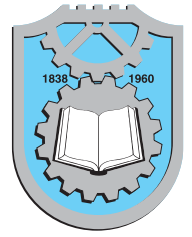




University of Kragujevac
Faculty of Engineering



Master's academic study
course book

Electrical Engineering and Computer Science

Kragujevac, 2026.

No.	Code	Subject name	Sem.	Number of hours	ECTS
FIRST YEAR					
1.	ME-xxx	At least three subjects from group A are chosen.	I	2+2+0+0 or (2+1+1+0)	6
2.	ME-xxx		I	2+2+0+0 or (2+1+1+0)	6
3.	ME-xxx		I	2+2+0+0 or (2+1+1+0)	6
4.	Mxxxxxxx	A maximum of two subjects from group B are chosen.	I	2+2+0+0 or (2+1+1+0)	6
5.	Mxxxxxxx		I	2+2+0+0 or (2+1+1+0)	6
6.	ME-SP	Professional practice – electrical engineering and computer science	II	/	5
7.	ME-SIR	Master's thesis - study research paper	II	0+0+0+20	10
8.	ME-MIO	Master's thesis - preparation and defense	II	/	15
Total hours of active teaching				600 (annually)	
Total ESPB					60

Note: The Table shows active teaching hours.

No.	Code	Subject name	Sem.	L.	Ex.	Lab.	ISW	ECTS
Elective subjects of group A*								
1.	ME-ERS	Electromagnetics with computer simulations	I	2.00	2.00	0.00	2.00	6.00
2.	ME-FOS	Digital image formation and processing methods	I	2.00	2.00	0.00	2.00	6.00
3.	ME-AVI	Analysis and design of artificial intelligence algorithms	I	2.00	2.00	0.00	2.00	6.00
4.	ME-PICK	Integrated circuit design	I	2.00	1.00	1.00	2.00	6.00
5.	ME-SKS	Statistical signal classification	I	2.00	2.00	0.00	2.00	6.00
6.	ME-AIP	Industrial processes automation	I	2.00	1.00	1.00	2.00	6.00
7.	ME-NOS	Advanced topics in signal processing	I	2.00	1.00	1.00	2.00	6.00
8.	ME-OVI	Selected topics in virtual instrumentation	I	2.00	1.00	1.00	2.00	6.00
9.	ME-DMS	Distributed networks and systems	I	2.00	1.00	1.00	0.00	6.00
10.	ME-PPA	Selected topics in business application design	I	2.00	1.00	1.00	2.00	6.00
11.	ME-IOT	Development of IoT applications	I	2.00	1.00	1.00	0.00	6.00
Elective subjects of group B								
12.	MM-DFR	Dataflow computers and their applications	I	2.00	2.00	0.00	2.00	6.00
13.	MM3259	Biologically inspired computing	I	2.00	1.00	1.00	2.00	6.00
14.	MM3256	Neural networks	I	2.00	1.00	1.00	2.00	6.00
15.	MM3153	Robotics and mechatronics	I	2.00	1.00	1.00	2.00	6.00
16.	MM3455	Virtual reality systems	I	2.00	1.00	1.00	2.00	6.00
17.	MM3453	Decision support systems	I	2.00	1.00	1.00	2.00	6.00
18.	MM3253	Design of electronic circuits	I	2.00	1.00	1.00	2.00	6.00
19.	MM1361	Operations research	I	2.00	1.00	1.00	2.00	6.00

* Students choose at least three subjects from group A (subjects 1-11), while a maximum of two subjects is chosen from group B (subjects 12-19)

Study programme: Electrical Engineering and Computer Science				
Course title: Electromagnetics with computer simulations				
Instructor/Instructors: Jasna Radulović, Marijana Gavrilović Božović, Nikola Mijailović				
Subject status: elective				
ECTS: 6				
Condition: none				
Course objective Acquiring the necessary theoretical and practical knowledge in selected areas of electromagnetism. Familiarization with the appropriate mathematical models of the discussed electromagnetic problems, as well as with the methods for solving them.				
Course outcome Upon completion of this course, master's students will have acquired the necessary level of knowledge to conduct research in the fields of analytical, numerical, and applied electromagnetics.				
Course contents <i>Lectures</i> General concepts of the electromagnetic field. Fundamental equations and theorems of the electromagnetic field. Analytical and approximate methods for solving electrostatic problems and problems involving time-invariant magnetic fields. Slowly varying electromagnetic fields. Electromagnetic wave propagation along transmission lines. Antennas. <i>Exercises</i> Solving problems and practical examples related to the theoretical lectures. Computer simulations of the electromagnetic field.				
Literature 1. LONNGREN, Karl. Fundamentals of electromagnetics with MATLAB 2nd edition. Scitech Publishing, 2007. 2. NOTAROŠ, Branislav M. MATLAB-based electromagnetics. Pearson Eductions Inc., 2014. 3. NOTAROŠ, Branislav M. Conceptual Electromagnetics. CRC Press, 2017.				
Hours of active teaching		Lectures: 30	Exercises: 30	
Teaching methods Lectures, classroom exercises and independent student work.				
Knowledge assessment (maximum number of points 100)				
Pre-exam obligations		points	Final exam	points
projects		40	written exam	30
homework(s) and seminar(s)		10	oral exam	20

Study programme: Electrical Engineering and Computer Science				
Course title: Digital image formation and processing methods				
Instructor/Instructors: Marijana Gavrilović Božović, Nikola Mijailović				
Subject status: elective				
ECTS: 6				
Condition: none				
Course objective Introduction of students to the fundamentals of digital image processing in the time and frequency domains, the nature of noise in images, image segmentation methods, shape description, and object recognition in images. Theoretical foundations of projection radiography and tomography				
Course outcome Enabling students to use existing software packages and independently design algorithms for image quality enhancement, extraction of characteristic shapes and determination of relationships among them, as well as image reconstruction based on projections				
Course contents <i>Lectures</i> Basic principles of image formation, color, transformations of multi-level grayscale images, histogram modification, noise elimination, two-dimensional Fourier transform applied to images, edge sharpening and detection, generalized image segmentation, morphological processing, object representation through attributes, shape recognition, classification. Mathematical foundations of tomography, Radon transform, Backprojection method and filtered backprojection method using the Fourier transform, Iterative methods. <i>Exercises</i> Practical application of theoretical concepts and algorithms on various image examples as preparation for an individual project that will be part of the course evaluation. Independent development of programs for image quality enhancement, filtering, and segmentation, object extraction and specification. Completion of assignments in the field of image reconstruction.				
Literature 1. GONZALES, Rafael C.; WOODS, Richard E. <i>Digital image processing</i> . 4 th ed., Global Edition, Pearson Education Limited, 2018. 2. UMBAUGH, Scott E. <i>Digital image processing and analysis (DIPA): Computer vision and image analysis</i> . 4 th ed., CRC Press, 2023. 3. BURGER, W.; BURGE, M. <i>Digital image processing, an algorithmic introduction</i> . 3 rd ed., Switzerland: Springer Nature, 2022.				
Hours of active teaching		Lectures: 30	Exercises: 30	
Teaching methods Theoretical lectures, laboratory exercises, and independent student work.				
Knowledge assessment (maximum number of points 100)				
Pre-exam obligations		points	Final exam	points
projects		50	oral exam	30
homework(s) and seminar(s)		20		

Study programme: Electrical Engineering and Computer Science			
Course title: Analysis and design of artificial intelligence algorithms			
Instructor/Instructors: Vladimir M. Milovanović			
Subject status: elective			
ECTS: 6			
Condition: none			
Course objective Understanding fundamental and advanced theoretical concepts of artificial intelligence algorithms, as well as getting acquainted with the latest contemporary methods through practical application examples. An overview of artificial intelligence in services and solutions of the leading global companies that are encountered on the Internet and everyday work on the computer with a focus and prospect on technologies that will be introduced in the near future.			
Course outcome Mastering the necessary knowledge and skills for analyzing and designing systems based on artificial intelligence, as well as the ability to apply modern artificial intelligence techniques in solving specific engineering tasks and problems, as well as recognizing them during a mere user encounter with them.			
Course contents <i>Lectures</i> Introduction. Basic concepts and terms. Search and optimization algorithms. Depth-first search and breadth-first search. A* search algorithm. Local search (optimization). Adversarial search algorithms. Dynamic programming. Linear programming and simplex algorithm. Gradient descent. Supervised learning algorithms. Linear, polynomial and logistic regression. Sigmoid and softmax functions. k-nearest neighbors algorithm. Support vector machines (SVMs). Decision trees. Ensemble learning. Bagging (Bootstrap aggregating). Random forests. Boosting algorithms. AdaBoost and XGBoost. Gaussian discriminant analysis (GDA). Linear and quadratic discriminant analysis (LDA and QDA). Unsupervised learning algorithms. k-means clustering. DBSCAN. Anomaly detection. Dimensionality Reduction. Principal components analysis (PCA). Independent component analysis (ICA). Factor analysis. Artificial neural networks. (Multi-layer) Perceptron. Convolutional neural networks (CNNs). Recurrent neural networks (RNNs). Autoencoders. Attention and self-attention mechanisms. Transformers. Generative-adversarial networks (GAN). Reinforcement learning. Markov Decision Processes (MDPs). Bellman equation. Q-learning. Computer vision. Feature extraction. Edge detection. Object detection. Image segmentation. Natural language processing (NLP). Word embedding. word2vec. Large language models (LLMs). Foundation models. Generative pre-trained transformers (GPTs). <i>Exercises</i> Examples of the application of artificial intelligence in everyday work. Software tools and libraries for machine and deep learning, as well as for artificial intelligence in general based on the Python programming language. Chatbots and virtual assistants. Prompt engineering and prompt optimization. Multimodal learning and models. Reasoning language models (RLMs).			
Literature 1. RUSSELL, S.; NORVIG, P. <i>Artificial intelligence: a modern approach</i> . 4 th ed., Pearson, 2020. 2. GOODFELLOW, I.; BENGIO, Y.; COURVILLE, A. <i>Deep learning</i> . The MIT Press, 2016. 3. ZHANG, A.; LIPTON, Z.; LI, M.; SMOLA, A. <i>Dive into deep learning</i> . Cambridge University Press, 2023. 4. SUTTON, R.; BARTO, A. <i>Reinforcement learning: an introduction</i> . 2 nd ed., Bradford Books, 2018.			
Hours of active teaching		Lectures: 30	Exercises: 30
Teaching methods Lectures and classroom exercises through presentations and slides, as well as independent research work by students on homework problem assignments and projects with advices from the instructor.			
Knowledge assessment (maximum number of points 100)			
Pre-exam obligations	points	Final exam	points
practical teaching and seminar(s)	10	oral exam	30
homeworks	30		
midterm exam(s) and/or project(s)	30		

Study programme: Electrical Engineering and Computer Science			
Course title: Integrated circuit design			
Instructor/Instructors: Vladimir M. Milovanović			
Subject status: elective			
ECTS: 6			
Condition: none			
Course objective Introduction to methods, techniques, and established practices of application-specific integrated circuit (ASIC) and chip design, as well as understanding the theoretical concepts of designing analog, digital, and mixed-signal integrated circuits and systems and systems-on-chip (SoCs).			
Course outcome Mastering the necessary knowledge and skills for designing analog, digital and mixed-signal integrated circuits and systems, as well as the ability to practically apply modern electronic design automation (EDA) tools and techniques in solving application-specific integrated circuit design tasks and problems.			
Course contents <i>Lectures</i> Introduction. Technologies for manufacturing and processing integrated circuits with an emphasis on CMOS. Characteristics of transistors and passive components (diodes, resistors, capacitors, inductors). Models of transistors and passive components. Parasitic effects. Parameter variability. Moore's law and Dennard's scaling law. Analog integrated circuits. Amplifiers (single-stage, multi-stage, operational, broadband). Gain, bandwidth, dissipation. Signal receivers (Rx), transmitters (Tx) and transceivers (TRx). Circuits for wireless signal transmission at radio frequencies. Nonidealities. Mismatch. Noise. Feedback. Switches and comparators. Bandgap voltage references and current sources. Low-dropout regulators (LDOs). Oscillators. Frequency synthesizers. Digital integrated circuits. Asynchronous and synchronous circuits. Standard logic cells and libraries. Combinational and sequential logic circuits. Static and dynamic memories. Timing. Trade-off and optimization between power and delay. (Dynamic) scaling of supply voltage and operating frequency. Logic generation and synthesis. Automatic placement and routing (PnR). Design methodologies. Data converters. Analog-to-digital and digital-to-analog converters. Time and frequency converters. Switched-capacitor circuits. Serial and parallel data transmission. Serializers and Deserializers (SerDes). Isolation. Modems (modulators and demodulators). Systems-on-chip (SoCs). <i>Exercises</i> Using free and proprietary commercial software tools, packages and libraries to automate the design of electronic circuits and systems with an emphasis on application-specific integrated circuits (ASICs) and systems-on-chip (SoCs).			
Literature - GRAY, Paul; HURST, Paul; LEWIS, Stephen; MEYER, Robert. <i>Analysis and design of analog integrated circuits</i>. 6th ed., Wiley, 2024. - RAZAVI, Behzad <i>Design of analog CMOS integrated circuit</i>. 2nd ed., McGraw-Hill, 2017. - RABAYE, Jan; CHANDRAKASAN, Anantha; NIKOLIĆ, Borivoje. <i>Digital integrated circuits: a design perspective</i>. 2nd ed., Pearson, 2002.			
Hours of active teaching		Lectures: 30	Exercises: 15+15
Teaching methods Lectures and classroom exercises through presentations and slides, as well as independent research work by students on homework problem assignments and projects with advices from the instructor.			
Knowledge assessment (maximum number of points 100)			
Pre-exam obligations	points	Final exam	points
practical teaching and seminar(s)	10	oral exam	30
homeworks	30		
midterm exam(s) and/or project(s)	30		

Study programme: Electrical Engineering and Computer Science			
Course title: Statistical signal classification			
Instructor/Instructors: Mina Vasković Jovanović			
Subject status: elective			
ECTS: 6			
Condition: none			
Course objective The objective of the course is for students to master basic pattern recognition techniques, i.e., designing decision-making systems, including statistical methods (hypothesis testing, parametric and non-parametric classification), as well as non-statistical methods (neural networks, fuzzy logic).			
Course outcome Students will acquire the skills to: generate or collect relevant information that characterizes an observed phenomenon, extract appropriate features and form high-quality training datasets, apply suitable techniques for statistical or non-statistical classification, and design a data clustering system.			
Course contents <i>Lectures</i> Random variables and random vectors. Methods for feature selection and extraction. Classifier design based on hypothesis testing using Bayesian analysis. Risk minimization methods. Design of parametric and non-parametric classifiers. Overview of signal classification methods using fuzzy logic and neural networks. Evaluation metrics for designed decision-making systems. <i>Exercises</i> Use of software tools for empirical inductive decision-making. Selection of the most informative attributes in the decision-making process. Performance evaluation of synthesized systems. All within the context of decision-making.			
Literature 1. DUDA, R.O.; HART, P.E. <i>Pattern classification</i>. 2nd ed., John Wiley & Sons, 2001. 2. LIN, C.; LEE, C. <i>Neural fuzzy systems</i>. Prentice Hall, 1995. 3. BISHOP, C.M. <i>Pattern recognition and machine learning</i>. Springer, 2006. 4. DUIN, R.P.W.; JUSZCZAK, P.; PACLIK, P.; PEKALSKA, E.; DE RIDDER, D.; TAX, D.M.J. <i>PRTTools4, a MATLAB toolbox for pattern recognition</i>. Delft University of Technology, 2004. 5. FUKUNAGA, Keinosuke. <i>Introduction to statistical pattern recognition</i>. Prentice Hall, 1992.			
Hours of active teaching		Lectures: 30	Exercises: 30
Teaching methods Theoretical lectures, exercises, and independent student work realized through projects and homework assignments.			
Knowledge assessment (maximum number of points 100)			
Pre-exam obligations	points	Final exam	points
homework(s) and seminar(s)	30	written exam	70

Study programme: Electrical Engineering and Computer Science				
Course title: Industrial processes automation				
Instructor/Instructors: Mina Vasković Jovanović				
Subject status: elective				
ECTS: 6				
Condition: passed course Automatic control systems				
Course objective To establish the link between modeling techniques and control problems. The course aims to equip students with the ability to apply various control methods and evaluate their effectiveness.				
Course outcome After completing the course, students will be able to explain key phenomena in process control and apply one of the following control methods: predictive control, pole placement, optimal control, adaptive control, and fuzzy control. They will also be able to assess the advantages and disadvantages of different control techniques.				
Course contents <i>Lectures</i> - Introduction to process control - Reasons for model development - Predictive control - Pole placement - Optimal control - Adaptive control - Fuzzy control - Advantages and disadvantages of different control techniques <i>Exercises</i> Solving assignments and practical examples related to theoretical lectures. Laboratory exercises: designing controllers for different types of processes.				
Literature 1. ASTROM, K.; WITTENMARK, J. <i>Computer controlled systems</i> . Pearson, 2011. 2. GOODWIN, G.; GRAEBE, S.; SALGADO, M. <i>Control system design</i> . Prentice-Hall, 2001.				
Hours of active teaching		Lectures: 30	Exercises: 15+15	
Teaching methods Theoretical lectures, exercises, and independent student work carried out through laboratory experiments and homework assignments.				
Knowledge assessment (maximum number of points 100)				
Pre-exam obligations		points	Final exam	points
projects		30	oral exam	40
homework(s) and seminar(s)		30		

Study programme: Electrical Engineering and Computer Science				
Course title: Advanced topics in signal processing				
Instructor/Instructors: Ivan Krstić				
Subject status: elective				
ECTS: 6				
Condition: none				
Course objective Introducing students to advanced topics in signal processing, with a particular focus on multirate systems and the application of sigma-delta modulation in signal processing				
Course outcome Understanding the concepts of multiresolution signal processing, the application of sigma-delta techniques in signal processing, as well as the ability to solve practical problems.				
Course contents <i>Lectures</i> Quantization. Quantization noise. Oversampling. Sigma-delta modulation and the fundamentals of sigma-delta signal processing theory. Fundamentals of multirate systems. Downsampling, upsampling, decimation, and interpolation. Filters in multirate systems. Multirate signal processing techniques in filter design. Filter banks. Multirate systems in telecommunications and audio applications. Hardware and software implementation of signal processing algorithms. <i>Exercises</i> Signal processing in sigma-delta domain. Analysis and synthesis of filters in multirate systems. System simulation in MATLAB (MATLAB clone) environment.				
Literature 1. HARRIS, Frederic J. <i>Multirate signal processing for communication systems</i> . 2 nd ed., River Publishers, 2021. 2. MILIĆ, Ljiljana. <i>Multirate filtering for digital signal processing: MATLAB applications</i> . IGI Global, 2009. 3. PELGROM, Marcel J.M. <i>Analog-to-digital conversion</i> . 4 th ed., Springer Nature, 2021.				
Hours of active teaching		Lectures: 30	Exercises: 15+15	
Teaching methods Lectures, practical exercises, and independent student work through project-based and homework assignments.				
Knowledge assessment (maximum number of points 100)				
Pre-exam obligations		points	Final exam	points
homeworks		30	oral exam	30
projects		40		

Study programme: Electrical Engineering and Computer Science				
Course title: Selected topics in virtual instrumentation				
Instructor/Instructors: Ivan Krstić				
Subject status: elective				
ECTS: 6				
Condition: none				
Course objective Acquisition of practical and theoretical knowledge necessary for the development, integration, and application of virtual instruments in engineering practice, with an emphasis on real-time data acquisition, processing, and visualization.				
Course outcome Ability to use development environments for creating virtual instruments, as well as to interface virtual instruments with sensors, actuators, and other hardware devices through standard communication interfaces.				
Course contents <i>Lectures</i> Introduction to virtual instrumentation: concept, motivation, and benefits. Architecture of a virtual instrument. Development environments. Hardware interfacing. Real-time data acquisition and processing. Implementation of signal processing algorithms. User interface design. Measurement and control management, process automation. Remote measurement via the Internet. Application examples. <i>Exercises</i> Creating virtual instruments using development environments (LabVIEW, MATLAB, Python), designing graphical user interfaces for measurement display and control. Interfacing with sensors via DAQ modules. Real-time signal processing. Development of complete virtual instruments for specific applications (e.g., ECG signal measurement, process equipment control panel).				
Literature 1. BAICAN, Roman; OPEL, Adam A.G.; NECSULESCU, DAN S. <i>Applied virtual instrumentation</i> . WIT Press, 2020. 2. CLARK, C.L. <i>LabVIEW digital signal processing and digital communications</i> . McGraw-Hill, 2010.				
Hours of active teaching		Lectures: 30	Exercises: 15+15	
Teaching methods Lectures, practical exercises, and independent student work through project-based and homework assignments.				
Knowledge assessment (maximum number of points 100)				
Pre-exam obligations		points	Final exam	points
homeworks		30	oral exam	30
projects		40		

Study programme: Electrical Engineering and Computer Science			
Course title: Distributed networks and systems			
Instructor/Instructors: Milan Čabarkapa			
Subject status: elective			
ECTS: 6			
Condition: none			
Course objective Introducing students to the development of distributed network systems and methods of synchronization in such systems. Familiarization with the implementation of distributed networks and systems based on blockchain Web3 concepts.			
Course outcome Enabling students to implement, configure, and administer distributed networks and systems.			
Course contents <i>Lectures</i> Operating system concepts in distributed networks and systems. Implementation of atomic operations. Implementation of semaphores, monitors, and other synchronization concepts in the context of distributed networks and systems. Network administration and programming, TCP and UDP sockets. Implementation of server sockets. Implementation of remote procedure calls, gRPC, and Java RMI. Implementation of object serialization and deserialization in distributed networks and systems. Implementation of advanced smart contracts and consensus mechanisms in blockchain Web3 distributed transactions. Bitcoin as a platform concept. Ethereum as a platform concept. <i>Exercises</i> Implementation of synchronization primitives and locks. Thread creation and management. Concurrency tools and thread pools. Synchronization. Producer-consumer. Readers and writers. Critical sections. Spin locks. Semaphores and barriers. Thread deadlocks. GUI – examples of concurrency. Distributed systems and failure models. Logical and vector clocks. Fault tolerance, replication, and consistency. Failure detection and recovery. Leader election and distributed consensus. Paxos and Raft algorithms. ZooKeeper – architecture, coordination, and leader election. Implementation and analysis of fault-tolerant distributed services.			
Literature 1. NARAYANAN, Arvind; BONNEAU, Joseph; FELTEN, Edward; MILLER, Andrew. <i>Bitcoin and cryptocurrency technologies: a comprehensive introduction</i> . Princeton University Press, 2016. 2. GOETZ, B. et al. <i>Java concurrency in practice</i> . Addison-Wesley, 2006. 3. COULOURIS, G.; DOLLIMORE, J.; KINDBERG, T.; BLAIR, G. <i>Distributed systems – concepts and design</i> . 5 th ed., Addison Wesley, 2012.			
Hours of active teaching		Lectures: 30	Exercises: 15+15
Teaching methods Theoretical lectures, exercises, and independent student work.			
Knowledge assessment (maximum number of points 100)			
Pre-exam obligations	points	Final exam	points
projects and practical exercises	20	oral exam	30
midterm exam(s)	30		
homework(s) and seminar(s)	20		

Study programme: Electrical Engineering and Computer Science			
Course title: Selected topics in business application design			
Instructor/Instructors: Milan Čabarkapa			
Subject status: elective			
ECTS: 6			
Condition: none			
Course objective Acquisition of the necessary theoretical and practical knowledge from selected modern business application design topics. Application of software architectures common to various software technologies and platforms.			
Course outcome Upon completion of the course, students will be able to design scalable, high-performance business applications. They will be equipped to quickly adopt new software technologies for the development of modern applications.			
Course contents <i>Lectures</i> Multilayer architecture of business applications. Client-server interaction based on the request-response model. Service-Oriented Architecture (SOA). Microservices. HTTP REST services. Client-server interaction based on data streaming. Architecture of scalable socket servers. Integration of business applications using message brokering systems. Organization of application domain logic. Data persistence. Object-Relational Mapping (ORM). Use of scalable NoSQL solutions for data storage. Types of NoSQL databases. <i>Exercises</i> Development of a scalable business application using a programming language of choice (Java recommended), along with accompanying data management systems.			
Literature 1. DAIGNEAU, R.; ROBINSON, I. <i>Service design patterns: fundamental design solutions for SOAP/WSDL and RESTful web services</i> . Addison-Wesley Professional, 2011. 2. SADALAGE, P.J.; FOWLER, M. <i>NoSQL: a brief guide to the emerging world of polyglot persistence</i> . Addison-Wesley Professional, 2012.			
Hours of active teaching		Lectures: 30	Exercises: 15+15
Teaching methods Theoretical lectures, exercises, and independent student work.			
Knowledge assessment (maximum number of points 100)			
Pre-exam obligations	points	Final exam	points
projects	30	oral exam	30
midterm exam(s)	30		
homework(s) and seminar(s)	20		

Study programme: Electrical Engineering and Computer Science			
Course title: Development of IoT applications			
Instructor/Instructors: Tijana Dimitrijević			
Subject status: elective			
ECTS: 6			
Condition: none			
Course objective Introduction to the architecture of application systems based on new IoT communication and computing technologies. Introduction to the hierarchical software architecture for the Internet of Things, its implementation, as well as aspects of the implementation of hierarchical IoT data processing in the Cloud, Fog, and Edge, as well as its real-world cybersecurity problems that arise in practice.			
Course outcome Training for the development of a hierarchical application software architecture for the Internet of Things optimized from the sensor, communication, server and end-user aspects for various areas of IoT applications.			
Course contents <i>Lectures</i> Principles, concepts, and architecture of IoT software solutions. IoT application and communication protocols. Principles of designing IoT software solutions. Cloud & Fog hierarchical data processing and analysis within IoT applications. Cyber Threats and Security Aspects in IoT Software Systems. Standardization of the IoT system. <i>Exercises</i> Solving certain problems in computational exercises. Application of software and/or hardware environments for the implementation of projects with the presentation of results.			
Literature 1. HANES, D.; SALGUERIRO, G.; GROSSETETE, P.; BARTON, R.; HENRY, J. <i>IoT fundamentals: networking technologies, protocols, and use cases for the internet of things</i> . Cisco Press, 2017. 2. HERSENT, O.; BOSWARTHICK, D.; ELLOUMI, O. <i>The internet of things: key applications and protocols</i> . John Wiley & Sons Ltd., 2011.			
Hours of active teaching		Lectures: 30	Exercises: 15+15
Teaching methods Lectures, computational and laboratory exercises.			
Knowledge assessment (maximum number of points 100)			
Pre-exam obligations	points	Final exam	points
midterm exam(s)	20	written exam	20
projects	20	oral exam	20
homework(s) and seminar(s)	20		

Study program: Electrical Engineering and Computer Science
Course title: Dataflow computers and their applications
Teacher: Filipović D. Nenad, Milutinović M. Veljko, Milićević Bogdan
Status: Elective course for several study programs
ESPB number: 6
Condition: none
Subject objective The aim of the course is to introduce students to modern DataFlow computer architectures and to acquire the necessary knowledge about DataFlow computers required for independent research, modeling solutions and application of these computers. DataFlow computers can achieve accelerations of 10 to 100 times compared to ControlFlow computers, and under certain circumstances much higher accelerations, while consuming 10 times less electricity, having a physical volume about 10 times smaller, and allowing much greater flexibility in the precision of treating relevant problems. Also, the aim of this course is for students to master creative techniques in this domain as well as techniques of interest for managing complex projects in the domain covered by this course.
Case outcome Students are expected to develop the ability to understand and independently design modern systems based on DataFlow computers, using the programming model announced by Intel for its processor-on-a-chip that will be released by the end of 2020. Students are also expected to develop the ability to program DataFlow computers at higher levels of abstraction, as well as to compare different paradigms in terms of parameters such as speed, power consumption, number of transistors on a chip, and flexibility, treatment algorithms.
Course content <i>Theoretical teaching</i> The course analyzes the development of supercomputers (Feynman and Neumann paradigms), defines the DataFlow SuperComputing paradigm, presents its advantages and introduces students to the new DataFlow programming model using the example of the Maxeler computer. The course covers all phases of system development based on the DataFlow paradigm: program compilation, operating system, methods for accelerating algorithms, methods for reducing consumption, synergy with IoT and WSN, i.e. with systolic fields and ASIC components. DataFlow computers will be presented comparatively in relation to ControlFlow computers. Special attention is paid to the contributions of 4 Nobel laureates (Feynman, Prigogine, Kahneman, Hunt), which can make the compilation process, under adequate conditions, incomparably more effective. Special attention is paid to the problems of efficiency and effectiveness in the domain of research and development. <i>Practical teaching</i> Practical classes include an analysis of tools for developing programs on DataFlow computers, and primarily an introduction to the MaxIDE programming environment. During practical exercises, students are introduced to a number of examples of DataFlow computer applications in the following areas: mathematical algorithms, image processing, machine learning, tensor calculus (which can be applied in genomics, financial analysis, simulations in the natural sciences, security, and elsewhere). The course includes four homework assignments (mathematical algorithms, image processing, machine learning, and tensor calculus). Study research includes the possibility of collaboration on the DataFlow book series published by Springer and Elsevier (which are on the SCI list), as well as the possibility of involvement in creative scientific research projects.
Literature - ELSEVIER: Stojanovic, S., Bojic, D., Bojovic, M., Valero, M., Milutinovic, V., "An overview of selected hybrid and reconfigurable architectures," Elsevier, 2017. - ELSEVIER: Korolija, N., Popovic, J., Cvetanovic, M., and Bojovic, M., "Dataflow-Based Parallelization of Control-Flow Algorithms," Advances in Computers, 2017. - ACM: Trobec, R. Vasiljevic, R., Tomasevic, M., Milutinovic, V., et al, "Interconnection Networks for PetaComputing," ACM Computing Surveys, November 2016. - ACM: Flynn, M., Mencer, O., Milutinovic, V., at al, "Moving from PetaFlops to PetaData," Communications of the ACM, May 2013. - IEEE: Milutinovic, V., "The HoneyComb Architecture," Proceedings of the IEEE, 1989. - IEEE: Milutinovic, V. et all, "Splitting Spatial and Temporal Localities for Entropy Minimization" Tutorial of the IEEE ISCA, 1995. - SPRINGER: Kotlar, M., Milutinovic, V., "The Tensor Calculus Operations for the Data Flow Paradigm," Springer, 2019 - SPRINGER: Milutinovic, V., and Kotlar, M., editors, "Exploring DataFlow Paradigm," Springer 2019 - SPRINGER: Milutinovic, V., Kotlar, M., et al, "DataFlow SuperComputing Essentials," Springer, 2017 - SPRINGER: Milutinovic, V., et al, "Guide to DataFlow SuperComputing," Springer, 2015, 2016, 2017, 2018 (textbooks) - IET: Jovanovic, Z. and Milutinovic, V., "FPGA accelerator for floating-point matrix multiplication," IET

Computers & Digital Techniques, Vol. 6, 2012 pp. 249-256.

12. ELSEVIER: Milutinovic, V., editor, Advances in Computers: "DataFlow," Elsevier, 2015, 2016, 2017, 2018, 2019, 2020 (SCI Book).

Number of hours of active teaching	Number of hours of active teaching:30	Number of hours of active teaching:30	
Teaching methods Lectures, auditory exercises, projects, demonstrations			
Knowledge score (maximum number of points 100)			
Pre-exam obligations	points	Final exam	points
seminar(s)	60	written exam	20
		oral exam	20

Study program: Mechanical Engineering / Electrical Engineering and Computer Science			
Course title: Biologically Inspired Computing			
Teacher: Filipović D. Nenad, Isailović M. Velibor, Milićević Bogdan			
Status: Elective course for several study programs			
ESPB number: 6			
Condition: none			
Course objective: Introducing students to concepts and techniques biological computing, selected examples of applications of evolutionary computing and genetic algorithms.			
Outcome of the case: Upon completion of the course, students will be able to solve biologically inspired computing problems using evolutionary computing approaches and genetic algorithms.			
Course content: <i>Theoretical teaching:</i> Evolutionary algorithm. Genetic algorithms. Evolutionary strategies. Neural networks. Hybridization with other techniques, mathematical algorithms. Classification, search and optimization schemes based on biological computing. Coevolution, interactive evolution. <i>Practical classes:</i> Exercises are performed in the computer lab. Project development with a practical and concrete problem.			
Literature: 1. AE Eiben and JE Smith: Introduction to Evolutionary Computing, Second Edition, Springer, 2015. (ISBN 978-3-662-44873-1) 2. S. Haykin: Neural networks and learning machines, Third Edition, Pearson, 2008. (ISBN 978-0-13-147139-9) 3. A. Brabazon: Natural computing algorithms, Springer, 2015. (ISBN 9783662436318)			
Number of hours of active teaching:		Theoretical classes: 30	Practical classes: 30
Teaching methods: Lectures, classroom exercises and independent student work.			
Knowledge score (maximum number of points 100)			
Pre-exam obligations	point	Final exam	point
activity during the lesson	5	oral exam	30
practical teaching	15		
projects	50		

Study program: Mechanical Engineering/Electrical and Computer Engineering				
Course title: Neural networks				
Teacher: Vesna Ranković, Tijana Geroski				
Status: Elective course for several study programs				
ESPB number: 6				
Condition: none				
Subject objective Introducing students to the basic concepts of neural networks, different architectures and training algorithms. Enabling students to independently design neural networks for engineering applications.				
Case outcome Students will be able to independently implement different types of neural networks that are applied in numerous fields of engineering.				
Course content <i>Theoretical teaching</i> Definition of a neural network. Properties and basic concepts of neural networks. Model of an artificial neuron. Types of activation functions and their applications. Neural network architectures: single-layer and multilayer networks. Introduction to deep learning. Basic differences between classical and deep neural networks. Deep network architectures and challenges in their training. Convolutional neural networks (CNN). Basic principles and architecture: input layer, convolutional layer, pooling layers, activation layers (ReLU, Leaky ReLU, etc.), and fully connected layers. Training convolutional networks: loss, optimization, regularization techniques. Application examples: image classification, object detection, and segmentation. Segmentation based on CNN architectures – U-Net, FCN, and other deep architectures adapted to pixel-precision tasks. Recurrent neural networks and LSTM. Theoretical foundations of recurrent networks. Problems with long-term dependencies and their solution using LSTM (Long Short-Term Memory) units. Structure of LSTM cells: input, forget and output gates. Training LSTM networks. Application of LSTM networks in the analysis of time series, sequential data and videos. <i>Practical teaching</i> Exercises are performed in a computer lab. Programming languages (e.g. Python) are used that enable the implementation of various neural network architectures.				
Literature 1. GOODFELLOW, Ian; BENGIO, Yoshua; COURVILLE, Aaron; <i>Deep learning</i> . MIT press, 2016. 2. CHOLLET, Francois. <i>Deep learning with Python</i> . Simon and Schuster, 2021.				
Number of hours of active teaching		Theoretical teaching: 30	Practical classes: 30	
Teaching methods Lectures, classroom exercises, laboratory exercises, independent work.				
Knowledge score (maximum number of points 100)				
Pre-exam obligations		point	Final exam	point
homework		40	written exam	
colloquiums		30	oral exam	30

Study programme: Mechanical Engineering/Military industrial engineering/Electrical Engineering and Computer Science				
Course title: Robotics and mechatronics				
Instructor/Instructors: Vesna M. Ranković				
Subject status: elective				
ECTS: 6				
Condition: none				
Course objective The aim of the course is to provide students with theoretical and practical knowledge in the field of industrial robotics and mechatronics, with special emphasis on kinematic modeling, motion planning, robot control, and programming. Students will develop the skills necessary for analyzing, designing, and integrating robotic systems into production processes.				
Course outcome The student will be able to interpret the fundamental concepts of industrial robotics, apply methods of kinematic and dynamic analysis, plan and define robot motion using both Cartesian and joint coordinates, utilize various approaches to industrial robot programming, and analyze their application in automated production processes.				
Course contents <i>Lectures</i> Fundamental configurations of industrial robots. Kinematic model of industrial robots. Direct and inverse kinematics problems. Motion planning. Defining trajectories in joint space and Cartesian space. Static and dynamic analysis of robots. Basic subsystems and components of industrial robots. End effectors. Control of industrial robots. Robot programming. Programming methods and types of programming languages. Environmental models and task description. Characteristic examples of robot applications. Application of robots in manipulation tasks. Process tasks. Application of robots in assembly. Methodology for implementing robots. Design, testing, and calibration of industrial robots. <i>Exercises</i> Exercises are performed in the computer classroom. Programming of ABB robots using RobotStudio software and Denso robots using Wincaps software.				
Literature 1. Lynch KM, Park FC. Modern robotics. Cambridge University Press; 2017. 2. https://hades.mech.northwestern.edu/images/7/7f/MR.pdf				
Hours of active teaching		Lectures: 30	Exercises: 15+15	
Teaching methods Lectures, classroom exercises, independent student work.				
Knowledge assessment (maximum number of points 100)				
Pre-exam obligations		points	Final exam	points
projects		40	written exam	60

Study program: Mechanical Engineering / Electrical Engineering and Computer Science			
Course title: Virtual Reality Systems			
Teacher: Filipović D. Nenad, Isailović M. Velibor, Geroski I. Tijana			
Status: Elective course for several study programs			
ESPB number: 6			
Condition: none			
Course objective: To teach students in the design, implementation, and optimization of virtual and augmented reality (VR/AR) systems. Students will learn how to create interactive and intuitive virtual and augmented environments, using the latest tools and technologies in the industry. The course will cover topics such as working with hardware (virtual reality headsets, motion sensors, cameras, and wearables), as well as software aspects such as real-time graphics development, 3D visualization, user motion tracking, and AR/VR integration in various applications such as education, medicine, industry, and entertainment. Students will also work on developing interactive applications that use concepts such as spatial awareness, user interaction, and data fusion in AR/VR environments.			
Outcome of the case: Upon completion of the course, students will be able to use the acquired knowledge and skills to develop and implement virtual and augmented reality (VR/AR) systems, including the design and optimization of interactive applications. They will be able to independently and in a team create virtual and augmented environments using the latest technologies and tools. Students will also gain practical experience with various VR/AR devices, such as virtual reality headsets, motion sensors and cameras. In addition, they will learn how to integrate AR/VR into various applications, such as education, medicine, industry and entertainment, as well as apply the concepts of spatial awareness, user interaction and data fusion in these environments.			
Course content: <i>Theoretical teaching:</i> Milgram's real-virtual continuum and the virtuality/augmentativity metric consider the dynamic boundary between the real and virtual worlds, while the elements of a VR system refer to the basic components that make up a VR/AR experience. Devices such as immersive and non-immersive VR devices, 3D audio, 3D video, and haptic devices enable the creation of immersive environments, while body, head, limb, and eye tracking techniques contribute to improving interaction in the virtual world. VR/AR interactivity is realized through various programming techniques, thereby demonstrating application in real-world examples. Examples of VR systems, as well as augmented reality (AR) systems, include basic AR system architectures and concrete examples of applications in industry, education, and medicine. <i>Practical classes:</i> The exercises are conducted in a computer lab, where students use modern tools and platforms such as Unity or Unreal Engine to develop simple VR/AR scenes. Students will work with a variety of VR/AR devices, including non-immersive, semi-immersive, and immersive devices, to create interactive environments. Through project development, students will work on solving a practical and concrete problem, applying the acquired knowledge to implement virtual and augmented applications in real environments, using the latest technologies and tools in the industry.			
Literature: 1. Parisi, Tony. Learning virtual reality: Developing immersive experiences and applications for desktop, web, and mobile. "O'Reilly Media, Inc.", 2015. 2. Schmalstieg, Dieter, and Tobias Hollerer. Augmented reality: principles and practice. Addison-Wesley Professional, 2016. 3. Vroegop, Dennis. Microsoft HoloLens Developer's Guide. Packt Publishing Ltd, 2017.			
Number of hours of active teaching:		Theoretical teaching: 30	Practical classes: 30
Teaching methods: Lectures, classroom exercises and independent student work.			
Knowledge score (maximum number of points 100)			
Pre-exam obligations	point	Final exam	point
practical teaching	30	written exam	
projects	40	oral exam	30

Study programme: Mechanical Engineering/Electrical Engineering and Computer Science				
Course title: Decision support systems				
Instructor/Instructors: Nenad D. Filipović, Vesna M. Ranković, Tijana I. Geroski				
Subject status: elective				
ECTS: 6				
Condition: none				
Course objective Introducing students to the concepts, theoretical foundations and capabilities of decision support systems, including classification and regression methods as the basis of analytical modeling and predictive analysis. Enabling students to independently apply the acquired knowledge in solving real-world problems, through the selection of appropriate models, interpretation of results and making data-based decisions.				
Course outcome Upon completion of the course, students will be able to understand the concepts and architecture of decision support systems, to formalize real-world problems in that context, and to apply appropriate classification and regression methods to solve them. They will be able to analyze and interpret model results, use modern software tools for model building and evaluation, and make informed decisions based on data. They will also be able to effectively communicate and present the results of the analysis, as well as solve practical tasks in the field of intelligent decision-making, independently or in a team.				
Course contents <i>Lectures</i> Basic concepts of decision support systems. Decision theory. The problem of rationality in decision-making. Decision factors. Decision-making stages. Types of decision-making systems. Decision-making system structure. Data exploration and analysis as a support for decision-making. Decision-making based on K-nearest neighbors rules. Reasoning under uncertainty: Bayesian decision-making, Bayesian networks and training. Belief networks. Neural networks. Fuzzy logic. Support vector method. Classifiers and classification. Stable and unstable predictors. The problem of class imbalance. Data preprocessing. Outlier detection and missing data prediction. Construction of decision-support tools: data acquisition, knowledge recording and modeling, system validation. Examples of decision-support systems. <i>Exercises</i> Exercises are performed in the computer lab. Project development with a practical and concrete problem.				
Literature 1. Bishop, Christopher M., and Nasser M. Nasrabadi. Pattern recognition and machine learning. Vol. 4. No. 4. New York: Springer, 2006. 2. Berthold, Michael R., and David J. Hand, eds. Intelligent data analysis: an introduction. Springer, 2007. 3. Hunink, MG Myriam, et al. Decision making in health and medicine: integrating evidence and values. Cambridge university press, 2014. 4. Bonczek, Robert H., Clyde W. Holsapple, and Andrew B. Whinston. Foundations of decision support systems. Academic Press, 2014.				
Hours of active teaching		Lectures: 30	Exercises: 15+15	
Teaching methods Lectures, classroom exercises, laboratory exercises, independent work.				
Knowledge assessment (maximum number of points 100)				
Pre-exam obligations		points	Final exam	points
colloquiums		50	oral exam	30
seminar		20		

Study programme: Electrical Engineering and Computer Science				
Course title: Design of electronic circuits				
Instructor/Instructors: Mina Vasković Jovanović, Marijana Gavrilović Božović				
Subject status: elective				
ECTS: 6				
Condition: none				
Course objective Combining previously acquired knowledge in the field of hardware and software knowledge in order to design elementary electronic circuits that will be able to perform a previously defined target function.				
Course outcome Upon completion of the course, students will be able to formulate a problem, conceptually design it, select components, and implement basic electronic circuits (analog, digital, and/or mixed signal electronics).				
Course contents <i>Lectures</i> Introduction to the subject, representative examples of basic electronic circuits Basic elements of electronic circuits - General overview passive and active electronic components, power supplies (linear, switching, LDO, DC/DC converters,...selection), operational amplifiers (general purpose, rail to rail, instrumentation amplifier, etc.), microcontrollers, PFGA, sensors, output elements Basic tools used in electronic circuit design (EDA – Electronics Design Automation), Altium Designer, KiCAD EDA, EasyEDA Overview Drawing and reading electronic schematics Simulation of electronic circuits (LTspice®, CircuitLab, etc.). Selection of electronic components, TH and SMD electronic components, interpretation of user manuals (data sheets) Review of available development platforms (Arduino, Raspberry Pi, etc.) Review of student works and their critical analysis <i>Exercises</i> Description of the implementation of real electronic circuits, Design and ordering a demo printed circuit board, Assembling a demo board, Trial operation of the demo board, Error analysis				
Literature 1. HOROWITZ, Paul; HILL, Winfield. <i>The art of electronics</i> . Cambridge University Press, 2015. 2. NIHAL, Kularatna. <i>Electronic circuit design: from concept to implementation</i> . Taylor & Francis Group, 2008.				
Hours of active teaching		Lectures: 30	Exercises: 15+15	
Teaching methods Lectures and classroom exercises, as well as independent work by students on homework problem assignments and practical projects.				
Knowledge assessment (maximum number of points 100)				
Pre-exam obligations		points	Final exam	points
activity during lectures		10	written exam	30
midterm exam(s)		10	oral exam	30
projects		10		
homework(s) and seminar(s)		10		

Study program: Mechanical Engineering/ Engineering Management/ Electrical Engineering and Computer Science				
Course title: Operations research				
Instructor/Instructors: Tadić P. Danijela, Aleksić V. Aleksandar				
Course type: core/core/elective				
ECTS: 6				
Prerequisite: no				
The course objective The goal of the course for students is to master the basic methods of operations research and to become familiar with a quantitative approach to solving engineering problems which is less burdened by the subjective views of decision makers.				
Course Learning Outcomes The student should be able to apply operations research methods in solving problems that exist in real organizational systems.				
Course description <i>Theoretical teaching</i> Theoretical teaching includes: Introduction to operations research. Linear programming (graph analytic method, simplex method, LINDO, dual problem, sensitivity analysis, integer linear programming, sensitivity analysis). Transportation problem and scheduling problem. Deterministic dynamic programming. Nonlinear programming. Markov chains and queues. Heuristic methods (gradient method, hardening method, branching method, genetic algorithm, etc.), Multi-attribute decision-making methods (comparison methods - AHP, ANP, BWM, DEMATEL, etc., , ranking methods - ELECTREE, PROMTHEE, TODIM, etc., distance-based methods - TOPSIS, VIKOR, EDAS, MOORA, MULTIMOORA, MABAC, etc., utility-based methods - WASPAS, SWARA, COPRAS, and other methods - SAW, ARAS, MAUT, etc. <i>Practical teaching</i> Within the framework of exercises (auditory and computer-based), students are trained to independently solve real engineering problems in various organizations by applying methods and appropriate software.				
Literature 1. Taha, H. A., <i>Operations Research: An Introduction</i> , 10th ed., Global Edition, Harlow: Pearson Education Limited, 2018. ISBN 978-0134444017.				
Number of active teaching classes		Theoretical teaching:30	Practical teaching:30	
Methods of the course teaching delivery The teaching consists of lectures and auditory and computer exercises where students actively participate in the acquisition and creative use of knowledge. These activities include: lectures using multimedia tools, group activities of students, use of Internet resources. All student obligations are fulfilled during the exercises in consultation with teachers and associates.				
Assessment of knowledge (maximum number of points 100)				
Pre-exam obligations		Points	Final exam	Points
colloquiums		40	Written exam	60

Study programme: Electrical Engineering and Computer Science		
Course title: Internship		
Instructor/Instructors:		
Subject status: compulsory		
ECTS: 5		
Condition: none		
Course objective The acquisition of direct knowledge about the functioning and organization of companies and institutions operating in the field for which the student is being prepared, as well as the application of previously acquired knowledge in practice.		
Course outcome Enabling students to apply their previously acquired theoretical and practical knowledge to solve specific engineering problems within a selected company or institution. Familiarizing students with the activities, business operations, management, and the role of engineers within the organizational structures of the chosen company or institution.		
Course contents An individual program is formed for each candidate in agreement with the management of the company or institution where the professional practice takes place. The program is designed according to the specific needs of the field in which the student is being trained.		
Literature 1. Relevant literature for solving a specific engineering problem.		
Hours of active teaching	Lectures:	Exercises: 90
Teaching methods Consultations and keeping a diary of professional practice, in which the student describes the activities and tasks performed during the professional practice.		
Knowledge assessment (maximum number of points 100)		

Study programme: Electrical Engineering and Computer Science		
Course title: Master thesis – research work		
Instructor/Instructors:		
Subject status: compulsory		
ECTS: 10		
Condition: none		
Course objective Application of fundamental theoretical, methodological, scientific, and professional-applied knowledge and methods to solve specific problems within the chosen field. In this part of the master thesis, the student examines the problem, its structure, and complexity, and based on conducted analyses, draws conclusions about possible ways to solve it. By studying the literature, the student becomes familiar with methods designed for solving similar tasks and engineering practices in their resolution. The goal of the student's activities in this part of the thesis is to gain necessary experience through solving complex problems and tasks, and to recognize opportunities for applying previously acquired knowledge in practice.		
Course outcome Enabling students to independently apply previously acquired knowledge from various fields they have studied to understand the structure of a given problem and conduct systematic analysis in order to draw conclusions about possible approaches to its resolution. Through self-guided exploration of literature, students expand their knowledge in the chosen field and study various methods and works related to similar issues. This develops students' ability to conduct analyses and identify problems within the given topic. Through practical application of acquired knowledge from different areas, students develop the ability to understand the role and position of an engineer in the chosen field, the need for collaboration with other disciplines, and teamwork..		
Course contents It is formed individually according to the needs and the field covered by the topic of the master thesis. The student explores professional literature, professional and thesis papers of students who have dealt with a similar topic, and conducts analyses in order to find a solution to the specific task defined by the master thesis assignment.		
Literature 1. Current journals from all publication years and approved master theses in the given field.		
Hours of active teaching	Lectures:	Exercises: 90
Teaching methods Lectures and computer classroom exercises.		
Knowledge assessment (maximum number of points 100)		

Study programme: Electrical Engineering and Computer Science				
Course title: Master thesis – preparation and defense				
Instructor/Instructors:				
Subject status: compulsory				
ECTS: 15				
Condition: none				
Course objective The aim of completing and defending the master thesis is for the student to demonstrate a satisfactory ability to apply theoretical and practical knowledge in practice.				
Course outcome By completing and defending their master thesis, students who have completed their studies should be capable of solving real-world practical problems and continue their education if they choose to do so. Competencies include, above all, the development of critical thinking skills, the ability to analyze problems, synthesize solutions, and predict the behavior of the chosen solution with a clear understanding of its strengths and weaknesses. Graduates also have the ability to solve specific problems using scientific methods and approaches. The ability to connect fundamental knowledge from different areas and apply it is particularly important. Graduates are proficient in the intensive use of information and communication technologies. Graduates at this level of study possess the competence to apply knowledge in practice, stay updated with professional advancements, and collaborate with local and international environments.				
Course contents It is individually formed according to the needs and scope covered by the assigned topic of the final thesis. In consultation with the mentor, the student prepares the final thesis in written form in accordance with the prescribed standards of the Faculty of Engineering Sciences. The student prepares and defends the written final thesis publicly, in agreement with the mentor and in accordance with the prescribed standards. The student studies professional literature, as well as theses and dissertations of other students dealing with similar topics, and conducts analyses to find a solution to the specific task defined by the final thesis assignment.				
Literature 1. Current journals from all publication years and approved final theses in the given field.				
Hours of active teaching		Lectures:	Exercises:	
Teaching methods The mentor formulates the topic with tasks for the preparation and defense of the final thesis. The candidate independently works on the problem assigned to them in consultation with the mentor and collaborator. After completing the thesis and receiving the mentor's approval that it has been successfully done, the candidate defends the thesis before a committee composed of at least three members. During the preparation of the final thesis, the mentor may provide additional guidance to the student, refer them to specific literature, and offer additional direction to ensure the production of a high-quality thesis. In the theoretical part of the thesis, the student engages in consultations with the mentor and, if necessary, with other instructors who specialize in the issues related to the topic of the final thesis.				
Knowledge assessment (maximum number of points 100)				
Pre-exam obligations		points	Final exam	points
thesis preparation		50	defense	50