the final exam

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance at lectures (L) and auditory exercises (AE)	1.1	1, 2, 3, 4, 5	Lectures (L), auditory exercises (AE)	Attendance tracking. Minimum attendance percentage: 70%.	0	0
Problem-solving exercises	0.8	2, 3, 4, 5	Revision exams (written exam)	Evaluation	20	40
Preparation for the oral exam and answering questions	0.6	1, 2, 3, 4, 5	Oral exam	Evaluation	15	30
Oral presentation	0.3	6	Oral presentation on the given/selected technical topic	Evaluation based on the set criteria	0	20
Homework assignments	0.1	3, 4, 5	Grammar exercises/shorter guided essays	Oral verification of solved tasks/grading essays	0	5
Active class participation	0.1	1, 2, 3, 4, 5	Active class participation in the form of explaining units, participating in and leading debates, graphical representation of units.	Active class participation evaluation/answers evaluation	0	5

1.10. Obligatory literature (at the time of submitting a study programme proposal)

1. Bošnjak Terzić, B. (2009). Study Technical English 1. Zagreb: Školska knjiga
2. Bošnjak Terzić, B. Study Technical English 2. Školska knjiga: Zagreb, 2008.
3. Glendinning, Eric H.; McEwan, J. (2006). Oxford English for Information Technology. Oxford University Press/Esteras, S.R. (2008). Infotech - English for Computer Users. Cambridge University Press
4. Campbell, S. (2009). English for the Energy Industry, Oxford: Oxford University Press (Express Series)
5. Esteras, S.R.: Infotech - English for Computer Users, Cambridge University Press, 2008.

1.11. Recommended additional literature (at the time of submitting a study programme proposal)

1. Murphy, R.: English Grammar in Use, CUP, Cambridge, 1995.

1.12. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*

1.13. Quality assurance methods ensuring the acquisition of knowledge, skills and competences
Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).

General information		
Lead instructor(s)	Yvonne Liermann-Zeljak, MA, Senior Lecturer Ivanka Ferčec, MA, Senior Lecturer	
Course title	English language III	
Study programme	Undergraduate university study programme in Computer Engineering	
Course status	Compulsory	
Year of study	2	
ECTS credits and teaching methods	ECTS credits	5
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	15+(15+0+0)+0

1. COURSE DESCRIPTION		
1.1. Course objectives		
-		
1.2. Course enrolment requirements		
There are no special requirements for enrolling in the course.		
1.3. Expected learning outcomes		
1. identify and describe the differences between general English and technical English based on selected texts and units 2. distinguish essential elements (keywords) in a more complex professional text as well as compose and interpret more complex professional texts 3. define and interpret professional terminology and use it to translate shorter texts 4. apply grammatical structures in written and oral communication 5. write formal letters 6. critically review technical texts in the written and oral form		
1.4. Course content		
Data security. Hackers. Cloud computing. Robotics. Programming. Computer and programming languages. Reported Speech. Phrasal verbs. Verb patterns. Articles		
1.5. Types of classes	☒ lectures ☐ seminars and workshops ☒ auditory exercises ☐ distance learning ☐ field work	☐ individual exercises ☐ multimedia and network ☐ laboratory exercises ☐ design exercises ☐ working with a supervisor ☐ other _____
1.6. Comments		
1.7. Student obligations		
Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.		
1.8. Monitoring and assessment of student work		

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.9. Assessment and evaluation of student work during classes and in the final exam

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance at lectures (L) and auditory exercises (AE)	0.7	1, 2, 3, 4, 5, 6	Lectures (L), auditory exercises (AE)	Attendance tracking. Minimum attendance percentage: 70%.	0	0
Problem-solving exercises	1.5	1, 2, 3, 4, 5, 6	Revision exams (written exam)	Evaluation	25	50
Preparation for the oral exam and answering questions	1.3	1, 2, 3, 4, 6	Oral exam	Evaluation	20	40
Grammar exercises/shorter guided essays	1	2, 3, 4, 5, 6	Grammar exercises/shorter guided essays	Oral verification of solved tasks/grading essays	0	5
Active class participation	0.5	1, 2, 3, 4, 6	Active class participation in the form of explaining units, participating in and leading debates, graphical representation of units.	Active class participation evaluation/answers evaluation	0	5

1.10. Obligatory literature (at the time of submitting a study programme proposal)

1. Krznarić, M. (2014). Zagreb: Tehničko veleučilište u Zagrebu, Elektrotehnički odjel.
2. Campbell, S. (2009). English for the Energy Industry, Oxford: Oxford University Press (Express Series)
3. Glendinning, Eric H.; McEwan, J. (2006). Oxford English for Information Technology. Oxford University Press
4. Esteras, S.R. (2008). Infotech - English for Computer Users. Cambridge University Press
5. Bošnjak Terzić, B.: Study Technical English 2, Školska knjiga, Zagreb, 2008.

1.11. Recommended additional literature (at the time of submitting a study programme proposal)

1. Thomson, A.J.; Martinet A.V.: A Practical English Grammar, Oxford University Press, 1986.
2. Thomson, A.J.; Martinet A.V.: A Practical English Grammar - Exercises 1, Oxford University Press, 1986.
3. Thomson, A.J.; Martinet A.V.: A Practical English Grammar - Exercises 2, Oxford University Press, 1986.
4. Ricca-McCarty, T.; Duckworth, M.: English for Telecoms and Information Technology, Oxford University Press, 2009.

1.12. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*

1.13. Quality assurance methods ensuring the acquisition of knowledge, skills and competences

Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).

General information		
Lead instructor(s)	Tomislav Mrčela, PhD, Full Professor with Tenure	
Course title	Engineering Graphics and Documentation	
Study programme	Undergraduate university study programme in Computer Engineering	
Course status	Compulsory	
Year of study	1	
ECTS credits and teaching methods	ECTS credits	4
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	30+(0+0+15)+0

1. COURSE DESCRIPTION		
1.1. Course objectives		
Training students for the design and presentation of technical documentation in the field of electrical engineering and information technology, using modern CAD software 2D and 3D tools.		
1.2. Course enrolment requirements		
Requirements for enrolment in the study programme fulfilled.		
1.3. Expected learning outcomes		
1. Define the basic concepts of graphic communication in technology 2. Create projections of simple geometric relationships of point, length, direction, figure and body 3. Create a technical drawing and draw orthogonal projections, isometry and section 4. Apply CAD tools in the creation of a project of technical documentation in the field of electrical engineering and information technology 5. Define and apply the basic methods of 3D CAD modeling with the connection of additive manufacturing (3D printing of simple objects from the field of electrical engineering and information technology)		
1.4. Course content		
Basics of technical drawing and geometric construction. Graphic communication in technical applications. Orthogonal and axonometric projections, body sections, types of lines, dimensioning, and standards and rules for creating technical documentation. Graphical interpretation in space and plane. Isometry. Meaning and possibilities of graphic communication in electrical engineering. Symbols of basic electrotechnical, electronic and electromechanical elements and assemblies. Types, creation and use of schemes in the electrical engineering profession. Block diagram. Action diagrams, circuit diagrams, connection diagrams, connection plan. Logic circuit diagrams and drawing methods. Connection schemes. Text documentation. Technical description, instructions for use. Description of components and methods of use of the CAD system. Use of CAE system for managing electrical projects and additional documentation. Introduction to documenting electronic devices (assemblies, plants) using CAD software. Basics of construction and creation of documentation using computers. Work on the AutoCAD program. Marking of elements according to IEC regulations. Basic 3D CAD modeling: sketch-based modeling, modeling operations, feature-based modeling, creating 2D drawings from simple 3D parts, links to additive manufacturing (3D printing).		
1.5. Types of classes	☒ lectures ☐ seminars and workshops ☐ auditory exercises ☒ distance learning ☐ field work	☐ individual exercises ☐ multimedia and network ☐ laboratory exercises ☒ design exercises ☐ working with a supervisor

		☐ other _____
1.6. Comments		

1.7. Student obligations

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.8. Monitoring and assessment of student work

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.9. Assessment and evaluation of student work during classes and in the final exam

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance at Lectures (L), Design exercises (DE)	1.5	1,2,3,4,5	Lectures (L), Design exercises (DE)	Attendance tracking. Minimum attendance percentage: 70%.	2	5
Preparation for the oral exam and answering questions orally	0.5	1,2,3,4,5	Oral exam	Evaluation	18	35
Solving the problem set on (DE)	0.9	1,2,3,4,5	Design exercises (DE)	Evaluation	12	20
Visual drawings	0.4	3	Visual drawings	Direct observation	0	10
Homework	0.4	4	Visual drawings	Direct observation	0	20
Preparing for an oral exam and oral exam	0.3	3,5	Written exam	Checking drawings	0	10

1.10. Obligatory literature (at the time of submitting a study programme proposal)

1. M. Kljajin, M. Opalić: Inženjerska grafika, Strojarski fakultet u Slavonskom Brodu, Slavonski Brod, 2016.
2. Padovan, Lukša: Inženjerska grafika i dokumentiranje, Graphis d.o.o. Zagreb, Zagreb, 2004.
3. M. Opalić, M. Kljajin, S. Sebastijanović: Tehničko crtanje, Zrinski d.d., Čakovec 2003.
4. Omura, George Mastering AutoCAD 2016 and AutoCAD LT 2016.

1.11. Recommended additional literature (at the time of submitting a study programme proposal)

1. David E. Goetsch, Raymond L. Rickman: Technical drawing for engineering communication 7 th Edition, 2016.
2. Elise Moss: Autodesk AutoCAD 2022 Fundamentals, SDC Publications, 2021.
3. Bernd Gischel, EPLAN Electric P8 Reference Handbook, Carl Hanser Verlag GmbH Co KG. 2015.
4. J. H. Earle: Graphics for Engineers Addison-Wesley Publishing Company, New York, 1999.
5. F. E. Giesecke, A. Mitchell, H.C. Spencer, I.L. Hill, J.T. Dygton: Technical Drawing Machimillan Publishing Company, New York, 1986.

1.12. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*
M. Kljajin, M. Opalić: Inženjerska grafika, Strojarski fakultet u Slavonskom Brodu, Slavonski Brod, 2016.	10	140

Padovan, Lukša: Inženjerska grafika i dokumentiranje, Graphis d.o.o. Zagreb, Zagreb, 2004.	10	140
M. Opalić, M. Kljajin, S. Sebastijanović: Tehničko crtanje, Zrinski d.d., Čakovec 2003.	10	140
Omura, George Mastering AutoCAD 2016 and AutoCAD LT 2016.	10	140
1.13. Quality assurance methods ensuring the acquisition of knowledge, skills and competences		
Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).		

General information		
Lead instructor(s)	Krešimir Grgić, PhD, Assistant Professor Drago Žagar, PhD, Full Professor with Tenure	
Course title	Communication Networks	
Study programme	Undergraduate university study programme in Computer Engineering	
Course status	Compulsory	
Year of study	2	
ECTS credits and teaching methods	ECTS credits	6
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	45+(15+15+0)+0

1. COURSE DESCRIPTION		
1.1. Course objectives		
-		
1.2. Course enrolment requirements		
-		
1.3. Expected learning outcomes		
1. analyze and differentiate different types of communication networks 2. distinguish between the physical and logical structure of modern wired and wireless communication networks 3. evaluate the protocol stack based on OSI and TCP/IP reference models in modern communication networks 4. compare and evaluate the properties, characteristics and implementation method of control, routing and communication protocols on the Internet 5. evaluate basic security requirements and quality of service requirements in modern communication networks 6. propose and apply software tools for understanding and analyzing the operation of communication protocols		
1.4. Course content		
Defining the communication network. Effectiveness of communication. Information and traffic characteristics of the network. Capacities and flows in the network. Communication network model. Design parameters of the network. Application of communication networks. Telecommunication network. Integrated digital communication network. Intelligent network. Signaling in the network. Physical structure of networks. Logical structure of networks. OSI reference model. TCP/IP reference model. Transmission media. Wireless communication. Mobile networks. Local networks. Industrial LANs and protocols. Telemetry networks and technologies. Ad Hoc networks. Internet network architecture. Network routing. Examples of communication networks. Network services. Quality of service QoS. Network security. Standardization of networks.		
1.5. Types of classes	☒ lectures ☐ seminars and workshops ☒ auditory exercises ☐ distance learning ☐ field work	☐ individual exercises ☐ multimedia and network ☒ laboratory exercises ☐ design exercises ☐ working with a supervisor ☐ other _____

1.6. Comments	

1.7. Student obligations

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.8. Monitoring and assessment of student work

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.9. Assessment and evaluation of student work during classes and in the final exam

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance at lectures (L), auditory exercises (AE), laboratory exercises (LE)	1.7	1, 2, 3, 4, 5, 6	Lectures (L), auditory exercises (AE), laboratory exercises (LE)	Attendance tracking. Minimum attendance percentage: 70%.	1	4
Problem-solving exercises	1.2	2, 4, 5	Revision exams (written exam)	Evaluation	16	32
Preparation for laboratory exercises (LE), results analysis, report writing	1.3	2, 4, 6	Laboratory exercises (LE)	Preparation for LE, LE supervision, LE report assessment	12	24
Preparing for an oral exam and oral exam	1.5	1, 2, 3, 4, 5	Oral exam	Evaluation	15	30
Consultative	0.3	2, 3, 4	Consultative	Evaluation	6	10

1.10. Obligatory literature (at the time of submitting a study programme proposal)

1. Bažant, A. et al.: Osnovne arhitekture mreža. Zagreb: Element, 2014.
2. Tanenbaum, A.S. Wetherall, D.J. Computer Networks (5th edition). Boston: Prentice Hall, 2011.
3. V. Sinković, Informacijske mreže, Školska knjiga Zagreb, 1994.

1.11. Recommended additional literature (at the time of submitting a study programme proposal)

1.12. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*

1.13. Quality assurance methods ensuring the acquisition of knowledge, skills and competences

Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).

General information		
Lead instructor(s)	Jerko Glavaš, PhD, Associate Professor	
Course title	Communication Skills	
Study programme	Undergraduate university study programme in Computer Engineering	
Course status	Compulsory	
Year of study	3	
ECTS credits and teaching methods	ECTS credits	5
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	30+(15+0+0)+0

2. COURSE DESCRIPTION		
1.14. Course objectives		
-		
1.15. Course enrolment requirements		
-		
1.16. Expected learning outcomes		
1. Identify the basics of the communication process. 2. Demonstrate the forms and role of non-verbal communication. 3. Develop effective message structuring in public and written communication. 4. Combine listening and questioning skills. 5. Establish presentation and group communication skills. 6. Create a communication system using information and communication technologies.		
1.17. Course content		
The concept and processes of communication. Verbal and non-verbal communication. Principles of effective communication. Listening and questioning skills. Assertive communication. Public speaking. Presentation skills. Teamwork. Group communication. Conflict resolution. Negotiation skills. Meeting management. Written communication. Business etiquette and protocol. Business ethics.		
1.18. Types of classes	☒ lectures ☐ seminars and workshops ☒ auditory exercises ☐ distance learning ☐ field work	☐ individual exercises ☐ multimedia and network ☐ laboratory exercises ☐ design exercises ☐ working with a supervisor ☐ other _____
1.19. Comments		
1.20. Student obligations		
Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.		
1.21. Monitoring and assessment of student work		

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.22. Assessment and evaluation of student work during classes and in the final exam

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance at lectures (L), auditory exercises (AE), laboratory exercises (LE), design exercises (DE)	1.5	1,2,3,4,5, 6	Lectures (L), laboratory exercises (LE), design exercises (CE)	Attendance tracking. Minimum attendance percentage: 70%.	0	10
Problem-solving exercises	1.3	2,3,4,5,6	Revision exams (written exam)	Evaluation	20	40
Preparing for an oral exam and oral exam	1.2	1,2,3,4,5, 6	Oral exam	Evaluation	15	30
Preparation of an introductory presentation during exercises.	1	2,3,4,5,6	Preparation of an introductory presentation during exercises.	Delivering presentations and participating in the exercises.	0	20

1.23. Obligatory literature (at the time of submitting a study programme proposal)

1. BOVEE, Courtland L.; THILL, John V. Suvremena poslovna komunikacija. Zagreb: Mate doo, 2012.
2. Guffey, Mary Ellen; Dana Loewy. Business communication: Process and product. Cengage Learning, 2010.
3. Borg, J., Govor tijela, Veble commerce, Zagreb, 2009.
4. Gottesman, D., Mauro, B., Umijeće javnog nastupa, Naklada Jesenski i Turk, Zagreb, 2006.

1.24. Recommended additional literature (at the time of submitting a study programme proposal)

1. M. Plenković: Komunikologija masovnih medija, Barbat, Zagreb, 1993.
2. Thun, F.S.von, Kako međusobno razgovaramo, Smetnje i razjašnjenja, Erudita, Zagreb, 2006.
3. F. Vreg: Humana komunikologija, HKD i Nonacom, Zagreb 1998.
4. Vodopija, Š. Opća i poslovna komunikacija, Naknada Žagar, Rijeka, 2006.
5. Rouse J.R., Rouse, S., Poslovne komunikacije, Masmedia, Zageb, 2005.
6. Pease, A. & B., Body Language, Orion Book, London, 2004.
7. Fox, R. Poslovna komunikacija, Hrvatska sveučilišna naknada, Zagreb, 2006.
8. Pease A. & B., Komunikacija za sva vremena, Lisac & Lisac, Zagreb, 2007.

1.25. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*

1.26. Quality assurance methods ensuring the acquisition of knowledge, skills and competences

Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).

General information

Lead instructor(s)	Anita Katić, PhD, Assistant Professor	
Course title	Linear Algebra II	
Study programme	Undergraduate university study programme in Computer Engineering, elective modules: Computer Engineering and Software Engineering	
Course status	Compulsory	
Year of study	2	
ECTS credits and teaching methods	ECTS credits	5
	Number of classes (lectures + auditory exercises)	30+30

1. COURSE DESCRIPTION

1.1. Course objectives

The objective of the course is to familiarize students with types of matrices and matrix factorizations that effectively solve practical problems, and to give students a detailed insight into vector spaces and the most important results of the theory of linear operators.

1.2. Course enrolment requirements

Requirements for enrolment in the second year of study fulfilled.

1.3. Expected learning outcomes

1. Create the characteristic polynomial and minimal polynomial of the given matrix
2. Discuss the relationship between singular values and eigenvalues of a matrix
3. Use Hamilton Cayley's theorem in the construction of a diagonal matrix
4. Construct the Jordan form of the matrix
5. Differentiate between different types of matrices with respect to the characteristic polynomial and minimal polynomial and form
6. Create the Gram-Schmidt orthogonalization procedure

1.4. Course content

Singular values. The connection between eigenvalues and singular values. Characteristic polynomial. Diagonalization and the Hamilton-Cayley theorem. Jordan form of a matrix. Symmetric and orthogonal matrices. Singular value decomposition of a matrix. Invariant subspaces. Regular and nilpotent operators. Matrix functions. Unitary spaces. Cauchy-Schwarz inequality. Normed vector spaces. Orthogonality. Gram-Schmidt orthogonalization process. Diagonal and triangular form of matrix. Diagonalization of symmetric matrices. Hermitian and unitary operators. Symmetric operators and associated quadratic forms. Cholesky factorization of a matrix. QR factorization of a matrix. Application of matrix decomposition to the least squares problem. Fischer linear discriminant, Tikhonov regularization, Principal Component Analysis (PCA)

1.5. Types of classes	☒ lectures ☐ seminars and workshops ☒ auditory exercises ☐ distance learning ☐ field work	☐ individual exercises ☐ multimedia and network ☐ laboratory exercises ☐ design exercises ☐ working with a supervisor ☐ other _____
1.6. Comments		

1.7. Student obligations

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.8. Monitoring and assessment of student work

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.9. Assessment and evaluation of student work during classes and in the final exam

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance at lectures (L), auditory exercises (AE), laboratory exercises (LE), design exercises (DE)	1,5		Lectures (L), laboratory exercises (LE), design exercises (DE)	Attendance tracking. Minimum attendance percentage: 70%.	0	0
Problem-solving exercises	1		Revision exams (written exam)	Evaluation	20	40
Preparation for laboratory exercises (LE), results analysis, report writing	1		Laboratory exercises (LE)	Preparation for LE, LE supervision, LE report assessment	0	10
Preparing for an oral exam and oral exam	1,5		Oral exam	Evaluation	25	50

1.10. Obligatory literature (at the time of submitting a study programme proposal)

1. N. Elezović. Linearna algebra. Element, Zagreb, 2016.
2. N. Elezović. Linearna algebra, zbirka zadataka. Element, Zagreb, 2016.
3. S. Kurepa. Uvod u linearnu algebru. Školska knjiga Zagreb, 1985.
4. Carl D. Meyer. Matrix analisys and applied Linear algebra, SIAM: Society for Industrial and Applied Mathematics; Har/Cdr edition (May 24, 2010)
http://www.cse.zju.edu.cn/eclass/attachments/2015-10/01-1446085870-145420.pdf

1.11. Recommended additional literature (at the time of submitting a study programme proposal)

1. Seymour Lipshutz. 3000 solved problems in Linear algebra. Shaum's outline series. 1988.
2. Anđelko Marić. Vektori, zbirka zadataka. Element, Zagreb 1997.

1.12. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*
1. N. Elezović. Linearna algebra. Element, Zagreb, 2016.	4	
2. N. Elezović. Linearna algebra, zbirka zadataka. Element, Zagreb, 2016.	6	
3. S. Kurepa. Uvod u linearnu algebru. Školska knjiga Zagreb, 1985.	5	

1.13. Quality assurance methods ensuring the acquisition of knowledge, skills and competences

Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon

passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).

General information		
Lead instructor(s)	Tomislav Keser, PhD, Associate Professor	
Course title	Computer Systems Development Technologies	
Study programme	Undergraduate university study programme in Computer Engineering, elective module: Computer Engineering	
Course status	Compulsory	
Year of study	3	
ECTS credits and teaching methods	ECTS credits	7
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	45 + (15 + 15 + 0) + 0

1. COURSE DESCRIPTION		
1.1. Course objectives		
Describe the development process and the life and economic cycle of an electronic device. Describe the manufacturing processes of electronic devices. Design an electronic device with a printed circuit board using computer-aided development environments. Simulate the operation of the designed device. Get to know the physical foundations and prevention techniques of the influence of electromagnetic interference on and between electronic devices. Familiarize yourself with the physiognomy of integrated circuits. Describe soldering techniques and soldering materials. Familiarize yourself with insulators, conductors and bearing materials. Choose suitable components for making an electronic device. Design cooling systems for electronic components. Analyze the conformity of the design of the electronic device according to the regulations for placing the device on the market. Generate technical and production documentation of the electronic device.		
1.2. Course enrolment requirements		
Requirements for enrolment in the second/third year of study fulfilled.		
1.3. Expected learning outcomes		
1. Explain computer system design technologies 2. Design an electronic device at the level of a printed circuit board using computer tools. 3. Apply programming tools and environments for program and hardware development 4. Recognize the causes of electromagnetic compatibility problems in electronic devices 5. Understand ways to reduce the influence of the causes of electromagnetic compatibility problems in electronic devices 6. Evaluate and test the functioning of the designed computer system		
1.4. Course content		
Introduction to computer system design technologies. Electrical, mechanical and thermal design of an electronic device. Prototyping technologies and procedures. Technologies and procedures in the industrial production of printed circuit boards. Technologies of encapsulation and installation of components. Basics of power sources and power techniques. Heat transfer mechanisms and design of refrigerators and cooling systems. Grounding and shielding of electronic devices. Signal noise reduction. Crosstalk reduction techniques. Electrostatic discharge, overvoltage and overcurrent protection of electronic devices. Types of technical documentation. Life cycle of electronic equipment and documentation. Maintenance and lifetime costs of an electronic device. Norms and regulations for the manufacture and placing on the market of electronic devices in the EU.		
1.5. Types of classes	☒ lectures ☐ seminars and workshops ☒ auditory exercises	☐ individual exercises ☐ multimedia and network ☒ laboratory exercises ☐ design exercises

	☐ distance learning ☐ field work	☐ working with a supervisor ☐ other _____
1.6. Comments		

1.7. Student obligations

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.8. Monitoring and assessment of student work

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.9. Assessment and evaluation of student work during classes and in the final exam

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance at lectures (L), auditory exercises (AE), laboratory exercises (LE)	2	1	Lectures (L), laboratory exercises (LE), design exercises (DE)	Attendance tracking. Minimum attendance percentage: 70%.	0	10
Problem-solving exercises	1	5, 6	Revision exams (written exam)	Evaluation	10	20
Preparation for laboratory exercises (LE), results analysis, report writing	1	1, 2, 3, 5	Laboratory exercises (LE)	Preparation for LE, LE supervision, LE report assessment	10	20
Preparing for an oral exam and oral exam	1	1, 2, 3, 4, 5, 6	Oral exam	Evaluation	25	50

1.10. Obligatory literature (at the time of submitting a study programme proposal)

1. Walt Kester (1996.), High Speed Design Techniques, Analog Devices (ISBN-0-916550-17-6)
2. R.W. Li, G. Liu , Flexible and Stretchable Electronics: Materials, Design, and Devices, J. S. Publishing, 2019.
3. Tim Williams (2013.), The Circuit Designer's Companion, Elsevier
4. Henry W. Ott (1988.), Noise reduction techniques in electronic systems, Wiley-Interscience

1.11. Recommended additional literature (at the time of submitting a study programme proposal)

1. M. Fakhfakh, E. Tlelo-Cuautle, M. H. Fino, Performance Optimization Techniques in Analog, Mixed-Signal, and Radio-Frequency Circuit Design, IGI Global, 2014.
2. M. M. Hella, P. Mercier, Power Management Integrated Circuits (Devices, Circuits, and Systems), CRC Press, 2016.
3. Kim R. Fowler (1996.), Electronic Instrument Design, Oxford University Press

1.12. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*
		30
		30

1.13. Quality assurance methods ensuring the acquisition of knowledge, skills and competences		
Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).		

General information		
Lead instructor(s)	Goran Martinović, PhD, Full Professor with Tenure	
Course title	Object-Oriented Software Development Principles	
Study programme	Undergraduate university study programme in Computer Engineering, elective modules: Computer Engineering and Software Engineering	
Course status	Compulsory	
Year of study	2	
ECTS credits and teaching methods	ECTS credits	6
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	30 + 15 + 30 + 0 + 0

1. COURSE DESCRIPTION

1.1. Course objectives

The goal of the course is to enable students to develop software using advanced, language-agnostic, object-oriented concepts. The principles applied in such an approach to development enable code reuse, simplify testing and make software easier to maintain. The main topics include layer separation, S.O.L.I.D. principles and design patters which support the aforementioned. The language used is C#, while the knowledge attained through this course builds upon the previously learned in courses such as Programming I, Programming II and Object-oriented programming.

1.2. Course enrolment requirements

Requirements for enrolment in the study programme fulfilled

1.3. Expected learning outcomes

1. Describe the basic principles important for object-oriented software development
2. Utilise S.O.L.I.D. principles when developing custom software solutions
3. Describe and sketch-out the structure of commonly used design patterns
4. Explain the deeper issue which the individual design pattern tackles
5. Identify the applied design pattern in code as well as the one appropriate for a specific problem
6. Apply design patterns when developing custom software solutions
7. Connect different design patterns and incorporate them in complex software solutions

1.4. Course content

Introduction. Core principles of OOP. The principles of object-oriented design (S.O.L.I.D.). Layered design. Clean code. Naming, comments, formatting. Code smells. Heuristics. Creational design patterns (Singleton, Factory method, Abstract factory, Builder, Prototype). Structural design patterns (Bridge, Adapter, Decorator, Flyweight, Proxy, Façade, Composite). Behavioural design patterns (Strategy, Memento, Template method, Iterator, Observer, State, Command, Mediator, Visitor, Null object, Chain of responsibility). Refactoring. Refactoring techniques and tools. Object relational mapping. ORM tools. LINQ.

1.5. Types of classes	☒ lectures ☐ seminars and workshops ☒ auditory exercises ☐ distance learning ☐ field work	☒ individual exercises ☐ multimedia and network ☒ laboratory exercises ☐ design exercises ☐ working with a supervisor ☐ other _____

1.6. Comments	

1.7. Student obligations

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.8. Monitoring and assessment of student work

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.9. Assessment and evaluation of student work during classes and in the final exam

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance at lectures (L), auditory exercises (AE), laboratory exercises (LE), design exercises (DE)	2.5	1,2,3,4,5,6,7	Lectures (L), laboratory exercises (LE), design exercises (DE)	Attendance tracking. Minimum attendance percentage: 70%.	0	0
Problem-solving exercises	1	2,5,6,7	Revision exams (written exam)	Evaluation of solved problems	20	40
Homework / seminars	0.5	1,2,3,4,5,6,7	Solving homework problems or writing a seminar	Evaluation of solved problems	7	10
Preparation for laboratory exercises (LE), results analysis, report writing	1	2,5,6,7	Laboratory exercises (LE)	Preparation for LE, LE supervision, LE report assessment	0	10
Preparing for an oral exam and oral exam	1	1, 2, 3, 4, 5	Oral exam	Evaluation	0	10

1.10. Obligatory literature (at the time of submitting a study programme proposal)

1. E. Freeman et al., Head First Design Patterns, O'Reilly Media, 2004.
2. E. Gamma et al., Design Patterns: Elements of Reusable Object-Oriented Software, Addison-Wesley Professional, 1998.
3. R.C. Martin, Clean Code: A Handbook of Agile Software Craftsmanship, Prentice Hall, 2008.

1.11. Recommended additional literature (at the time of submitting a study programme proposal)

1. M. Fowler, Refactoring, Addison-Wesley, 2001.
2. R.C. Martin, Agile Software Development: Principles, Patterns, and Practices, Prentice Hall, 2002.

1.12. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*
Head first design patterns	1	70
Design Patterns: Elements of Reusable Object-Oriented Software	1	70
Clean code: A Handbook of Agile Software Craftsmanship	1	70

1.13. Quality assurance methods ensuring the acquisition of knowledge, skills and competences

Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).

General information		
Lead instructor(s)	Josip Balen, PhD, Assistant Professor Krešimir Nenadić, PhD, Associate Professor	
Course title	Basics of Web and Mobile Application Development	
Study programme	Undergraduate university study programme in Computer Engineering, elective modules: Computer Engineering and Software Engineering	
Course status	Compulsory	
Year of study	3	
ECTS credits and teaching methods	ECTS credits	6
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	30+(0+30+15)+0

1. COURSE DESCRIPTION

1.1. Course objectives

Introduce students to the basics of creating HTML documents. Show students modern technology and web application design tools. Explain the basic structure of HTML documents, HTML elements and attributes. Explain the process of creating user interface and functionality on the server side. Introduce students to Java and Kotlin programming languages. Introduce students to technologies and software tools for creating mobile applications. Explain the main components of mobile apps and their programme implementation. Introduce students to application testing on devices and emulators.

1.2. Course enrolment requirements

Requirements for enrolment in the third year of study fulfilled.

1.3. Expected learning outcomes

1. Identify the client and server technologies used in web applications development
2. Use a specific tool for web applications development
3. Create a simple example of a web application consisting of a client part (user interface) and a server part (working with a database)
4. Identify programming concepts specific to creating applications for mobile devices and the web
5. Use integrated development environments (IDE) for mobile applications development
6. Develop a simple mobile application

1.4. Course content

Creating web documents. Introduction to HTML - syntax, structure, basic elements and attributes. Introduction to stylesheets - CSS - writing and applying styles, cascading, external stylesheets. Introduction to JavaScript - syntax, data types, DOM document model, access to elements, events. Introduction to PHP - syntax, data types, database access.
Getting to know and working with Java and Kotlin programming languages. Familiarity with tools for creating applications for mobile devices and for the web. The main components of a mobile application. Creation of user interface for mobile applications. Programmatic implementation of the main components. Using emulators and real devices when testing the correctness of applications.

1.5. Types of classes		
	☒ lectures ☐ seminars and workshops ☐ auditory exercises ☐ distance learning ☐ field work	☐ individual exercises ☐ multimedia and network ☒ laboratory exercises ☒ design exercises ☐ working with a supervisor

		☐ other _____
1.6. Comments		

1.7. Student obligations

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.8. Monitoring and assessment of student work

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.9. Assessment and evaluation of student work during classes and in the final exam

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance at lectures (L), auditory exercises (AE), laboratory exercises (LE), design exercises (DE)	2	1	Lectures (L), laboratory exercises (LE), design exercises (DE)	Attendance tracking. Minimum attendance percentage: 70%.	0	5
Problem-solving exercises	0.4	2,3,4	Revision exams (written exam)	Evaluation	0	10
Preparation for laboratory exercises (LE), results analysis, report writing	0.3	1,3	Laboratory exercises (LE)	Preparation for LE, LE supervision, LE report assessment	0	15
Preparing for an oral exam and oral exam	1	2,3,4,5	Oral exam	Evaluation	15	30

1.10. Obligatory literature (at the time of submitting a study programme proposal)

1. Razvoj mobilnih aplikacija-priručnik za edukaciju. Osijek: Elektrotehnički fakultet Osijek, 2013.
2. Phillips, Bill; Stewart, Chris; Hardy, Brian; Marsicano, Kristin . Android Programming: The Big Nerd Ranch Guide (2nd Edition). Atlanta: Big Nerd Ranch, LLC., 2015
3. R.W. Sebesta, Programming the World Wide Web (2nd Ed.), Addison-Wesley, Boston, MA, 2004.

1.11. Recommended additional literature (at the time of submitting a study programme proposal)

1. P. Sarang, Java Programming, Oracle Press, 2012.
2. F. Darwin, Android Cookbook Problems and Solutions for Android Developers, O'Reilly Media, 2012.
3. R. Cadenhead, Java 6 II izdanje, Kombib, 2008.
4. D. Poo, D. Kiong, S. Ashok, Object-Oriented Programming and Java, Springer Verlag, 2007.
5. M. Fordham, Kotlin Development for Beginners: (with Code Examples), Amazon Media EU, 2017.
6. M. Moskala, I. Wojda, Android Development with Kotlin, Packt Publishing, 2017
7. K. Kalata, Internet Programming, Thompson Learning, London, 2001.

1.12. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*

Razvoj mobilnih aplikacija, Priručnik za edukaciju, Elektrotehnički fakultet Osijek, 2013.	15	
Y. Fain, Programiranje Java, Wrox, 2011.	1	
1.13. Quality assurance methods ensuring the acquisition of knowledge, skills and competences		
Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).		

General information		
Lead instructor(s)	Goran Martinović, PhD, Full Professor with Tenure Alfonzo Baumgartner, PhD, Associate Professor	
Course title	Basics of Data Analysis	
Study programme	Undergraduate university study programme in Computer Engineering, elective module: Software Engineering	
Course status	Elective	
Year of study	3	
ECTS credits and teaching methods	ECTS credits	6
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	2+0+2+0+0

1. COURSE DESCRIPTION		
1.1. Course objectives		
Explain the architectures and operating principles of services in cloud. Familiarize students with data properties, requirements and methods for data discovery and analysis using statistical and machine learning-based procedures, and demonstrate the use of service environments, tools and software technologies for data analysis, big data in business, research, industrial and other applications.		
1.2. Course enrolment requirements		
Requirements for enrolment in the third year of study fulfilled.		
1.3. Expected learning outcomes		
1. understand the architecture and principles of service computing, data properties, data transport formats, and the requirements and methods of data analysis in the cloud environment 2. evaluate the procedures and models of machine learning with the aim of creating improved algorithmic and software adapted to the cloud service environment 3. create the necessary cloud architecture, methods and programming methodologies for data analysis and big data 4. apply the defined cloud architecture, methods and programming technologies for data analysis and big data 5. examine the efficiency and applicability of the cloud services, as well as the procedures and software solutions for data analysis from different sources 6. analyse and modify the implemented solutions with the aim of improving the cloud service system in applications		
1.4. Course content		
Basic principles of data analysis. Levels of data structure, other data properties. Methods and basic principles for discovering, storing, handling, processing and interpreting data. Data warehouses. ETL procedure. An ecosystem for data analysis. Data analysis based on machine learning and statistical approaches. Cloud computing, infrastructure, platform, application and other distributed forms of services. Implementation features and possibilities of using cloud computing and other tools in data analysis. Data transport formats, XML, JSON. Non-relational data and NoSQL. Introduction to advanced web/mobile services. Fundamentals of analysing large data sets and data streams. Languages, tools, environments and technologies for implementing data analysis procedures. Development, versioning, testing and marketing of data analysis services. Applications for solving classification, regression, content analysis and anomaly detection problems in business and industrial environments.		
1.5. Types of classes	☒ lectures ☐ seminars and workshops	☐ individual exercises ☐ multimedia and network ☒ laboratory exercises

	☐ auditory exercises ☐ distance learning ☐ field work	☐ design exercises ☐ working with a supervisor ☐ other _____
1.6. Comments		

1.7. Student obligations

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.8. Monitoring and assessment of student work

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.9. Assessment and evaluation of student work during classes and in the final exam

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance at lectures (L), laboratory exercises (LE)	1	1, 2, 3, 4, 5, 6	Lectures (L), laboratory exercises (LE)	Attendance tracking. Minimum attendance percentage: 70%.	3	6
Writing preparations for LV, analysis of results, and report writing	1.5	3, 4, 5, 6	Laboratory exercises (LE)	Evaluation	12	24
Preparation for the oral exam and answering questions	1	1, 2, 3	Oral exam	Evaluation	10	20
Solving theoretical, problem, model and programming tasks	1.5	2, 3, 6	Written exam	Evaluation	10	20
Project work	1	3, 4, 5, 6	Laboratory exercises (LE)	Evaluation	10	20

1.10. Obligatory literature (at the time of submitting a study programme proposal)

1. B. Burns, Designing Distributed Systems, O'Reilly, 2018.
2. M. Collier, R. Shahan: Fundamentals of Azure, Microsoft Press, 2015.
3. EMC Education Services, Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, Wiley, 2015.
4. Kavis, M.J. Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS) Wiley, 2014.
5. M. Kleppmann, Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems, O'Reilly, 2017.

1.11. Recommended additional literature (at the time of submitting a study programme proposal)

1. M. Barlow, Real-Time Big Data Analytics: Emerging Architecture, O'Reilly, 2015.
2. J. Barnes, Azure Machine Learning, Microsoft Press, 2015.
3. B. Baesens, Analytics in a Big Data World: The Essential Guide to Data Science and its Applications, Wiley, 2014.
4. J. Davis, R. Daniels, Effective DevOps; Building a Culture of Collaboration, Affinity, and Tooling at Scale, O'Reilly, 2016.

5. B. Ellis, Real-Time Analytics: Techniques to Analyze and Visualize Streaming Data, Wiley, 2014.
6. A. Holmes, Hadoop in Practice (2nd Ed.), Manning Publications, 2014.
7. F. Hueske, V. Kalavri, Stream Processing with Apache Flink, O'Reilly, 2019.
8. J. Rhoton, R. Haukioja, Cloud Computing Explained: Implementation Handbook for Enterprises (2nd Ed.), Recursive Press, 2009.
9. N. Zumel, Practical Data Science with R (2nd. Ed.), Manning Publications, 2019.

1.12. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*
1. B. Burns, Designing Distributed Systems, O'Reilly, 2018.	5	80
2. M. Collier, R. Shahan: Fundamentals of Azure, Microsoft Press, 2015.	5	80
3. EMC Education Services, Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, Wiley, 2015.	5	80
4. Kavis, M.J. Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS) Wiley, 2014.	5	80
5. M. Kleppmann, Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems, O'Reilly, 2017.	5	80

1.13. Quality assurance methods ensuring the acquisition of knowledge, skills and competences

Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).

General information		
Lead instructor(s)	Željko Hocenski, PhD, Full Professor with Tenure Ivan Aleksi, PhD, Assistant Professor	
Course title	Computer Architecture	
Study programme	Undergraduate university study programme in Computer Engineering	
Course status	Elective	
Year of study	3	
ECTS credits and teaching methods	ECTS credits	7
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	30 + (15 + 15 + 15) + 0

1. COURSE DESCRIPTION

1.1. Course objectives

To present students with theoretical and practical knowledge in the field of computer architecture. To teach the student to recognize and explain specific problems in the field of computer and microcontroller construction. To train students for the analysis and development of circuit and programming support in the assembler programming language for the PicoBlaze microprocessor and in the C++ programming language for microcontrollers. Apply acquired knowledge in the development of circuit and programming support for a specific computer system.

1.2. Course enrolment requirements

Requirements for enrolment in the third year of study fulfilled.

1.3. Expected learning outcomes

1. explain the structure of the computer system
2. analyse the functioning of computer system parts
3. explain connection and serial and parallel data transfer
4. design a programming solution in assembly language
5. apply programming tools and environments for program development
6. evaluate and test the functioning of the designed computer system

1.4. Course content

Basic features of a digital computer. Von Neumann's model of the computer. Functional units of computers. Microprocessor. Architecture of an 8-bit microprocessor. Computer functioning and execution of commands. Ways of addressing. Computer buses. Address decoders and bus circuits. Command execution time. Microprocessor instruction set. Programming in machine language. Subroutines. Stack. Architecture of the personal computer. The Intel microprocessor family. Basic boards and characteristic busbars. Input-output functional units of the computer. Parallel Input and Output (PIO) interface. Parallel buses and basic protocols (AT, SCSI, PCI, GPIB). Interface for serial communication (UART, SIO). Serial buses and protocols (RS-232, RS-485, USB, IEEE-1394, IIC). Timing circuits (CTC). Memory circuits. Organization of memory systems. Cache and virtual memory. Memory management. External storage units. Magnetic media (HDD). Optical recording (CD ROM, DVD). Circuit for direct memory access (DMA). Ways of serving outdoor units. Intermittent mode. Architecture of modern microprocessors and computers. Self-diagnosis. Reliability. Equipment and tools for design and diagnosis.

1.5. Types of classes	☒ lectures ☐ seminars and workshops ☒ auditory exercises	☐ individual exercises ☐ multimedia and network ☒ laboratory exercises ☒ design exercises

	☐ distance learning ☐ field work	☐ working with a supervisor ☐ other _____
1.6. Comments		
1.7. Student obligations		
Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.		
1.8. Monitoring and assessment of student work		
Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.		
1.9. Assessment and evaluation of student work during classes and in the final exam		

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance at lectures (L), auditory exercises (AE), laboratory exercises (LE), design exercises (DE)	2,5	1, 2, 3, 4, 5, 6	Lectures (L), laboratory exercises (LE), design exercises (DE)	Attendance tracking. Minimum attendance percentage: 70%.	3	5
Problem-solving exercises	1, 5	3, 4, 5	Revision exams (written exam)	Evaluation	18	35
Preparation for laboratory exercises (LE), results analysis, report writing	1, 5	4, 5	Laboratory exercises (LE)	Preparation for LE, LE supervision, LE report assessment	15	20
Solving problems during design exercises (DE)	1	5, 6	Design exercises (DE)	Evaluation	10	10
Preparing for an oral exam and oral exam	1	1, 2, 3, 4, 5, 6	Oral exam	Evaluation	15	30

1.10. Obligatory literature (at the time of submitting a study programme proposal)

1. Hocenski Ž; Martinović, G; Aleksi,I. Arhitektura računala- Zbirka zadataka. ETF Osijek 2010.
2. Williams, R. Computer Systems Architecture. Addison Wesley, 2001.

1.11. Recommended additional literature (at the time of submitting a study programme proposal)

1. S. Ribarić: Arhitektura računala, Školska knjiga, Zagreb, 1990

2. J.L. Hennessy, D.A. Patterson: Computer Architecture, A Quantitative Approach; Morgan Kaufmann Publishers, 1990.

3. V.P. Heuring, Harry F. Jordan, Computer Systems Design and Architecture, Addison-Wesley, 1997.

4. Ž. Hocenski, G. Martinović, M. Antunović, Arhitektura računala- Laboratory exercises, ETF Osijek, 2005.

1.12. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*
1.13. Quality assurance methods ensuring the acquisition of knowledge, skills and competences		
Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).		

General information		
Lead instructor(s)	Irena Galić, PhD, Associate Professor	
Course title	Software Engineering	
Study programme	Undergraduate university study programme in Computer Engineering	
Course status	Compulsory	
Year of study	3	
ECTS credits and teaching methods	ECTS credits	5
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	30+(0+30+0)+0

1. COURSE DESCRIPTION

1.1. Course objectives

To familiarize students with methods and tools necessary for developing quality software code to facilitate easier software maintenance. Methods and tools for version control of software code, tools for collaboration and teamwork, tools for software organization and maintenance (bug tracking/issue tracking), documentation creation, and task assignment within the team. To familiarize students with software code testing methods to facilitate further development and maintenance of developed software. To familiarize students with software modeling and design methods and software development methods. To explain the impact of copyright on software development and explain software licensing and distribution methods.

1.2. Course enrolment requirements

Requirements for enrolment in the third year of study fulfilled.

1.3. Expected learning outcomes

1. Compare code versioning tools
2. Compare the most popular software development tools and their advantages and disadvantages
3. Organize software development by selecting and using one of the available tools for bug tracking and documentation creation
4. Formulate requirements for software code and suggest testing methods for successful testing
5. Create functional tests for existing software code

1.4. Course content

Engineering practices in software development: proper commenting of software code, use of software code versioning tools (primarily Git), use of systems and services for sharing software code and collaboration, use of tools and services for bug tracking and documentation creation. Software testing methods. GUI testing. Test-driven development. Tools for software test automation. Continuous integration. Continuous deployment. Modeling and specification of requirements. UML design. Software development methods. Copyright in software code licensing. Open-source licenses.

1.5. Types of classes	☒ lectures ☐ seminars and workshops ☐ auditory exercises ☐ distance learning ☐ field work	☐ individual exercises ☐ multimedia and network ☒ laboratory exercises ☐ design exercises ☐ working with a supervisor ☐ other _____
1.6. Comments	Classes can be conducted in English.	

1.7. Student obligations

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.8. Monitoring and assessment of student work

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.9. Assessment and evaluation of student work during classes and in the final exam

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance at lectures (L), laboratory exercises (LE)	1	1, 2, 3, 4, 5	Lectures (L), laboratory exercises (LE)	Attendance tracking. Minimum attendance percentage: 70%.	5	10
Preparation for laboratory exercises (LE), results analysis, report writing	1	1, 2, 3, 4, 5	Laboratory exercises (LE)	Verification of solved tasks from LE and assignments	10	20
A software project creation and defense	1	1, 2, 3, 4, 5	Laboratory exercises (LE)	Verification of project task solutions	25	50
Preparing for an oral exam and oral exam	2	1, 2, 3, 4,	Oral exam	Evaluation	10	20

1.10. Obligatory literature (at the time of submitting a study programme proposal)

1. Uvod u GIT, T. Krajina, available online for free
2. Software Engineering: Pinciples and Practice, Hans van Vliet, Wiley, 2007

1.11. Recommended additional literature (at the time of submitting a study programme proposal)

1. Uvod u GIT, T. Krajina, dostupno online besplatno
2. Software Engineering: Pinciples and Practice, Hans van Vliet, Wiley, 2007

1.12. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*
1. T. Krajina, Uvod u GIT, book, available online for free: https://tkrajina.github.io/uvod-u-git/git.pdf	available online	40
Software Engineering: Pinciples and Practice, Hans van Vliet, Wiley, 2007	1	40

1.13. Quality assurance methods ensuring the acquisition of knowledge, skills and competences

Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).

General information

Lead instructor(s)	Krešimir Grgić, PhD, Associate Professor	
Course title	Cybersecurity	
Study programme	Undergraduate university study programme in Computer Engineering, elective module: Software Engineering	
Course status	Compulsory	
Year of study	3	
ECTS credits and teaching methods	ECTS credits	6
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	30L + 15AE + 15LE

1. COURSE DESCRIPTION

1.1. Course objectives

To acquaint students with the issue of cybersecurity in modern computer and communication systems (risk assessment, understanding of existing security threats, possible attacks and available prevention and detection measures). To teach students the basic principles of modern cryptographic systems, and to familiarize them with the method of their application in various security protocols. To train students to correctly plan, implement and maintain the most important security mechanisms in different types of computer and communication systems.

1.2. Course enrolment requirements

Requirements for enrolment in the third year of study fulfilled.

1.3. Expected learning outcomes

1. Understand and describe the basic principles of modern cryptosystems (symmetric and asymmetric), as well as the way and possibilities of their application
2. Understand and describe possible security risks, threats and attacks in modern computer and communication systems
3. Interpret and apply modern security protocols in computer and communication systems
4. Understand and apply different security mechanisms for attack prevention and detection
5. Analyze and evaluate security requirements, and plan and implement security policy and mechanisms in various wired and wireless network environments

1.4. Course content

Basic concepts and assumptions of cyber security. Basic principles of modern cryptographic systems. Symmetric cryptosystems - concept, types and application. Asymmetric cryptosystems - concept, types and application. Cryptographic hash functions. Digital signature. Management of cryptographic keys. Security policy, risk assessment and management. Security threats and attack types. Malicious software. Security protocols and mechanisms for attack prevention and detection. Security in wired and wireless networks.

1.5. Types of classes	☒ lectures ☒ seminars and workshops ☒ auditory exercises ☐ distance learning ☐ field work	☐ individual exercises ☐ multimedia and network ☒ laboratory exercises ☐ design exercises ☐ working with a supervisor ☐ other _____

1.6. Comments	

1.7. Student obligations

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.8. Monitoring and assessment of student work

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.9. Assessment and evaluation of student work during classes and in the final exam

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance at lectures (L), auditory exercises (AE), laboratory exercises (LE)	2	1, 2, 3, 4, 5	Lectures (L), auditory exercises (AE), laboratory exercises (LE)	Attendance tracking. Minimum attendance percentage: 70%.	1	4
Problem-solving exercises	1.1	1, 2, 4	Revision exams (written exam)	Evaluation	16	32
Preparation for laboratory exercises (LE), results analysis, report writing	1	3, 4, 5	Laboratory exercises (LE)	Preparation for LE, LE supervision, LE report assessment	12	24
Preparation and presentation of the seminar paper	0.4	2, 3, 4, 5	Preparation and presentation of the seminar paper	Verification of the content of the seminar work and presentation of the results	6	10
Preparing for an oral exam and oral exam	1.5	1, 2, 3, 4, 5	Oral exam	Evaluation	15	30

1.10. Obligatory literature (at the time of submitting a study programme proposal)

1. J. M. Kizza, Guide to Computer Network Security (4th edition), Springer, 2017.
2. C. Paar, J. Pelzl, Understanding Cryptography, Springer, 2010.

1.11. Recommended additional literature (at the time of submitting a study programme proposal)

1. W. Stallings, Cryptography and Network Security (7th edition), Pearson, 2017.

1.12. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*

1.13. Quality assurance methods ensuring the acquisition of knowledge, skills and competences

Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).

General information		
Lead instructor(s)	Josip Job, PhD, Associate Professor	
Course title	Automata and Formal Languages	
Study programme	Undergraduate university study programme in Computer Engineering, elective module: Software Engineering	
Course status	Compulsory	
Year of study	3	
ECTS credits and teaching methods	ECTS credits	
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	45 + (15+0+0)+0

1. COURSE DESCRIPTION		
1.1. Course objectives		
Present the theory of automata and formal languages to students, as well as the possibilities of their application.		
1.2. Course enrolment requirements		
Requirements for enrolment in the third year of study fulfilled.		
1.3. Expected learning outcomes		
1. Describe the basic concepts of automata theory and formal languages. 2. Explain the basic differences between types of automata. 3. Classify a problem according to the Chomsky hierarchy. 4. Represent a problem using formal grammar and the corresponding automaton. 5. Propose a formal model for describing a computational process. 6. Explain and demonstrate the basic concepts of computability theory with an example. 7. Explain and demonstrate the basic concepts of complexity theory with an example. 8. Evaluate the spatial and temporal complexity of a problem.		
1.4. Course content		
Regular expressions. Regular languages and grammars. Finite state automata (DFA, NFA), conversion of NFA to DFA, minimization of DFA. Pumping lemma for regular languages. Context-free languages and grammars. Generation and parsing of strings. Pushdown automaton. Pumping lemma for context-free languages. Turing machine, recursively enumerable languages, unrestricted grammar productions. Properties of recursive and recursively enumerable languages (computability, halting problem, and undecidability). Gödel's theorems. Church-Turing thesis. Structural complexity of languages, Chomsky hierarchy of languages, hierarchy of grammars and automata. Complexity theory, spatial and temporal complexity, complexity classes.		
1.5. Types of classes	☒ lectures ☐ seminars and workshops ☒ auditory exercises ☐ distance learning ☐ field work	☐ individual exercises ☐ multimedia and network ☐ laboratory exercises ☐ design exercises ☐ working with a supervisor ☐ other _____
1.6. Comments		
1.7. Student obligations		

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.8. Monitoring and assessment of student work

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.9. Assessment and evaluation of student work during classes and in the final exam

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance at lectures (L), auditory exercises (AE), laboratory exercises (LE), design exercises (DE)	1,4	1 - 8	Lectures (L), laboratory exercises (LE), design exercises (DE)	Attendance tracking. Minimum attendance percentage: 70%.	0	0
Problem-solving exercises	2,5	1 - 8	Revision exams (written exam)	Evaluation	20	40
Activity during classes, solving project tasks	0,6	1 - 8	Tasks	Knowledge assessment during lectures/exercises, checking written answers or solutions to tasks	10	20
Preparing for an oral exam and oral exam	2	1 - 8	Oral exam	Evaluation	20	40

1.10. Obligatory literature (at the time of submitting a study programme proposal)

1. M. Sipser Introduction to the Theory of Computation 3rd Edition Cengage Learning, Boston, 3rd edition, 2012
2. S. Srbljić Uvod u teoriju računarstva Element, Zagreb, 2007.

1.11. Recommended additional literature (at the time of submitting a study programme proposal)

1. Linz, Peter An Introduction to Formal Languages and Automata Jones & Bartlett, 5th edition, 2012

2. S. Srbljić Jezični procesori 1: Uvod u teoriju formalnih jezika, automata i gramatika Udžbenik Sveučilišta u Zagrebu, Element, Zagreb, 2000.

1.12. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*
1. Gary Smart, Practical Python Programming for IoT: Build advanced IoT projects using a Raspberry Pi 4, MQTT, RESTful APIs, WebSockets, and Python 3, Packt Publishing, 2020.S. Srbljić Uvod u teoriju računarstva Element, Zagreb, 2007.	1	75

1.13. Quality assurance methods ensuring the acquisition of knowledge, skills and competences

Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon

passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).

General information		
Lead instructor(s)	Ratko Grbić, PhD, Assistant Professor	
Course title	Introduction to Machine Learning	
Study programme	Undergraduate university study programme in Computer Engineering	
Course status	Compulsory	
Year of study	3	
ECTS credits and teaching methods	ECTS credits	5
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	(30+(0+30+0)+0)

1. COURSE DESCRIPTION		
1.1. Course objectives		
Introduction to the principles and methods in the field of machine learning and their corresponding applications. Acquiring appropriate skills in working with software tools for data analysis and building machine learning algorithms that enable problem-solving in various fields of engineering, as well as human activities in general.		
1.2. Course enrolment requirements		
Requirements for enrolment in the second/third year of study fulfilled.		
1.3. Expected learning outcomes		
1. Define the basic terminology and concepts of machine learning. 2. Explain the advantages and disadvantages of fundamental machine learning algorithms. 3. Explain the methods for model selection and evaluation. 4. Use software tools to implement machine learning methods and algorithms. 5. Apply clustering algorithms and dimensionality reduction algorithms. 6. Apply supervised learning algorithms to solve classification and regression problems.		
1.4. Course content		
Introduction to machine learning. Software packages for machine learning. Data preprocessing. Unsupervised, supervised, and reinforcement learning. Regression and classification. Linear regression and logistic regression. K-nearest neighbors algorithm. Decision trees. Support vector machines. Clustering algorithms. Dimensionality reduction algorithms and feature extraction. Neural networks. Introduction to deep learning and convolutional neural networks. Model selection. Model evaluation. Various applications of machine learning and examples (natural language processing, computer vision, etc.).		
1.5. Types of classes	☒ lectures ☐ seminars and workshops ☐ auditory exercises ☐ distance learning ☐ field work	☒ individual exercises ☐ multimedia and network ☒ laboratory exercises ☐ design exercises ☐ working with a supervisor ☐ other _____
1.6. Comments		
1.7. Student obligations		

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.8. Monitoring and assessment of student work

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.9. Assessment and evaluation of student work during classes and in the final exam

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance at lectures (L), laboratory exercises (LE)	2	1,2,3,5,6	Lectures (L), laboratory exercises (LE), design exercises (DE)	Attendance tracking. Minimum attendance percentage: 70%.	7	10
Preparation for laboratory exercises (LE), results analysis, report writing	1	4,5,6	Laboratory exercises (LE)	Preparation for LE, LE supervision, LE report assessment	15	30
Solving the project task assigned within the laboratory exercises (LE)	1	3,4,5,6	Laboratory exercises (LE)	Verification of project task solution, LE supervision, presentation of solution	15	30
Preparing for an oral exam and oral exam	1	1,2,3,5,6	Oral exam	Evaluation	15	30

1.10. Obligatory literature (at the time of submitting a study programme proposal)

1. S. Raschka, Python Machine Learning, Packt Publishing, 2015.
2. E. Alpaydin, Introduction to Machine Learning, MIT Press, 2014.

1.11. Recommended additional literature (at the time of submitting a study programme proposal)

1. S. Raschka, Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, and TensorFlow, 2nd Edition, 2017.
2. A. Burkov, The Hundred-Page Machine Learning Book, 2019.
3. C.M. Bishop, Pattern Recognition and Machine Learning, Springer, 2007.

1.12. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*
S. Raschka, Python Machine Learning, Packt Publishing, 2015.	1	
E. Alpaydin, Introduction to Machine Learning, MIT Press, 2014.	1	

1.13. Quality assurance methods ensuring the acquisition of knowledge, skills and competences

Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).

General information		
Lead instructor(s)	Petar Kerže, MKin, Senior Lecturer	
Course title	Physical Education I	
Study programme	Undergraduate university study programme in Computer Engineering, elective modules: Software Engineering and Computer Engineering	
Course status	Compulsory	
Year of study	1	
ECTS credits and teaching methods	ECTS credits	1
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	(0+(0+30+0)+0)

1. COURSE DESCRIPTION		
1.1. Course objectives		
The goal and tasks of physical and health culture derive from the goals and tasks of the general educational system, and from the goals and tasks of the physical and health education field. They also derive from the role that it the area has a possible and necessary influence on changes in the anthropological status of students. It continues performed within certain homogenized groups, and according to the different wishes of the students who express interest in certain sports		
1.2. Course enrolment requirements		
Requirements for enrolment in the study programme fulfilled		
1.3. Expected learning outcomes		
1. Follow the guidelines and instructions about physical exercise and its importance for maintaining health and the impact on raising the level of quality of life. 2. Expand knowledge of a specific sport that is included in the curriculum, 3. Perform simple set tasks independently and as a team		
1.4. Course content		
The curriculum contains elements of team sports such as: basketball, volleyball, futsal, handball, table tennis tennis, badminton, free exercise without weights and elements of swimming, sports gymnastics and athletics. As part of the Physical Culture course, students are given the opportunity to participate in faculty teams at university competition. The university championship offers competitions in sports such as handball, futsal, football, basketball, volleyball, table tennis, swimming, chess, bowling, billiards, darts, cross country, 3x3 basketball and beach volleyball. In all the mentioned sports, a competition is held for male and female students.		
1.5. Types of classes	☐ lectures ☐ seminars and workshops ☐ auditory exercises ☒ distance learning ☐ field work	☐ individual exercises ☐ multimedia and network ☒ laboratory exercises ☐ design exercises ☐ working with a supervisor

		☐ other _____
1.6. Comments		

1.7. Student obligations

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.8. Monitoring and assessment of student work

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.9. Assessment and evaluation of student work during classes and in the final exam

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance at laboratory exercises (LE)	1	1, 2, 3	Laboratory exercises (LE)	Attendance tracking. Minimum attendance percentage: 70%.	-	-

1.10. Obligatory literature (at the time of submitting a study programme proposal)

-

1.11. Recommended additional literature (at the time of submitting a study programme proposal)

-

1.12. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*

1.13. Quality assurance methods ensuring the acquisition of knowledge, skills and competences

Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).

General information		
Lead instructor(s)	Petar Kerže, MKin, Senior Lecturer	
Course title	Physical Education II	
Study programme	Undergraduate university study programme in Computer Engineering, elective modules: Software Engineering and Computer Engineering	
Course status	Compulsory	
Year of study	1	
ECTS credits and teaching methods	ECTS credits	1
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	(0+(0+30+0)+0)

1. COURSE DESCRIPTION		
1.1. Course objectives		
The goal and tasks of physical and health culture derive from the goals and tasks of the general educational system, and from the goals and tasks of the physical and health education field. They also derive from the role that it the area has a possible and necessary influence on changes in the anthropological status of students. It continues performed within certain homogenized groups, and according to the different wishes of the students who express interest in certain sports		
1.2. Course enrolment requirements		
Requirements for enrolment in the study programme fulfilled		
1.3. Expected learning outcomes		
1. Follow the guidelines and instructions about physical exercise and its importance for maintaining health and the impact on raising the level of quality of life. 2. Expand knowledge of a specific sport that is included in the curriculum, 3. Perform simple set tasks independently and as a team		
1.4. Course content		
The curriculum contains elements of team sports such as: basketball, volleyball, futsal, handball, table tennis tennis, badminton, free exercise without weights and elements of swimming, sports gymnastics and athletics. As part of the Physical Culture course, students are given the opportunity to participate in faculty teams at university competition. The university championship offers competitions in sports such as handball, futsal, football, basketball, volleyball, table tennis, swimming, chess, bowling, billiards, darts, cross country, 3x3 basketball and beach volleyball. In all the mentioned sports, a competition is held for male and female students.		
1.5. Types of classes	☐ lectures ☐ seminars and workshops ☐ auditory exercises ☒ distance learning	☐ individual exercises ☐ multimedia and network ☒ laboratory exercises ☐ design exercises ☐ working with a supervisor

	☐ field work	☐ other _____
1.6. Comments		

1.7. Student obligations

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.8. Monitoring and assessment of student work

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.9. Assessment and evaluation of student work during classes and in the final exam

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance at laboratory exercises (LE)	1	1, 2, 3	Laboratory exercises (LE)	Attendance tracking. Minimum attendance percentage: 70%.	-	-

1.10. Obligatory literature (at the time of submitting a study programme proposal)

-

1.11. Recommended additional literature (at the time of submitting a study programme proposal)

-

1.12. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*

1.13. Quality assurance methods ensuring the acquisition of knowledge, skills and competences

Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).

General information		
Lead instructor(s)	Petar Kerže, MKin, Senior Lecturer	
Course title	Physical Education III	
Study programme	Undergraduate university study programme in Computer Engineering, elective modules: Software Engineering and Computer Engineering	
Course status	Compulsory	
Year of study	1	
ECTS credits and teaching methods	ECTS credits	1
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	(0+(0+30+0)+0)

1. COURSE DESCRIPTION		
1.1. Course objectives		
The goal and tasks of physical and health culture derive from the goals and tasks of the general educational system, and from the goals and tasks of the physical and health education field. They also derive from the role that it the area has a possible and necessary influence on changes in the anthropological status of students. It continues performed within certain homogenized groups, and according to the different wishes of the students who express interest in certain sports		
1.2. Course enrolment requirements		
Requirements for enrolment in the study programme fulfilled		
1.3. Expected learning outcomes		
1. Follow the guidelines and instructions about physical exercise and its importance for maintaining health and the impact on raising the level of quality of life. 2. Expand knowledge of a specific sport that is included in the curriculum, 3. Perform simple set tasks independently and as a team		
1.4. Course content		
The curriculum contains elements of team sports such as: basketball, volleyball, futsal, handball, table tennis tennis, badminton, free exercise without weights and elements of swimming, sports gymnastics and athletics. As part of the Physical Culture course, students are given the opportunity to participate in faculty teams at university competition. The university championship offers competitions in sports such as handball, futsal, football, basketball, volleyball, table tennis, swimming, chess, bowling, billiards, darts, cross country, 3x3 basketball and beach volleyball. In all the mentioned sports, a competition is held for male and female students.		
1.5. Types of classes	☐ lectures ☐ seminars and workshops ☐ auditory exercises ☒ distance learning ☐ field work	☐ individual exercises ☐ multimedia and network ☒ laboratory exercises ☐ design exercises ☐ working with a supervisor

		☐ other _____
1.6. Comments		
1.7. Student obligations		
Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.		
1.8. Monitoring and assessment of student work		
Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.		
1.9. Assessment and evaluation of student work during classes and in the final exam		

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance at laboratory exercises (LE)	1	1, 2, 3	Laboratory exercises (LE)	Attendance tracking. Minimum attendance percentage: 70%.	-	-

1.10. Obligatory literature (at the time of submitting a study programme proposal)

-

1.11. Recommended additional literature (at the time of submitting a study programme proposal)

-

1.12. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*

1.13. Quality assurance methods ensuring the acquisition of knowledge, skills and competences

Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).

General information		
Lead instructor(s)	Petar Kerže, MKin, Senior Lecturer	
Course title	Physical Education IV	
Study programme	Undergraduate university study programme in Computer Engineering, elective modules: Software Engineering and Computer Engineering	
Course status	Compulsory	
Year of study	1	
ECTS credits and teaching methods	ECTS credits	1
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	(0+(0+30+0)+0)

1. COURSE DESCRIPTION		
1.1. Course objectives		
The goal and tasks of physical and health culture derive from the goals and tasks of the general educational system, and from the goals and tasks of the physical and health education field. They also derive from the role that it the area has a possible and necessary influence on changes in the anthropological status of students. It continues performed within certain homogenized groups, and according to the different wishes of the students who express interest in certain sports		
1.2. Course enrolment requirements		
Requirements for enrolment in the study programme fulfilled		
1.3. Expected learning outcomes		
1. Follow the guidelines and instructions about physical exercise and its importance for maintaining health and the impact on raising the level of quality of life. 2. Expand knowledge of a specific sport that is included in the curriculum, 3. Perform simple set tasks independently and as a team		
1.4. Course content		
The curriculum contains elements of team sports such as: basketball, volleyball, futsal, handball, table tennis tennis, badminton, free exercise without weights and elements of swimming, sports gymnastics and athletics. As part of the Physical Culture course, students are given the opportunity to participate in faculty teams at university competition. The university championship offers competitions in sports such as handball, futsal, football, basketball, volleyball, table tennis, swimming, chess, bowling, billiards, darts, cross country, 3x3 basketball and beach volleyball. In all the mentioned sports, a competition is held for male and female students.		
1.5. Types of classes	☐ lectures ☐ seminars and workshops ☐ auditory exercises ☒ distance learning ☐ field work	☐ individual exercises ☐ multimedia and network ☒ laboratory exercises ☐ design exercises ☐ working with a supervisor

		☐ other _____
1.6. Comments		
1.7. Student obligations		
Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.		
1.8. Monitoring and assessment of student work		
Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.		
1.9. Assessment and evaluation of student work during classes and in the final exam		

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	Max
Attendance at laboratory exercises (LE)	1	1, 2, 3	Laboratory exercises (LE)	Attendance tracking. Minimum attendance percentage: 70%.	-	-

1.10. Obligatory literature (at the time of submitting a study programme proposal)
-
1.11. Recommended additional literature (at the time of submitting a study programme proposal)
-
1.12. Number of obligatory literature copies in relation to the number of students currently taking the course

Title	*Number of copies*	*Number of students*

1.13. Quality assurance methods ensuring the acquisition of knowledge, skills and competences
Conducting university questionnaires about teachers (student-teacher relationship, transparency of assessment criteria, motivation for teaching, teaching clarity, etc.). Conducting Faculty surveys of courses (upon passing the exam, student self-assessment of the adopted learning outcomes and student workload in relation to the number of ECTS credits allocated to activities and courses as a whole).

General information		
Lead instructor(s)		
Course title	Final Paper	
Study programme	Undergraduate university study programme in Computer Engineering	
Course status	Compulsory	
Year of study	3	
ECTS credits and teaching methods	ECTS credits	10
	Number of classes (lectures + auditory exercises + laboratory exercises + design exercises + seminars)	-

1. COURSE DESCRIPTION

1.1. Course objectives

Assign a task at the appropriate scientific and professional level for a student to demonstrate their engineering skills relevant for the practical problem. Supervise the student in completing the assigned task.

1.2. Course enrolment requirements

Requirements for enrolment in the third year of study fulfilled.

1.3. Expected learning outcomes

Depends on the topic of the Final Paper.

1.4. Course content

Depends on the topic of the Final Paper.

1.5. Types of classes	One-on-one appointments with the supervisor
1.6. Comments	

1.7. Student obligations

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.8. Monitoring and assessment of student work

Defined by the Student evaluation criteria of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek and paragraph 1.9.

1.9. Assessment and evaluation of student work during classes and in the final exam

STUDENT ACTIVITY	ECTS	LEARNING OUTCOME	TEACHING METHOD	ASSESSMENT METHOD	POINTS	
					Min	max
Defined by the Final Papers and Master's Theses evaluation criteria	10	-	-	-	-	-

1.10. Obligatory literature (at the time of submitting a study programme proposal)

Depends on the topic of the Final Paper.

1.11. Recommended additional literature (at the time of submitting a study programme proposal)
Depends on the topic of the Final Paper.
1.12. Number of obligatory literature copies in relation to the number of students currently taking the course
Pursuant to the Ordinance on Final Papers and Master's Theses: - the topic is approved by the Committee for Final Papers and Master's Theses; - the paper is evaluated by an evaluator appointed by the Committee for Final Papers and Master's Theses: - The Committee for Final Papers and Master's Theses makes the final decision based on the evaluator's recommendation.

5.4. Evaluation criteria

OKVIRI KRITERIJA OCJENJIVANJA STUDENATA FERIT-a

U Tablici 1 su prikazane moguće aktivnosti tijekom semestra, „pragovi", preporučeni udio pojedinačne aktivnosti u ukupnom broju bodova ostvarivih tijekom semestra i sl. Za svaki predmet potrebno je uz praćenje pohađanja nastave provoditi još najmanje dvije aktivnosti. Ako je za aktivnost potreban broj bodova/postotak naveden u obliku „od-do", nositelj predmeta za svoj predmet treba za tu aktivnost odrediti točno potreban broj bodova/postotak unutar tog raspona.

Ako studenti ne ostvare minimalno potreban uspjeh iz svih aktivnosti da bi se one smatrale uspješno položenim, tj. ako ne ostvare „pragove" iz svih aktivnosti, nemaju pravo prijaviti ispit, nego trebaju nadoknaditi aktivnost.

Ako student dobrovoljno želi neku aktivnost izvršavati ponovno sljedeće ak. godine, onda se podrazumijeva da niti jedna aktivnost na predmetu nije uspješno položena, tj. student mora ponovno polagati sve aktivnosti na predmetu.

Ako je trajanje uspješno položene aktivnosti i/ili bodova vezano uz ispitni rok, onda to znači da je vezano za jedan ispitni termin u slučaju izvanrednih ispitnih rokova, odnosno za najviše oba ispitna termina redovitog ispitnog roka (zimski, ljetni, jesenski). Iznimno, ako se održava izvanredni ispitni rok u rujnu, onda uspješno položene aktivnosti i/ili bodovi u jesenskom roku obuhvaćaju i taj izvanredni ispitni rok.

Ukupan broj bodova (UBB) i konačna ocjena određuju se prema Tablici 2.

Za sve studente vrijede oni kriteriji koji su vrijedili pri prvom upisu predmeta. Ako student pri ponavljanju predmeta izvršava ponovno sve aktivnosti, tada za studenta vrijede oni kriteriji koji su definirani za ak. godini u kojoj student ponavlja predmet.

Studenti u statusu „dovršetka studija" po razini opterećenja jednaki su redovitim studentima, te se stoga na njih odnose sve odredbe na isti način kao i na redovite studente.

Pod terminom nastave smatra se razdoblje od najmanje jednog školskog sata istog oblika nastave iz istog predmeta tijekom kojeg nastavnik evidentira nazočnost studenata.

Studentu koji ometa izvođenje nastave nastavnika i/ili praćenje nastave ostalih studenata, odnosno izvođenje provjere znanja, nastavnik ima pravo poništiti evidentiranu nazočnost u dotičnom terminu, odnosno evidentirati za termin neopravdani izostanak, te ga uputiti da napusti prostoriju. Usto prema sveučilišnom „Pravilniku o stegovnoj odgovornosti studenata" nastavnik ima pravo studenta prijaviti za ometanje izvođenja nastave ili provjere znanja, odnosno za nedolično ponašanje prema nastavnicima, studentima i zaposlenicima.

Tablica 1. Moguće aktivnosti tijekom semestra, „pragovi", preporučeni udio pojedinačne aktivnosti u ukupnom broju bodova ostvarivih tijekom semestra i sl.

<table>
<tr><th>Moguće aktivnosti tijekom semestra</th><th>Maksimum bodova po uspješno položenoj aktivnosti (nastavnik određuje maksimum unutar dolje navedenog raspona)</th><th colspan="2">Minimalno potreban uspjeh iz aktivnosti da bi se smatrala uspješno položenom („prag")</th><th>Trajanje uspješno položene aktivnosti[a]</th><th>Trajanje bodova iz aktivnosti[b]</th><th>Nadoknada u slučaju neuspješno položene aktivnosti</th><th rowspan="2">Maksimalan zbroj bodova ostvarenih tijekom semestra mora biti fiksan za predmet, i to u rasponu od 40 do 70 bodova (v. Tablicu 2)
∑⇒</th></tr>
<tr><td>Pohađanje nastave (PR+AV+ +KV+LV)</td><td>od 0 do 10</td><td colspan="2">Ukupno (PR+AV+KV+LV) minimalno 70% nazočnosti[c,d,e].</td><td rowspan="5">Trajno</td><td rowspan="5">Do početka sljedećeg ciklusa nastave iz predmeta</td><td>Potrebno sljedeće ak. godine ponovno pohađati nastavu[f]</td></tr>
<tr><td>LV/KV[g]</td><td>od 0 do 30</td><td colspan="2">100 % kolokviranih vježbi</td><td>Moguće za do 30% vježbi[h]</td></tr>
<tr><td>Domaće zadaće</td><td>od 0 do 30</td><td colspan="2" rowspan="3">0 % do 50 % bodova</td><td rowspan="3">Moguće za do 20% bodova[h]</td></tr>
<tr><td>Seminarski rad</td><td>od 0 do 30</td></tr>
<tr><td>Dodatne aktivnosti[i]</td><td>od 0 do 30</td></tr>
<tr><td rowspan="2">Kontrolne zadaće[j]</td><td rowspan="2">od 0 do 50</td><td>Iz svake pojedinačno</td><td>Od 20 % do 50 %</td><td colspan="2" rowspan="2">Prvi sljedeći ispitni rok</td><td rowspan="2">Pismeni ispit (v. redak ispod za detalje)</td></tr>
<tr><td>Kumulativno</td><td>50 %</td></tr>
<tr><td>Pismeni ispit[k]</td><td>Jednako broju bodova za aktivnost „Kontrolne zadaće"[l]</td><td colspan="2">50 %[m]</td><td colspan="3">Na tekućem ispitnom roku</td></tr>
</table>

[a] Za vrijeme navedenog trajanja se smatra da je aktivnost uspješno položena (pa i u slučaju da je isteklo vrijeme „trajanja bodova iz aktivnosti", v. sljedeću fusnotu).

[b] Za vrijeme navedenog trajanja se računaju bodovi ostvareni iz aktivnosti , odnosno nakon isteka navedenog trajanja se bodovi izjednačavaju sa nulom, ali se aktivnost i dalje smatra uspješno položenom sve dok ne istekne vrijeme „trajanja uspješno položene aktivnosti" (v. prethodnu fusnotu).

[c] Navedeni prag se ne odnosi na izvanredne studente. Na polaznike Razlikovnih obveza odnosi se postotak definiran za svaki pojedinačni predmet, a koji može biti manji od 70%. Za predmete s konzultativnim izvođenjem obavezan je dolazak na barem pet termina konzultacija.

[d] Ovo je ujedno prag i za potpis u indeks (ovjera „urednog izvršavanja obveza").

[e] Za PR, i isto tako AV, nastavnik ne može tražiti više od 70% nazočnosti.

[f] U slučaju opravdanog izostanka s nastave, nastavnik studentu može odobriti nadoknadu: PR i AV (moguće do 50% sati) u obliku veće angažiranosti na nekoj od ostalih aktivnosti ili na nekoj dodatnoj aktivnosti, za LV i KV (moguće do 30% vježbi) kako je opisano pod fusnotom „h".

[g] Obavezno provoditi ako u izvedbenom planu postoje laboratorijske ili konstrukcijske vježbe. Kolokviranje LV/KV podrazumijeva sljedeće: napisana/popunjena priprema za svaku vježbu, uspješno odrađena svaka vježba, napisan/popunjen izvještaj za svaku vježbu, uspješno položene provjere znanja iz izvještaja (prag za provjere znanja iznosi 50%). Studenti ne mogu nadoknaditi vježbe na kojima nisu bili nazočni iz neopravdanih razloga. Nenapisana/nepopunjena priprema se smatra jednakom neopravdanom izostanku s vježbi, tj. student nema pravo prisustvovati vježbi, te taj izostanak može nadoknaditi tek sljedeće ak. godine. Neuspješna provjera znanja iz priprema, odnosno netočno popunjena/napisana priprema smatra se jednakom opravdanom izostanku s vježbi, tj. student nema pravo prisustvovati vježbi, ali može nadoknaditi vježbu.

[h] Potrebno nadoknaditi najkasnije prije početka prvog sljedećeg ispitnog roka (iznimno, ako je riječ o nekoj od specifičnih dodatnih aktivnosti, npr. praktični rad u laboratoriju, projektni zadatak, i sl., nastavnik može studentima odobriti duži rok za nadoknadu ako za to postoje opravdani razlozi). Neuspješna nadoknada ili veći iznos nadoknade može se odraditi tijekom sljedećeg ciklusa nastave iz predmeta. Pritom se odrađuju samo neizvršeni dijelovi aktivnosti (npr. ponovno se odrađuju samo neodrađene LV/KV, popravlja se prethodno započeti seminarski rad, itd.).

[i] Dodatne aktivnosti mogu biti grupni zadaci na predavanjima, studentske prezentacije, praktični rad u laboratoriju, projektni zadaci i sl.

[j] Obavezno provoditi ako u izvedbenom planu postoje auditorne vježbe kao oblik provođenja nastave. Tijekom semestra se organiziraju po dvije kontrolne zadaće. Kod ove neuspješno odrađene aktivnosti student iznimno ima pravo prijave ispita kako bi mogao pristupiti pismenom ispitu kao nadoknadi za ovu aktivnost.

[k] Pismeni ispit nije aktivnost tijekom semestra, nego je nadoknada za nepoložene kontrolne zadaće. Student može pristupiti pismenom ispitu jedino ako je uspješno položio ostale aktivnosti.

[l] Nakon uspješno položenog pismenog ispita i završnog usmenog ispita, pod aktivnost kontrolnih zadaća evidentira se broj bodova ostvarenih na pismenom ispitu.

[m] Nositelj predmeta na početku ak. godine definira je li pismeni ispit eliminacijski, tj. smije li student pristupiti usmenom dijelu ispita i ako nije uspješno položio pismeni ispit. Ako student ispit polaže pred ispitnim povjerenstvom (8. izlazak ili prigovor na ocjenu), povjerenstvo pregledava pismeni ispit koji ne mora biti eliminacijski, ali se od studenta u svakom slučaju očekuje i da na usmenoj provjeri znanja pokaže i znanje koje je bilo potrebno za uspješno polaganje pismenog dijela ispita.

Tablica 2. Utvrđivanje ukupnog broja bodova (UBB) i konačne ocjene

<table>
<tr><td rowspan="2">Zbroj bodova ostvarenih tijekom semestra
$\sum\Rightarrow$</td><td rowspan="2">od 40 do 70 bodova</td><td rowspan="2">Zbroj bodova ostvarenih tijekom semestra i bodova na završnom usmenom ispitu
$\sum\Rightarrow$</td><td>Ukupan broj bodova (UBB)</td><td rowspan="3">Utvrđivanje ocjene na temelju UBB
$\Rightarrow$</td><td>UBB</td><td>Konačna ocjena</td></tr>
<tr><td rowspan="3">100 bodova</td><td>90≤UBB≤100</td><td>izvrstan (5)</td></tr>
<tr><td rowspan="2">Završni usmeni ispit[n]</td><td rowspan="2">od 60 do 30 bodova</td><td>75≤UBB<90</td><td>vrlo dobar (4)</td></tr>
<tr><td>60≤UBB<75</td><td>dobar (3)</td></tr>
<tr><td colspan="4"></td><td>UBB<60</td><td>dovoljan (2)</td></tr>
</table>

NAPOMENE VEZANE UZ PROVJERE ZNANJA I IZVEDBENI PLAN:

- kontrolne zadaće se trebaju realizirati unutar ukupno 16, odnosno 32 sata nastave za AV sa 15, odnosno 30 sati prema izv. planu. To povećanje satnice je moguće samo ako ga je nastavnik najavio satničarima najkasnije nakon odrađenih 8, odnosno 16 sati AV. Tijekom semestra se organiziraju po dvije kontrolne zadaće u trajanju od 45 do 60 minuta za predmete sa 15 sati AV, odnosno u trajanju od 60 do 90 minuta za predmete sa 30 sati AV.
- nadoknade LV/KV sa 15, odnosno 30 sati trebaju se realizirati unutar najviše 16, odnosno 32 sata nastave. To povećanje satnice je moguće samo ako ga je nastavnik najavio satničarima najkasnije nakon odrađenih 50% satnice. Ako je to povećanje nedovoljno za nadoknade, nadoknada se može provesti u obliku provjere znanja iz priprema i izvještaja iz nekolokviranih vježbi u terminima koje je nastavnik dogovorio s pojedinačnim studentima.
- provjere znanja iz LV/KV (iz priprema i izvještaja) trebaju biti provedene tijekom termina LV/KV (npr. na početku ili na kraju svakog pojedinačnog termina) ili u posebnim terminima. Pritom satnica posebnih termina ne ulazi u izvedbeni plan niti se računa pod realizacijom izvedbenog plana. Za posebne termine će satničari osigurati mjesto u rasporedu pod uvjetom da nositelj predmeta na početku ak. godine najavi održavanje posebnih termina za provjeru znanja iz LV/KV i navede trajanje svakog termina.
- budući da nisu obavezni, kolokviji (vezani za usmeni ispit) realiziraju se izvan satnice predviđene izvedbenim planom, tj. ta satnica ne ulazi u izvedbeni plan niti se računa pod realizacijom izvedbenog plana. Pritom će satničari osigurati potrebne termine i objaviti ih u rasporedu pod uvjetom da nositelj predmeta na početku ak. godine najavi održavanje dva kolokvija tijekom semestra i navede trajanje svakog kolokvija.

[n] Ispitni prag na završnom usmenom ispitu iznosi 50% uspješnosti na završnom usmenom ispitu. Završni usmeni ispit se može održati i u obliku dva kolokvija tijekom semestra (prag za svaki pojedinačni iznosi od 20% do 50%, kumulativno 50%). Uspješno položeni kolokviji vrijede prvi sljedeći ispitni rok. Pritom, u slučaju da je student na jednom kolokviju imao uspješnost najmanje 50%, ali kumulativno manje od 50%, nastavnik može odobriti studentu da na usmenom ispitu odgovara parcijalno, tj. samo tematske cjeline nepoloženog kolokvija.
Za usmeni ispit (odnosno kolokvije tijekom semestra) ispitivač treba definirati u prosjeku 2 do 5 ispitnih pitanja za svaki sat predavanja. Ispitivač nije dužan ispitivati strogo prema ispitnim pitanjima, odnosno ispitna pitanja služe kao smjernice studentima za pripremu za usmeni ispit (odnosno kolokvije tijekom semestra).