University of Rijeka
Faculty of Engineering

CURRICULUM
UNIVERSITY UNDERGRADUATE STUDY OF ELECTRICAL ENGINEERING

Rijeka, March 2024.

1. CURRICULUM DESCRIPTION

1.1. The list of compulsory and elective courses with the number of active classes required for their performance and ECTS credits

1. semester							
	Subject title	Hours / week					ECTS
		L	aT	IT	dT	L+T	
	Mathematics 1	3	3			6	7
	Physics	2	2			4	6
	Fundamentals of Electrical Engineering 1	3	2	1		6	8
	Software Applications	2		2		4	6
	Communication Skills	1	1			2	3
	TOTAL					**22**	**30**

L - lectures, aT – auditory tutorials, lT – laboratory tutorials, dT – design tutorials,

2. semester							
	Subject title	Hours / week					ECTS
		L	aT	IT	dT	L+T	
	Mathematics 2	3	3			6	7
	Fundamentals of Electrical Engineering 2	3	2	1		6	7
	Programming	2	1	1		4	7
	Materials in Electrical Engineering	2	1			3	5
	Engineering Graphics	2			2	4	4
	TOTAL					**23**	**30**

3. semester							
	Subject title	Hours / week					ECTS
		L	aT	IT	dT	L+T	
	Mathematics 3	3	4			7	7
	Electrical Circuits	3	1			4	7
	Electronics 1	3	1	1		5	7
	Fundamentals of Power Engineering and Sustainable Development	3	1			4	6
	English Language	1	2			3	3
	TOTAL					**23**	**30**

4. semester							
	Subject title	Hours / week					ECTS
		L	aT	IT	dT	L+T	
	Measurements in Electrical Engineering	3		2		5	6
	Digital Electronics	2	1	1		4	6
	Fundamentals of Automatic Control	2	1	1		4	6
	Elective Subject					4	6
Subject from elective group Automation:							
	Electronics 2	2	1	1		4	6
Subject from elective group Power Engineering:							
	Electrical Power Switchgear Installations	3	1	1	1	6	6
	TOTAL					**21A 23E**	**30**

Elective Subject							
	Subject title	Hours / week					ECTS
		L	aT	IT	dT	L+T	
	Fundamentals of Robotics	2	2			4	6
	Communication Networks	2	1	1		4	6
	Mechanics and Structural Elements	2	1	1		4	6

5. semester							
	Subject title	Hours / week					ECTS
		L	aT	IT	dT	L+T	
	Electrical Machines	3	1	1		5	6
	Power Electronics	2	2	1		5	6
	Signals and Systems	3	1			4	6
	Elective Project[1]				3	3	5
Subject from elective group Automation:							
	Industrial Automation	2			2	4	7
Subject from elective group Power Engineering:							
	Electrical Power Networks	3	1		1	5	7
	TOTAL					**21A 22E**	**30**

[1] Election from list of offered projects: Communication Networks, Digital Electronics, Electrical Circuits, Electrical Machines, Electrical Power Networks, Electrical Power Switchgear Installations, Electronics 1, Electronics 2, Fundamentals of Automatic Control, Fundamentals of Electrical Engineering 1, Fundamentals of Electrical Engineering 2, Fundamentals of Power Engineering and Sustainable Development, Fundamentals of Robotics, Industrial Automation, Mathematics 3, Measurements in Electrical Engineering, Power Electronics, Programming, Signals and Systems, Software Applications,.

6. semester							
	Subject title	Hours / week					ECTS
		L	aT	IT	dT	L+T	
	Electrical Drives	2	1	1		4	6
	Final Work						12
Subject from elective group Automation:							
	Automatic Control	3	1	1		5	6
	Embedded Computer Systems	2	1	1		4	6
Subject from elective group Power Engineering:							
	Control of Modern Electrical Power Systems	2	1	1		4	6
	Low Voltage Electrical Installations	2	1	1		4	6
	TOTAL					**13A 12E**	**30**

UNIVERSITY UNDERGRADUATE STUDY OF ELECTRICAL ENGINEERING TOTAL	Hours	ECTS
	123A 125E	180

Basic description		
Course title	**Automatic Control**	
Study programme	**University Undergraduate Study of Electrical Engineering**	
Course status	optional	
Year	**3.**	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	45+30+0

1.COURSE DESCRIPTION							
1.1. Course objectives							
The aim of the subject is adopting of theoretical and simulation knowledge from the automation field. Training students to simulate individually in Matlab with application of different control methods. Developing skills of individual and group work and results presentation.							
1.2. Course enrolment requirements							
Fundamentals of Automatic Control.							
1.3. Expected course learning outcomes							
Define basic terms and definitions in automation control field. Describe basic control structures and characteristics. Analyse linear control systems in time and frequency domain. Analyse stability of linear control systems. Apply PID regulator and other regulators developed from the PID regulator. Compare time and frequency domain graph-analytical and analytical control system design methods. Apply cascade control. Synthesise linear control systems in state space. Analyse controllability and observability of linear control systems.							
1.4. Course content							
Basic terms and definitions. Basic control structures and characteristics. Analysis of linear control systems in time and frequency domain. Stability of linear control systems. PID regulator and other regulators developed from the PID regulator. Time and frequency domain conventional and modern control system design: graph-analytical and analytical methods, cascade control - technical and symmetrical optimum, state space synthesis of linear control systems. Controllability and observability of linear control systems.							
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork		☒ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other				
1.6. Comments							
1.7. Student's obligations							
Course attendance, activity, simulation exercises, studying.							
1.8. Evaluation of student's work							
Course attendance	2.5	Activity/Participation		Seminar paper		Experimental work	

Written exam	1	Oral exam		Essay		Research	
Project		Sustained knowledge check	1.5	Report		Practice	
Portfolio		Simulation exercises	1				

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Written or oral explanation of simulation exercises, continuous knowledge testing (two partial exams), written or oral final exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

N. Perić: Automatic control, Fakultet elektrotehnike i računarstva, Zagreb, 2001. (in Croatian)

1.11. Optional / additional reading (at the time of proposing study programme)

D. Matika, D. Brnobić: Fundamentals of Automatic Regulation, Tehnički fakultet Rijeka, 2004. (in Croatian)
Z. Vukić, Lj. Kuljača: Automatic control - linear systems analysis, Kingen, d.o.o., Zagreb, 2005. (in Croatian)
J. D'Azzo, C. Houpis, S. Sheldon: Linear Control System Analysis and Design with Matlab: Fifth Edition, Marcel Dekker, Inc., New York, 2003.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
N. Perić: Automatic control, Fakultet elektrotehnike i računarstva, Zagreb, 2001. (in Croatian)	0 (Internet)	40

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution’s quality assurance system.

Basic description		
Course title	Communication Skills	
Study programme	University Undergraduate Study of Electrical Engineering	
Course status	compulsory	
Year	1.	
ECTS credits and teaching	ECTS student 's workload coefficient	3
	Number of hours (L+E+S)	15+15+0

1. COURSE DESCRIPTION

1.1. Course objectives

The aim of the course is to enable students to acquire knowledge and skills related to the fundamental communication needs of engineers both in the domestic and international environment, such as presenting professional content, writing CVs, job applicatons, emails and reports in English and Croatian.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

After attending the course and fulfilling all obligations, the students will be able to:
- apply the norms of the standard Croatian language in written and spoken public communication
- apply the norms of the standard English language in written and spoken public communication
- apply the skills of asking questions and present professional content
- apply the skills of writing official letters
- critically assess one`s own and others` communication skills
- negotiate and demonstrate the skill of assertive communication
- actively participate in teamwork

1.4. Course content

Introduction, active learning methods, learning styles. Verbal and non-verbal communication. Active listening. Questioning skills. Persuading and negotiation. Written communication: writing emails, CVs, job applications and reports. Presentation skills. Strategies for eliminating stage fright and fear of public speaking. Presentation of professional content. Communication and participation in group and teamwork. Critical assessment and providing feedback. Intercultural competence, cultural differences and etiquette.

1.5. Teaching method	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other _____
1.6. Comments	The course consists of: 1) lectures focused on a particular aspect of written and spoken public communication and 2) exercises in which the students solve specific language tasks from their field of profession, where they try to autonomosuly find and offer reasoned solutions, which are then commented on together, compared and valued.	

1.7. Student's obligations

Course attendance, active participation in the teaching process, autonomous learning.

1.8. Evaluation of student's work

Course attendance	1	Activity/Participation		Seminar paper	0.5	Experimental work	
Written exam	0.5	Oral exam		Essay	0.5	Research	
Project		Sustained knowledge check	0.5	Report		Practice	
Portfolio							

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Course attendance, knowledge check (1 midterm test), preparing and giving a presentation, writing emails, a CV, a job application and a report.

1.10. Assigned reading (at the time of the submission of study programme proposal)

John W. Davies (2001), Communication skills. Pearson education Limited.
Mirjana Matea Kovač, Nina Sirković (2014), Presentation, writing and interpersonal communication skills, FESB

1.11. Optional / additional reading (at the time of proposing study programme)

Thomas E. Harris, John C. Sherblom (2018), Small Group and Team Communication, Waveland Press
Kamilo Antolović, Nikša Sviličić (2020.), Komunikacijske vještine. Verbalne i neverbalne utjecajne tehnike, K&K promocija, Zagreb

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
John W. Davies (2001), Communication skills. Pearson Education Limited.	1	80
Mirjana Matea Kovač, Nina Sirković (2014), Presentation, writing and interpersonal communication skills, FESB	1	80

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Communication Networks**	
Study programme	**University Undergraduate Study of Electrical Engineering**	
Course status	**optional**	
Year	2.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

1. COURSE DESCRIPTION

1.1. Course objectives

Defining the principles of network operation and communication among devices. Describing the structure and architecture of networks and basic communication protocols. Developing the ability to use basic tools for the analysis and configuration of networks based on the TCP/IP and OSI models.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Upon successful completion of the course, students will be able to: Define basic measures of communication channels. Define the OSI reference model for computer system architecture. Describe the purpose of all layers in the OSI reference model. Compare the OSI and TCP/IP models. Describe commonly used protocols and represent them with finite state machines. Apply basic tools for the analysis and configuration of networks and network protocols. Implement simple simulations of networks and communication protocols. Describe types and examples of security threats in the context of network systems. Perform basic configuration of network devices.

1.4. Course content

Organization of communication networks. Basic measures of communication channels - channel capacity, bandwidth, signal-to-noise ratio, throughput. TCP/IP model. OSI reference model. Physical layer in the OSI model: theoretical foundations, media, construction of the physical layer. Data link layer. Error detection and correction. Finite state machines. Examples of network protocols. Device addressing in networks. IEEE standard 802. Network layer. Traffic routing algorithms. Elements and services of the transport layer. Application layer. Internet applications and application protocols. Security. Discrete simulation of communication networks. Basic tools for working with and setting up communication networks, OpenWrt. Application of communication networks in electrical engineering.

1.5. Teaching method	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork	☐ individual assignment ☐ multimedia and network ☒ laboratories ☐ mentorship ☐ other _____
1.6. Comments		

1.7. Student's obligations

Attending lectures, completing homework assignments, conducting laboratory exercises, and taking written exams.

1.8. Evaluation of student's work

Course attendance	2	Activity/Participation		Seminar paper		Experimental work	
Written exam	1	Oral exam		Essay		Research	
Project		Sustained knowledge check	2	Report		Practice	1
Portfolio							

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Attending lectures, completing homework assignments, conducting laboratory exercises, and taking written exams.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Radovan, M.: Računalne mreže (1), Rijeka, Digital point tiskara, 2010.

Radovan, M.: Računalne mreže (2), Rijeka, Digital point tiskara, 2011.

1.11. Optional / additional reading (at the time of proposing study programme)

Kurose, J.F., Ross K.W.: Computer Networking: A Top-Down Approach, 6th Edition, Pearson Education, 2012.
Hunt, C.: TCP/IP Network Administration, 3rd Edition, O'Reilly Networking, 2002.
G. Davies: Networking Fundamentals, 1st Edition, Packt Publishing, 2019

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Računalne Mreže	1	50

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	Control of Modern Power Systems	
Study programme	University Undergraduate Study of Electrical Engineering	
Course status	optional	
Year	3	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

1. COURSE DESCRIPTION

1.1. Course objectives

Understanding basic concepts in the field of control and automation in modern power systems. Obtaining an insight into problems related to the control of conventional power production units, namely synchronous generators, as well as grid-tied power converters and renewable energy sources.

1.2. Course enrolment requirements

Fundamentals of Automatic Control.

1.3. Expected course learning outcomes

Ability to: describe basic terms and concepts in the field of automatic control; design and analyze linear control system in time and frequency domain; understand the operational principle and to model basic power system components such as energy conversion systems, power transformers, grid-tied inverters, etc.; apply well-known linear control techniques for solving ongoing problems in modern power systems such as excitation control of synchronous generators, active and reactive power control of grid-tied converters, power system inertia support by means of synchroconverters, etc.

1.4. Course content

Introduction to modern power systems and the application of control theory for enhancing their operation. Time- and frequency-domain analysis of linear systems. Conventional P-, PI- and PID-type controller, two-degree-of-freedom (2DOF) controllers. Cascade control. State-space analysis and control design. Operational principle and reduced-order modeling of synchronous generators, power transformers, and renewable energy sources. Excitation control of synchronous generators. Introduction to reference frame theory and vector control. Modeling and control of grid-tied voltage source converters (VSCs). Phase-locked loops (PLLs) and synchronization of grid-tied VSCs. Analysis and operation of gried-tied VSCs under unbalanced grid conditions. Power system inertia support and synchroconverters. Control of synchroconverters.

1.5. Teaching method	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☒ laboratories ☐ mentorship ☐ other _____
1.6. Comments		

1.7. Student's obligations

Course attendance, activity, simulation exercises, studying.

1.8. Evaluation of student's work

Course attendance	2	Activity/Participation		Seminar paper		Experimental work	
Written exam	1	Oral exam		Essay		Research	
Project		Sustained knowledge check	2	Report		Practice	1
Portfolio							

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Written and oral elaboration of previously performed simulation and/or laboratory excercises, continuous knowledge examination through partial exams, written and oral final exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Kalea, Marijan.: Obnovljivi izvori energije, Kiklos - krug knjige, Zagreb, 2014.

Kuljača, Lj., Vukić, Z.: Automatsko upravljanje – analiza linearnih sustava. Zagreb; Kigen, d.o.o., 2004.

1.11. Optional / additional reading (at the time of proposing study programme)

Masoud Karimi-Ghartemani: Modeling and Control of Modern Electrical Energy Systems, Wiley, 2022
J. Machowski, Z. Lubosny, J. Bialek, J. Bumby: Power System Dynamics: Stability and Control (3rd edition), Wiley, 2020.
Vijay Vittal, James D. McCalley, Paul M. Anderson, A. A. Fouad: Power System Control and Stability, 3rd Edition, Wiley, 2019
P. Kundur: Power System Stability and Control, McGraw-Hill, Inc, 1994

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Obnovljivi izvori energije	6	40
Automatsko upravljanje – analiza linearnih sustava	5	40

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Digital Electronics**	
Study programme	**University Undergraduate Study of Electrical Engineering**	
Course status	compulsory	
Year	**2.**	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

1. **COURSE DESCRIPTION**							
1.1. Course objectives							
Understanding basic concepts of digital logic and operation of logic circuits. Understanding basic methods for analysing and designing combinational and sequential digital circuits and systems. Developing the ability of analysing, synthesizing and solving problems.							
1.2. Course enrolment requirements							
None.							
1.3. Expected course learning outcomes							
Defining logical levels and basic characteristics of digitals signals. Applying various number systems. Using various codes to express digital data. Defining the Boolean algebra axioms and basic theorems. Minimizing logical functions. Distinguishing AND-OR, AND-OR complement, XOR and NOR logic. Using various combinational logic circuits and functions. Explaining operational principles and applications of sequential logic circuits.							
1.4. Course content							
Basic digital concepts: digital and analog quantities, logic levels, digital signals, digital systems. Number systems and operations: decimal, binary, octal and hexadecimal system, complement of number. Error detection and correction codes; weighted and unweighted codes, Hamming code. Boolean Algebra; axioms and theorems, Boolean functions, standard form of function, truth table. Minimization of logic functions: Karnaugh map, Quine–McCluskey algorithm. Combinational logic circuits; AND-OR, AND-OR complement, XOR and exclusive NOR. Universal properties of NAND and NOR logic gates. Functions of combinational logic; adders, comparators, coders, decoders, multiplexors, demultiplexors. Latches: S-R latch, J-K latch and edge triggered flip-flops, applications. Counters; asynchronous, synchronous, design of counters, applications. Shift registers; basic and bidirectional registers, applications.							
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork			☒ individual assignment ☐ multimedia and network ☒ laboratories ☐ mentorship ☐ other			
1.6. Comments	-						
1.7. Student's obligations							
Course attendance, laboratory exercises, individual studying.							
1.8. Evaluation of student's work							
Course attendance	2	Activity/Participation		Seminar paper		Experimental work	

Written exam	1	Oral exam		Essay		Research	
Project		Sustained knowledge check	1.5	Report		Practice	1.5
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Sustained knowledge check (tests), laboratory exercises, written exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

A. P. Godse and D. A. Godse: Digital Logic Circuits, Technical Publications, 2011.
U. Peruško i V. Glavinić: Digital Systems, Školska knjiga, 2005. (in Croatian)

1.11. Optional / additional reading (at the time of proposing study programme)

T. L. Floyd: Digital Fundamentals, 10/E, Prentice Hall, 2009.
M. M. Mano and M. D. Ciletti: Digital Design, 4/E, Prentice Hall, 2007.
W. Kleitz: Digital Electronics with VHDL, Prentice Hall, 2006.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
A. P. Godse and D. A. Godse: Digital Logic Circuits, Technical Publications, 2011.	1	70
U. Peruško i V. Glavinić: Digital Systems, Školska knjiga, 2005. (in Croatian)	5	70

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Elective Project**	
Study programme	**University Undergraduate Study of Electrical Engineering**	
Course status	optional	
Year	**3.**	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	0+45+0

1. **COURSE DESCRIPTION**			
1.1. Course objectives			
Application of acquired knowledge and skills to solve practical problems in the field of associated course from which the project is elected.			
1.2. Course enrolment requirements			
Enrolled course from which the project is elected.			
1.3. Expected course learning outcomes			
Apply the knowledge and skills from professional content of the associated course. Solve practical task. Acquire competence for individually solving specific professional tasks.			
1.4. Course content			
Chosen chapter of associated course from which the project was elected.			
1.5. Teaching methods	☐ lectures ☐ seminars and workshops ☐ exercises ☐ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☐ laboratories ☒ mentorship ☐ other	
1.6. Comments			
1.7. Student's obligations			
Attending the consultation, individually solving task and writing the project report.			
1.8. Evaluation of student's work			

Course attendance		Activity/Participation		Seminar paper		Experimental work	
Written exam		Oral exam		Essay		Research	
Project	2	Sustained knowledge check		Report		Practice	
Portfolio		Individual task solving	3				

1.9. Procedure and examples of learning outcome assessment in class and at the final exam
Assesses and evaluates the accuracy and completeness of the project task solution and its presentation.
1.10. Assigned reading (at the time of the submission of study programme proposal)
References listed for the associated course from which the project is elected.

1.11. Optional / additional reading (at the time of proposing study programme)

References listed for the associated course from which the project is elected.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Electrical Circuits**	
Study programme	**University Undergraduate Study of Electrical Engineering**	
Course status	compulsory	
Year	**2.**	
ECTS credits and teaching	ECTS student 's workload coefficient	7
	Number of hours (L+E+S)	45+15+0

1. **COURSE DESCRIPTION**							
1.1. Course objectives							
Understanding of relationship between electrical parameters in electrical circuits. Ability of solving circuits and behaviouring determination of electrical circuits. Ability of solving given problem to determinate state in electrical circuits. From basic competencies ability of analysis and basic computing skils will be developed.							
1.2. Course enrolment requirements							
Fundamentals of Electrical Engineering 2.							
1.3. Expected course learning outcomes							
1. Choose and apply proper method for solving and analysis linear and time continued electrical circuits in term to obtain time responses. 2. Valorize solutions obtained by circuits analysis. 3. Apply circuit theorems and assess obtained solutions. 4. Calculate imitance functions and transfer functions and on that basis assess circuit frequency response. 5. Calculate basic and mirror twoports parameters. 6. Anayze circuits which contains transmission lines and assess obtained results.							
1.4. Course content							
Definition and principal laws of electrical circuits. Elements of circuits. Kirchhoff's laws. Circuits equations at time domain and frequency domain. Free and forced circuit response. Topology analysis. Circuits theorems. Circuit functions and it's properties. First and second order circuits. Equations and parameters of two-port and multi-port circuits. Mirror parameters. Characteristics and connections of two-ports. Electrical filters. Circuits with distributed parameters. Ideal line and special cases of lines.							
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork			☒ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other			
1.6. Comments							
1.7. Student's obligations							
Course attendance, homework, written exam.							
1.8. Evaluation of student's work							
Course attendance	2	Activity/Participation		Seminar paper		Experimental work	

Written exam	1.5	Oral exam		Essay		Research	
Project	0.5	Sustained knowledge check	3	Report		Practice	
Portfolio							

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Course attendance, activity, homework, continuous knowledge testing, written exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

N. Stojković, V. Naglić, N. Mijat: Theory of networks and lines, Tehnički fakultet, Rijeka, 2005. (in Croatian)
N. Stojković: Theory of networks and lines – problems collection, Tehnički fakultet, Rijeka, 2005. (in Croatian)

1.11. Optional / additional reading (at the time of proposing study programme)

Ivanšić, I.: Function of complex variable and Laplace transformation, Sveučilišna naklada Liber, Zagreb, 1978. (in Croatian)

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
N. Stojković, V. Naglić, N. Mijat: Theory of networks and lines, Tehnički fakultet, Rijeka, 2005. (in Croatian)	10	100
N. Stojković: Theory of networks and lines – problems collection, Tehnički fakultet, Rijeka, 2005. (in Croatian)	10	100

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Electrical Drives**	
Study programme	**University Undergraduate Study of Electrical Engineering**	
Course status	compulsory	
Year	**3.**	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

1. **COURSE DESCRIPTION**							
1.1. Course objectives							
Understanding the basic concepts and the requirements of the electrical drives. Specific qualities of the different machines in the electrical drives. Understanding the structure of electrical drives. Define the mathematical model of electrical drives.							
1.2. Course enrolment requirements							
Fundamentals of Automatic Control.							
1.3. Expected course learning outcomes							
Description of the physical working principle of the electrical drives. Description of characteristic types of the electrical drives and loads. Definition of the static characteristic of standard electrical drives. Comparison of qualities between different electrical machines in electrical drives. Comparison of advantages and drawbacks between different control systems for particular electrical drive types. Mathematical description of the electrical drive and development of the simulation model of the electrical drive.							
1.4. Course content							
Basic concepts. Fundamentals of the rotating machines. Torque characteristics of the loads. Direct current machines with separately or in series excitation in different types of the electrical drives. Speed control of the direct current machines with separated or in series excitation. Dynamic response of the direct current machine with separated excitation. Induction machine: structure, static characteristics and basic types of the speed control. Scalar control (voltage over frequency) of the induction machine. Basic concepts of frequency converters. Synchronous machines in the motoring and the regenerative mode, their characteristics, applications and associated problems. Frequency conveters for synchronous machines. Special electrical drives. Losses in electrical drives during dynamics states.							
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork		☒ individual assignment ☐ multimedia and network ☒ laboratories ☐ mentorship ☐ other				
1.6. Comments							
1.7. Student's obligations							
Course attendance, activities in class, writing laboratory reports, studying							
1.8. Evaluation of student's work							
Course attendance	2	Activity/Participation		Seminar paper		Experimental work	0.5

Written exam	1.5	Oral exam		Essay		Research	
Project		Sustained knowledge check	2	Report		Practice	
Portfolio							

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Course attendance, activities in class, sustained knowledge checks (midterm exam), written and oral exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

B. Jurković: Elektromotorni pogoni, Školska knjiga, Zagreb, 1986.
Ion Boldea, Syed A. Nasar Electric Drives Prentice Hall, 2006.

1.11. Optional / additional reading (at the time of proposing study programme)

W. Leonhard: Control of Electrical Drives, Springer Verlag, 1996.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
B. Jurković: Elektromotorni pogoni, Školska knjiga, Zagreb, 1986.	8	60
Ion Boldea, Syed A. Nasar Electric Drives Prentice Hall, 2006.	2	60
W. Leonhard: Control of Electrical Drives, Springer Verlag, 1996.	2	60

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance systems.

Basic description		
Course title	Electrical Machines	
Study programme	University Undergraduate Study of Electrical Engineering	
Course status	compulsory	
Year	3.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	45+30+0

1. COURSE DESCRIPTION

1.1. Course objectives

To provide students with theoretical and practical knowledge about the basic concepts and principles of operation of static and rotary electrical machines. By defining the stationary states of electrical machines, establish a basis for their evaluation and selection. During the procedure of testing electrical machines in laboratory conditions, develop students' awareness of the immediate application of acquired knowledge.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Upon successful completion of the course, students will:

1. correctly asess the choice of the type of electrical machine to be used depending on the work process,
2. perform calculations of electrical machines in a stationary state on the basis of their equivalent circuit,
3. draw conclusions about their impact on the power grid,
4. examine the basic operating conditions of electrical machines in laboratory conditions (insulation resistance test, transformer open-circuit and short-circuit test; start-up and speed regulation of an asynchronous motor; synchronization and island operation of a synchronous generator, etc.).

1.4. Course content

Fundamentals of electromechanical energy conversion. Magnetic field and basics of magnetic circuits. Hysteresis and eddy current losses. Principle of transformer operation. Equivalent circuit and description of transformer operating states. Parallel grid operation and special types of transformers. Principle of operation and types of synchronous machines. Excitation systems. Vector-phasor diagram. Equivalent circuit and description of the synchronous machine operating states. Regulation of the frequency and voltage for the case of island operation and grid operation of synchronous generator. Synchronization. PQ diagram of the synchronous generator. Principle of operation and types of asynchronous (induction) machines. Equivalent circuit and description of the operating states of the asynchronous motor. Starting and rotation speed regulation of asynchronous motors. Principle of operation and types of DC machines. Types of excitation circuits and description of their external characteristics. Speed regulation of DC motors.

1.5. Teaching method		
	☒ lectures	☐ individual assignment
	☐ seminars and workshops	☐ multimedia and network
	☒ exercises	☒ laboratories
	☐ long distance education	☐ mentorship
	☐ fieldwork	☐ other _____

1.6. Comments	

1.7. Student's obligations

Attendance of classes and laboratory exercises, activity in class, continuous verification of knowledge, final exam.

1.8. Evaluation of student's work

Course attendance	2	Activity/Participation		Seminar paper		Experimental work	
Written exam	1	Oral exam		Essay		Research	
Project		Sustained knowledge check	2	Report		Practice	1
Portfolio							

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Attendance of classes and laboratory exercises, activity in class, continuous verification of knowledge, final exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

R. Prenc: Električni strojevi, elektronički nastavni materijali, 2020.
B. Skalicki, J. Grilec: Električni strojevi i pogoni, Fakultet strojarstva i brodogradnje, Sveučilište u Zagrebu, 2005.
I. Mandić, V. Tomljenović, M. Pužar: Sinkroni i asinkroni električni strojevi, Tehničko veleučilište u Zagrebu, 2012.
R. Wolf: Osnove električnih strojeva, Školska knjiga, Zagreb, 1991.

1.11. Optional / additional reading (at the time of proposing study programme)

G.R. Slemon: Electric Machines and drives: Addison –Wesley , 1992.
N. Mohan: Electric Drives, MNPERE, 2003.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
B. Skalicki, J. Grilec: Električni strojevi i pogoni, Fakultet strojarstva i brodogradnje, Sveučilište u Zagrebu, 2005.	5	60
R. Wolf: Osnove električnih strojeva, Školska knjiga, Zagreb, 1991.	5	60

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Electrical Power Switchgear Installations**	
Study programme	**University Undergraduate Study of Electrical Engineering**	
Course status	optional	
Year	**2.**	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	45+45+0

1. **COURSE DESCRIPTION**							
1.1. Course objectives							
The course is a basic professional discipline for all the students of the electric power system studies. The goal is to introduce the students to plants and elements for generation, transmission and distribution of electric energy in industry and electroenergetics.							
1.2. Course enrolment requirements							
None.							
1.3. Expected course learning outcomes							
Classification and basic characteristics of high voltage and low voltage electrical plants in industry and electroenergetics. Description and performance of electrical plants. Methods for calculation of short circuit currents and calculations used for definition of the characteristics of necessary equipment for electrical plants, generation plants and power system in general.							
1.4. Course content							
Voltage and current stresses in electrical plants. Peak short circuit current, breaking short circuit current, thermal short circuit current. Selection of electrical plant elements and configuration regarding voltage level and role in the system. Symmetrical and unsymmetrical three-phase systems. Sequence impedances of power system elements. Auxiliary devices in electrical plants: control, measurement, signal and protection devices. Dimensioning of busbars and selection of post and bushing insulators. Phenomena during breaking currents; types and selection of breakers. Disconnectors and high voltage fuses. Measuring transformers. Surge arresters. Operational and protection grounding system in electrical plants. Operational measurements in electrical plants. Supply sources and auxiliary operations for distribution of supply.							
1.5. Teaching methods	☒ lectures ☒ seminars and workshops ☒ exercises ☐ long distance education ☒ fieldwork		☐ individual assignment ☐ multimedia and network ☒ laboratories ☐ mentorship ☐ other				
1.6. Comments							
1.7. Student's obligations							
Course attendance, activity, seminar paper, studying.							
1.8. Evaluation of student's work							
Course attendance	2	Activity/Participation		Seminar paper		Experimental work	

Written exam	1	Oral exam		Essay		Research	
Project		Sustained knowledge check	1.5	Report		Practice	1.5
Portfolio							

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Course attendance, activity, seminar paper, continuous knowledge testing (three mid-term exams), written exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

H. Požar: High-voltage switchgear, Tehnička knjiga, Zagreb, 1990. (In Croatian)
H. Požar:Electrical Plants, Školska knjiga, Zagreb, 1990. (In Croatian)

1.11. Optional / additional reading (at the time of proposing study programme)

H. Požar: Production of electricity, University of Zagreb, Zagreb, 1962

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
H. Požar: High-voltage switchgear, Tehnička knjiga, Zagreb, 1990. (In Croatian)	1	40
H. Požar:Electrical Plants, Školska knjiga, Zagreb, 1990. (In Croatian)	1	40

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution’s quality assurance system.

Basic description		
Course title	**Electrical Power Networks**	
Study programme	**University Undergraduate Study of Electrical Engineering**	
Course status	optional	
Year	**3.**	
ECTS credits and teaching	ECTS student 's workload coefficient	7
	Number of hours (L+E+S)	45+30+0

1. **COURSE DESCRIPTION**		
1.1. Course objectives		
Obtaining physical understanding of electrical parameters in electrical power networks and their correlation under different operating conditions. The ability to model, analyse and determine electrical conditions in electrical power networks. The ability to solve problems with a goal of analysis or optimal development of electrical power networks.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Describe the elements of electrical power networks. Define the equivalent models of electrical power network elements. Analyse the electrical conditions in electrical power networks. Perform the load flow calculation of electrical power networks. Perform the short circuit calculation of electrical power networks. Analyse the stability state of electrical power networks. Perform the reliabilty analysis of electrical power networks. Perform the calculation of voltage drop and electrical power losses in radial electrical power networks. Define the conditions of electrical power networks' development. Describe the characteristics of transmission and distribution electrical networks.		
1.4. Course content		
Definition, structure and main division of electrical power networks. The historical development of electrical power networks. The elements of electrical power networks. The electrical parameters of electrical power network elements. Resistance, inductive reactance and capacitive reactance of the electrical power network elements. The equivalent models of network elements. The composition of equivalent models. Quadripoles. Matix operation for the analysis of electrical power networks and the composition of matrices. The type of calculations in electrical power networks. Load flow calculation. Voltage drop and power flow calculation. Star point earthing in electrical power networks. The analysis and short circuit calculation in electrical power networks. The stability of electrical power networks and its calculation. The analysis of medium voltage and low voltage electrical power networks. The theoretical introduction in transimission power networks. The theoretical introduction in distribution power networks. The load forecast and the planning of the development of electrical power networks.		
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☒ laboratories ☐ mentorship ☐ other
1.6. Comments		
1.7. Student's obligations		

Course attendance, activity, homework, studying.

1.8. Evaluation of student's work

Course attendance	2.5	Activity/Participation		Seminar paper		Experimental work	
Written exam	1	Oral exam	0.5	Essay		Research	
Project	1	Sustained knowledge check	2	Report		Practice	
Portfolio		Homework					

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Course attendance, activity, homework – construction projects, continuous knowledge testing (three mid-term exams), written and oral exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

M. Ožegović, K. Ožegović: Electrical Power Networks I-VI, FESB Split, 1996.-2008. (In Croatian)
Course materials in electronic form.

1.11. Optional / additional reading (at the time of proposing study programme)

J. Grainger, W. Stevenson: Power System Analysis, McGrow-Hill, 1994.
B. Debs: Modern Power System Control and Operation, DSI, Atlanta, 1996.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
M. Ožegović, K. Ožegović: Electrical Power Networks I-VI, FESB Split, 1996.-2008. (In Croatian)	8	40

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Electronics 1**	
Study programme	**University Undergraduate Study of Electrical Engineering**	
Course status	compulsory	
Year	**2.**	
ECTS credits and teaching	ECTS student 's workload coefficient	7
	Number of hours (L+E+S)	45+30+0

1. COURSE DESCRIPTION

1.1. Course objectives

Understanding of physical relations in semiconductors in electric field. Understanding of operating and behavioring of electronics devices. Ability of solving set problem in terms of calculating electrical values in semiconductor material and electronics devices. Understanding operation of basic circuits using bipolar and unipolar transistors. From basic competencies ability of analysis and basic computing skills will be developed.

1.2. Course enrolment requirements

Fundamentals of Electrical Engineering 1.

1.3. Expected course learning outcomes

1. Analyze and valorize physical phenomena in semiconductor material with and without electrical field affect.
2. Asses rectifiers effect of *pn*-junction and metal-semiconductor junction.
3. Analyze and valorize operation of semiconductor diode in statical and dynamical conditions.
4. Analyze and valorize operation of basic semiconductor optoelectronics components.
5. Analyze and valorize operation of bipolar transistor in statical and dynamical conditions.
6. Analyze and valorize operation of unipolar transistors in statical and dynamical conditions.
7. Measure current-voltage characteristics of basic semiconductor electronics elements.
8. Analyze and valorize operation of circuits using bipolar transistors.
9. Analyze and valorize operation of circuits using unipolar transistors.
10. Analyze basic stages of bipolar transistors amplifiers.

1.4. Course content

Introduction to electronics. Semiconductor materials. Physical properties of semiconductors. Currents in semiconductors. Planar technology on silicon. Theory *pn*-junction. Semiconductor *pn* diode. Optoelectronics devices. Principle of operation and basic construction of bipolar *npn* and *pnp* transistor. Transistor operation region. Transistor orientations. Ebers-Moll equations and corresponding substitution models. Statical characteristics. Real transistors. Transistor dynamical parameters for small-signal operation. High-frequency transistor properties. Principle of operation and basic construction of junction transistor with field effect. Operation region of JFET. Statical characteristics of *n*- and *p*-channel JFET. Dynamical parameters of JFET. Substitution models of JFET. Principle of operation and basic construction of unipolar MOS transistora with field effect. Operation region of MOSFET. Statical characteristics of *n*- and *p*-channel MOSFET. Scaling of MOSFET. Dynamical parameters of MOSFET for small-signal operation. Substitution models of MOSFET. CMOS inverter. Operation analysis of circuits using bipolar transistors. Operation analysis of circuits using unipolar transistors. Basic stages of bipolar transistors amplifiers.

1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork	☐ individual assignment ☐ multimedia and network ☒ laboratories ☐ mentorship ☐ other
1.6. Comments		

1.7. Student's obligations

Course attendance, laboratory work, written exam.

1.8. Evaluation of student's work

Course attendance	2	Activity/Participation		Seminar paper		Experimental work	
Written exam	2	Oral exam		Essay		Research	
Project		Sustained knowledge check	3	Report		Practice	
Portfolio							

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Course attendance, laboratory work, continuous knowledge testing, written exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

P.Biljanović, Poluvodički elektronički elementi, Školska knjiga Zagreb, 2004.
P.Biljanović, Elektronički sklopovi, Školska knjiga Zagreb, 2001.
J. Šribar, J. Divković-Pukšec, Elektronički elementi, zbirka riješenih zadataka i izvoda, I i II dio, Element, Zagreb, 1996.

1.11. Optional / additional reading (at the time of proposing study programme)

P.Biljanović, Mikroelektronika, Školska knjiga Zagreb, 2001.
S.M.Sze, Physics of Semiconductor Devices, New Jersey: J. Wiley &Sons, Inc. Publication, 2007.
A.S.Sedra, K.C. Smith, Microelectronic Circuits, 5th edit, N. York, Oxford, Uni. Press, 2004.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
P.Biljanović, Poluvodički elektronički elementi, Školska knjiga Zagreb, 2004.	10	80
J. Šribar, J. Divković-Pukšec, Elektronički elementi, zbirka riješenih zadataka i izvoda, I i II dio, Element, Zagreb, 1996.	10	80
P.Biljanović, Elektronički sklopovi, Školska knjiga Zagreb, 2001.	10	80

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Electronics 2**	
Study programme	**University Undergraduate Study of Electrical Engineering**	
Course status	optional	
Year	**2.**	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

1. **COURSE DESCRIPTION**							
1.1. Course objectives							
Students will be able to describe and analyse transistor circuits in typical configurations.							
1.2. Course enrolment requirements							
None.							
1.3. Expected course learning outcomes							
Analyze the transistor using the large signal model. Analyze the transistor using the small signal model. Analyze different transistor amplifier configurations. Analyze amplifier's frequency response. Describe amplifiers with feedback loop. Analyze operational amplifier. Describe and analyze CMOS logic circuits.							
1.4. Course content							
Circuits with bipolar transistors. Basic transistor amplifier configurations. Differential amplifiers. Cascaded amplifiers. Power amplifiers. Operational amplifiers. Amplifier frequency response. Feedback amplifiers. Stability of feedback amplifiers. Basic CMOS logic circuits. ECL circuits.							
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork			☒ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other			
1.6. Comments	-						
1.7. Student's obligations							
Course attendance, activity, homework, studying.							
1.8. Evaluation of student's work							
Course attendance	2	Activity/Participation		Seminar paper		Experimental work	
Written exam	1	Oral exam		Essay		Research	
Project	1	Sustained knowledge check	2	Report		Practice	
Portfolio							
1.9. Procedure and examples of learning outcome assessment in class and at the final exam							
Course attendance, activity, project work, continuous knowledge testing (three mid-term exams), written exam.							

1.10. Assigned reading (at the time of the submission of study programme proposal)

Ž. Butković: Elektronics 2, Zagreb 2010. (in Croatian)
P. Biljanović: Electronic Circuits, 2 ed., Školska knjiga, Zagreb, 1993. (in Croatian)

1.11. Optional / additional reading (at the time of proposing study programme)

R. C. Jaeger and T. N. Blalock, Microelectronic Circuit Design, 3rd ed, McGraw Hill, 2008.
Sedra, A.S., Smith, K.C., Microelectronic Circuits, 5th ed, Oxford University Press, 2004.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Ž. Butković: Elektronics 2, Zagreb 2010. (in Croatian)	5	50
P. Biljanović: Electronic Circuits, 2 ed., Školska knjiga, Zagreb, 1993. (in Croatian)	5	50

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Embedded Computer Systems**	
Study programme	**Undergraduate University Study of Electrical Engineering**	
Course status	optional	
Year	3.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

1. COURSE DESCRIPTION		
1.1. Course objectives		
Introduction to embedded computer systems, their basic architecture and installation within electrical digital/analog systems. Mastering the development environment (IDE) for programming embedded computer systems and acquiring basic knowledge for creating systems based on embedded computer systems.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
After passing the course, the student should be able to: • Describe the standard architecture of embedded computer systems • Describe the structure of the control unit, bus, memory, clock generation, supply voltage and system reset • Application of development environment/tools for programming, analysis and validation of embedded computer systems (simulators, emulators, debuggers) • Determine the key parameters and registers of the embedded computer system • Use and management of interrupts • Describe and apply embedded computer system peripherals: analog-digital I/O, AD and DA conversion, Timers, counters, PWM, EEPROM, serial communication protocols: UART, SPI, I2C • Realize and verify the operation of algorithms for solving specific problems in built-in applications system		
1.4. Course content		
Introduction to embedded computer systems. Basic microcontroller architecture, power source and diagnostics, clock and reset generation. Control unit: registers, ALU, instruction cycle. Bus, memory, data types and storage. Machine language. Serial-USB interface, ICSP, Emulators, Simulators. Development environment and introduction to creating programs for embedded computer systems. Debugging. Use of interrupts in the program structure. Peripheral functions: Analog-digital I/O, analog-digital and digital-analog conversion. Peripheral functions: Timers, counters, PWM, CCP. Peripheral functions: EEPROM and Flash memory. Serial communication protocols: UART, SPI, I2C.		
1.5. Teaching method	☒ lectures ☐ seminars and workshops ☐ exercises ☐ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☒ laboratories ☐ mentorship ☐ other _____
1.6. Comments		
1.7. Student's obligations		

Attending classes, prepared participation in laboratory exercises, independent study.

1.8. Evaluation of student's work

Course attendance	1	Activity/Participation	1	Seminar paper		Experimental work	
Written exam		Oral exam		Essay		Research	
Project	1	Sustained knowledge check	2	Report		Practice	1
Portfolio							

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Attending classes, activity in class, independent performance of laboratory exercises, project, continuous verification of knowledge.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Crisp J. Introduction to Microprocessors and Microcontrollers, 2nd Eddition, 2004

1.11. Optional / additional reading (at the time of proposing study programme)

Bates M. PIC Microcontrollers: An Introduction to Microelectronics 3rd Eddition, 2012
Wayne W. Computers as Components: Principles of Embedded Computer Systems Design, 2008
Rafiquzzaman M. Microcontroller Theory and Applications with the PIC18F 2nd Eddition, 2018

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Crisp J. Introduction to Microprocessors and Microcontrollers, 2nd Eddition, 2004	1	40

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Engineering Graphics**	
Study programme	**University Undergraduate Study of Electrical Engineering**	
Course status	compulsory	
Year	1.	
ECTS credits and teaching	ECTS student 's workload coefficient	4
	Number of hours (L+E+S)	30+30+0

1. COURSE DESCRIPTION		
1.1. Course objectives		
Acquiring knowledge required for the desing and interpretation of technical documentation using traditional tools and computer techniques. Developing the ability to visualize and use graphics as a system for engineering communication in which ideas are expressed clearly and in accordance with standards.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Define and explain the concept of engineering graphics. Interpret the technical drawing. Select the appropriate shape description method to display the object. Create technical doccumentation using traditional and CAD techniques in accordance with standards. Create drawing documentation in electrical engineering.		
1.4. Course content		
Graphic communicationa. Sketching. Traditional and CAD techniques. The role of engineering graphics. Formation of simple geometric bodies and complex objects. Shape description: projection theory, multi-view and cross-sectional drawings, axonometric representations. Standardization and standards. Creation of technical documentation in accordance with standards. Drawing documentation in electrical engineering.		
1.5. Teaching method	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other _____
1.6. Comments	-	
1.7. Student's obligations		
Course attendance and activity (lectures, exercises), solving program assignments, studying.		
1.8. Evaluation of student's work		

Course attendance	2	Activity/Participation		Seminar paper		Experimental work	
Written exam		Oral exam		Essay		Research	
Project		Sustained knowledge check	0,5	Report		Practice	
Portfolio		Program	1,5	Homework			

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Program assignments, continuous knowledge testing

1.10. Assigned reading (at the time of the submission of study programme proposal)

M. Kljajin, M. Opalić: Inženjerska grafika, Strojarski fakultet u Slavonskom Brodu, Slavonski Brod, 2016. – drugo dopunjeno izdanje
M. Kljajin, M. Opalić: Inženjerska grafika, Strojarski fakultet u Slavonskom Brodu, Slavonski Brod, 2010.
G. Marunić, J. Butorac, S. Troha: Inženjerska grafika, Zbirka zadataka iz opisa oblika, Zigo Rijeka, Rijeka, 2008.
Lecture materials

1.11. Optional / additional reading (at the time of proposing study programme)

D.K. Lieu, S. Sorby: Visualization, Modeling, and Graphics for Engineering Design, Delmar Cengage Learning, 2009.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
M. Kljajin, M. Opalić: Inženjerska grafika, Strojarski fakultet u Slavonskom Brodu, Slavonski Brod, 2016. – drugo dopunjeno izdanje	3	90
M. Kljajin, M. Opalić: Inženjerska grafika, Strojarski fakultet u Slavonskom Brodu, Slavonski Brod, 2010.	10	90
G. Marunić, J. Butorac, S. Troha: Inženjerska grafika, Zbirka zadataka iz opisa oblika, Zigo Rijeka, Rijeka, 2008.	10	90
Materijali s predavanja	web	90

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution’s quality assurance system.

Basic description		
Course title	**English Language**	
Study programme	**University Undergraduate Study of Electrical Engineering**	
Course status	compulsory	
Year	2.	
ECTS credits and teaching	ECTS student 's workload coefficient	3
	Number of hours (L+E+S)	15+30+0

1. COURSE DESCRIPTION

1.1. Course objectives

Students should be able to use general purpose English as well as technical jargon at the elementary level according to the Common European Framework of Reference for Languages (B1-B2 level).

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Students should be able to compare general English with technical English on the basis of selected texts and topics. Recognise and explain grammatical structures and principles typical of the professional jargon from selected texts/examples. Implement grammatical structures and aspects in written and oral communication. Recognise terminology, key words and/or information in selected texts as well as differentiate and analyse relevant elements in them. Describe and interpret accurately diagrams, charts, figures and mathematical formulae. Present the advantages and disadvantages in covered units. Express one`s point of view and evaluate solutions of given problems both in oral and written form.

1.4. Course content

Topics: Engineering profession. Mathematical formulae. Fundamentals of electrical engineering. Materials in electrical engineering. Energy and forms of energy. Renewable and unrenewable energy sources. Capacitance. Introduction to electric power systems. Conduction and transmission of electric current. Electric generators and motors. Computer essentials. Globalisation.
Grammatical and language structures: Tenses. Passive. Modal verbs. Articles. Nouns. Word formation. Adjectives and comparison of adjectives. Relative Clauses. Participles. Conditional clauses. Prefixes and suffixes.

1.5. Teaching method	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other _____
1.6. Comments	The course consists of lectures focused on selected topics from the field of profession and exercises in which the students solve specific language tasks	

1.7. Student's obligations

Course attendance, active participation in the teaching process, autonomous learning.

1.8. Evaluation of student's work

Course attendance	1	Activity/Participation		Seminar paper	0.5	Experimental work	
Written exam	0.5	Oral exam		Essay		Research	
Project		Sustained knowledge check	1	Report		Practice	
Portfolio							

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Course attendance, continuous knowledge assessment, seminar paper, written exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Velčić Janjetić, E. & Badurina Filipin, A.: Radni materijal za Engleski jezik u elektrotehnici, 2024.

1.11. Optional / additional reading (at the time of proposing study programme)

Ibbotson, M.: Professional English in Use. Engineering. Cambridge Universtity Press 2009.
Ibbotson, M.: Cambridge English for Engineering. Cambridge University Press 2015.
Smith, R. H. C.: English for Electrical Engineering in Higher Education Studies. Garnet Publishing Ltd 2014.
Glendinning, E. H. & Glendinning, N.: Oxford English for Electrical and Mechanical Engineering. Oxford University Press 2001.
Vince, M.: Intermediate Language Practice. Heinemann ELT. Oxford 1998. Paterson, K. & Wedge, R.: Oxford Grammar for EAP. Oxford University Press 2013.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Velčić Janjetić, E. & Badurina Filipin, A.: Radni materijal za Engleski jezik u elektrotehnici, 2024.	70	70

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution’s quality assurance system

Basic description		
Course title	**Final Work**	
Study programme	**University Undergraduate Study of Electrical Engineering**	
Course status	compulsory	
Year	**3.**	
ECTS credits and teaching	ECTS student 's workload coefficient	12
	Number of hours (L+E+S)	-

1. **COURSE DESCRIPTION**							
1.1. Course objectives							
The Final Work is an individual assignment and verification of student expertises, which should show the appropriate level of engineering skills for individually solving specific professional task.							
1.2. Course enrolment requirements							
Enrolled course from which the Final Work is selected.							
1.3. Expected course learning outcomes							
Apply acquired knowledge, expertises and skills of the content of Final Work associated course. Solve practical task. Acquire competence for individually solving specific professional task.							
1.4. Course content							
The content of the Final Work is based on the application of acquired knowledge from educational programs at the undergraduate university studies. Final thesis can be specified from a particular course specific professional content and exceptionally from course that belongs to the group of shared content, when it represents a broader entity with a particular course specific content of the studies. Student enrollers the Final Work by enrolling the last semester. Thesis of the Final Work is establishes by Commission for Final Works, based on suggestion of teacher who will mentor the Final Work.							
1.5. Teaching methods	☐ lectures ☐ seminars and workshops ☐ exercises ☐ long distance education ☐ fieldwork		☒ individual assignment ☐ multimedia and network ☐ laboratories ☒ mentorship ☐ other				
1.6. Comments							
1.7. Student's obligations							
Attending the consultation, individually solving task and writing the Final Work report.							
1.8. Evaluation of student's work							
Course attendance		Activity/Participation		Seminar paper		Experimental work	
Written exam		Oral exam		Essay		Research	
Project		Sustained knowledge check		Report		Practice	
Portfolio		Individual task solving	10	Final work in written form	2		

1.9. Procedure and examples of learning outcome assessment in class and at the final exam
Assesses and evaluates the accuracy and completeness of a given task solving process, the Final Work written report, and its oral presentation
1.10. Assigned reading (at the time of the submission of study programme proposal)
1.11. Optional / additional reading (at the time of proposing study programme)
1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences
Through the Institution's quality assurance system.

Basic description		
Course title	**Fundamentals of Automatic Control**	
Study programme	**University Undergraduate Study of Electrical Engineering**	
Course status	compulsory	
Year	**2.**	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

1. **COURSE DESCRIPTION**		
1.1. Course objectives		
Acquiring theoretical fundamentals and practical knowledge for solving problems in area of automatic control. Usage of program tools for solving control problems. Understanding the principle of a control loop. Knowledge of how to describe control loops using transfer functions. Understanding the basic concepts of stability theory.		
1.2. Course enrolment requirements		
Fundamentals of Electrical Engineering 2.		
1.3. Expected course learning outcomes		
After the passed test, the student will be able to: Describe fundamental characteristics of control loops and the principles of regulation. Define, analyse and compare mathematical models of different control system components using Laplace transform. Define the transfer function and step response characteristic of basic dynamic components. Calculate the transfer function of complex dynamic systems. Define the amplitude-phase frequency characteristic of basic dynamic components. Draw the amplitude-phase frequency characteristic of complex systems. Define the stability of control systems. Analyze the stability using analytical and graphical-analytical methods. Describe and calculate the quality indicators of control systems. Apply analytical and numerical functions within simulation software packages for analysis and problem solving. Correctly select the parameters of a controller in a simple control system. Understand the structure of a controller.		
1.4. Course content		
Basic terminology. Mathematical description of control system components. Laplace transform. Transfer functions and time responses of control system components. Amplitude- and phase-frequency characteristics of control system components. Algebraic and graph-analytical stability criteria. Controller structure and parameters. Control system design examples. Control system accuracy. Control system quality indicators.		
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork	☐ individual assignment ☐ multimedia and network ☒ laboratories ☐ mentorship ☐ other
1.6. Comments		
1.7. Student's obligations		
Course attendance, activities in class, individual attending of laboratory exercises, studying		

1.8. Evaluation of student's work

Course attendance	2	Activity/Participation		Seminar paper		Experimental work	
Written exam	1	Oral exam		Essay		Research	
Project		Sustained knowledge check	2.5	Report		Practice	0.5
Portfolio							

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Course attendance, activities in class, writing laboratory exercise reports, sustained knowledge checks (two tests), written exam

1.10. Assigned reading (at the time of the submission of study programme proposal)

Vukić, Z. and Kuljača, Lj.: Automatic Control – Linear System Analysis, Kigen d.o.o., Zagreb, 2004. (in Croatian)
Matika, D. and Brnobić, D.: Basics of automatic control, Mimeographed notes, Technical Faculty Rijeka, Croatia, 2004 (in Croatian)

1.11. Optional / additional reading (at the time of proposing study programme)

Nise, N.: Control System Engineering. New York; John Wiley and Sons., 2000
Kuljača, Lj. and Vukić, Z.: Automatic Control of Systems. Zagreb; Croatia, Školska knjiga., 1985 (in Croatian)
Šurina, T.: Automatic Regulation. Zagreb; Croatia, Školska knjiga., 2001 (in Croatian)

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Vukić, Z. and Kuljača, Lj.: Automatic Control – Linear System Analysis, Kigen d.o.o., Zagreb, 2004. (in Croatian)	5	60
Matika, D. and Brnobić, D.: Basics of Automatic Control, Mimeographed Notes, Technical Faculty Rijeka, Croatia, 2004 (in Croatian)	14	60

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance systems.

Basic description		
Course title	**Fundamentals of Electrical Engineering 1**	
Study programme	**University Undergraduate Study of Electrical Engineering**	
Course status	compulsory	
Year	**1.**	
ECTS credits and teaching	ECTS student 's workload coefficient	8
	Number of hours (L+E+S)	45+45+0

1. **COURSE DESCRIPTION**		
1.1. Course objectives		
Introduction to basic electrical quantities, concepts and principles. Ability to solve numerical problems in the field of electrical engineering. Perform experiments and qualitative analysis of established or measured values.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Correctly interpret and use basic concepts and quantities of the electrostatic and electromagnetic fields. Describe and explain the laws of electromagnetic and electrostatic fields (induction, self-induction, the law of flow, potential, Coulomb force ...). Apply the basic laws of electrostatic and electromagnetic fields. Develop and interpret basic calculations of simple magnetic circuits and electrostatic fields. To construe and interpret the basic concepts and the quantities of the DC circuits. Explain and apply basic laws circuits (Kirchhoff's laws, superposition theorem, Thevenin's theorem, method of loop currents, ...) in the calculations of DC circuits. Design and analyze calculations of current, voltage and power in simple DC circuits. Measure electrical quantities in DC circuits.		
1.4. Course content		
Electric charge and electric chargability of the body. Coulomb's law. Electric field. Electric induction. Vector density of electric displacement D. Gauss' law. Work force in electric field. Electric potential and voltage. The lines of electric filed and equipotential surfaces. The relationship between electric field and potential. Capacitor and capacitor's capacity. Matter in the electric field. Field on the border of two insulators. Capacitor's connections. The energy of the electrostatic field. The concept of electric current. Resistance and conductance. The temperature dependence of the resistance. Ideal and real sources of electric current. Electric circuit. Power and energy of DC circuits. Kirchhoff's laws. Linear DC circuits. Nonlinear element in a DC circuit. The magnetic field. The force on a moving charge and current flowing conductor. Current loop in magnetic field. Biot-Savart law. Magnetic flux. Faraday's law of electromagnetic induction. Self-induction and mutual induction. Matter in magnetic field. Ferromagnetism. Magnetic circuits and magnetization curves and hysteresis. Energy of magnetic field.		
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☒ long distance education ☐ fieldwork	☐ individual assignment ☐ multimedia and network ☒ laboratories ☐ mentorship ☐ other
1.6. Comments		
1.7. Student's obligations		

Course attendance, activity, studying.

1.8. Evaluation of student's work

Course attendance	3	Activity/Participation		Seminar paper		Experimental work	
Written exam		Oral exam		Essay		Research	
Project		Sustained knowledge check	3	Report		Practice	
Portfolio		Laboratories	0.5	Final exam	1.5		

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Course attendance, measuring of electric quantities, continuous knowledge testing (mid-term exams, tests), final exam (written and oral exam).

1.10. Assigned reading (at the time of the submission of study programme proposal)

Pinter, V.: Fundamentals of electrical engineering I, Tehnička knjiga, Zagreb, (in Croatian)
Đurović, G.: Electrical engineerging I, Školska knjiga, Zagreb, 2004. , (in Croatian)

1.11. Optional / additional reading (at the time of proposing study programme)

Jajac, B.: Theoretical fundamentals of electrical engineering, Part I-III, Graphis, Zagreb, 2001-2007. (in Croatian)
Kuzmanović, B.: Fundamentals of electrical engineering I, Tehnička knjiga, Zagreb, 1997. (in Croatian)

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Pinter, V.: Fundamentals of electrical engineering I, Tehnička knjiga, Zagreb, (in Croatian)	14	120
Đurović, G.: Electrical engineerging I, Školska knjiga, Zagreb, 2004. , (in Croatian)	11	120

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Fundamentals of Electrical Engineering 2**	
Study programme	**University Undergraduate Study of Electrical Engineering**	
Course status	compulsory	
Year	**1.**	
ECTS credits and teaching	ECTS student 's workload coefficient	7
	Number of hours (L+E+S)	45+45+0

1. **COURSE DESCRIPTION**		
1.1. Course objectives		
Introduction to basic electrical quantities, concepts and principles. Ability to solve numerical problems in the field of electrical engineering. Performing experiments and qualitative analysis of established or measured values.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
To explain the emergence of a sinusoidal waveform AC voltage concepts, concepts of periods, frequency, current and maximum values and the initial phase shift. Apply the characteristic quantities of the maximum, effective and average values of the current and voltage in the vector and numerical analysis of AC circuits. Distinguish and describe the basic physical models of working and reactive (inductive and capacitive) resistance in the AC circuit. Analyze and explain the vector diagrams and calculations of AC circuits with serial and parallel connection of working and reactive resistance. Explain the fluctuations of working and reactive energy of electric field in condenser and magnetic field in coil. Explain and use the two-dimensional complex numbers in numerical analysis of two-component of working-reactive AC circuits. Apply the basic laws and methods of calculations of AC circuits. Describe the three-phase electrical system and rotating magnetic field. Measure electrical quantities in AC circuits.		
1.4. Course content		
Nonstationary (transient) state in DC circuits. Periodically variable electrical quantities. Characteristic values of the periodic quantities (mean and effective value). Elements of electrical networks. The application of complex analysis in network analysis with sinusoidal currents and voltages. The concept and properties of impedance and admittance. Current and voltage resonance. Instantaneous, active, reactive and apparent power. Matching of load. Analysis of electrical networks with linear elements (application of Kirchhoff's laws, contour currents, voltages of nodes, superposition, theorems network, transfiguration). Symmetric and asymmetric three-phase systems. Rotating magnetic field. Coil with an iron core in an AC circuit. Physical picture of the transformer. Nonlinearity in AC networks and application of Fourier analysis.		
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☒ long distance education ☐ fieldwork	☐ individual assignment ☐ multimedia and network ☒ laboratories ☐ mentorship ☐ other
1.6. Comments		
1.7. Student's obligations		

Course attendance, activity, studying.

1.8. Evaluation of student's work

Course attendance	3	Activity/Participation		Seminar paper		Experimental work	
Written exam		Oral exam		Essay		Research	
Project		Sustained knowledge check	2	Report		Practice	
Portfolio		Laboratories	0.5	Final exam	1.5		

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Course attendance, measuring of electric quantities, continuous knowledge testing (mid-term exams, tests), final exam (written and oral exam).

1.10. Assigned reading (at the time of the submission of study programme proposal)

Pinter, V.: Fundamentals of Electrical Engineering II, Tehnička knjiga, Zagreb, (in Croatian)
Đurović, G.: Electrical Engineering II, Školska knjiga, Zagreb, 2004. , (in Croatian)

1.11. Optional / additional reading (at the time of proposing study programme)

Jajac, B.: Theoretical fundamentals of electrical engineering, Part I-III, Graphis, Zagreb, 2001-2007. (in Croatian)
Kuzmanović, B.: Fundamentals of electrical engineering II, Tehnička knjiga, Zagreb, 1997. (in Croatian)

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Pinter, V.: Fundamentals of Electrical Engineering II, Tehnička knjiga, Zagreb, (in Croatian)	10	120
Đurović, G.: Electrical Engineering II, Školska knjiga, Zagreb, 2004. , (in Croatian)	10	120

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Fundamentals of Electrical Engineering and Sustainable Development**	
Study programme	**University Undergraduate Study of Electrical Engineering**	
Course status	compulsory	
Year	**2.**	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	45+15+0

1. **COURSE DESCRIPTION**							
1.1. Course objectives							
The main goals of the course are to familiarise students with the fundamentals of electrical engineering and the concept of sustainable development. From general competencies, the ability to analyze, basic computing skills and problem solving will be developed.							
1.2. Course enrolment requirements							
None.							
1.3. Expected course learning outcomes							
Describe energy sources and energy conversions. Explain principles of operation of the most important types of power plants. Explain basic principles of electromechanical energy conversion. Explain principles of operation of electric rotating machines and transformers. Apply knowledge of low voltage electrical installations and lighting. Explain the structure and most significant characteristics of traditional and modern transmission and distribution networks. Explain the impact of the electricity sector on the environment and apply solutions to reduce greenhouse gas emissions in the electricity sector.							
1.4. Course content							
Forms, sources and classification of energy. Energy sources and energy conversion. Thermal power plants, hydroelectric power plants, renewable energy sources. Electricity production and consumption in the world. Transformers and rotating machines. Power system. Structure and operation of transmission and distribution networks. Elements of electric power networks and plants. Basic analysis in power engineering. Impact of the electricity sector on the environment - environmental protection. Greenhouse effect and greenhouse gases. Solutions for reducing greenhouse gas emissions in the electricity sector. Emission reduction strategies through examples and international actions.							
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork		☐ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other				
1.6. Comments							
1.7. Student's obligations							
Course attendance, activity, homework, studying.							
1.8. Evaluation of student's work							
Course attendance	2	Activity/Participation		Seminar paper		Experimental work	

Written exam	1.5	Oral exam	1	Essay		Research	
Project		Sustained knowledge check	1.5	Report		Practice	
Portfolio		Homework					

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Course attendance, continuous knowledge testing (mid-term exams), written and oral exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

H. Požar, Osnove energetike 1, 2 i 3, Školska knjiga, Zagreb, 1992. (in Croatian)
B. Udovičić, Elektroenergetski sustav, Kigen, Zagreb, 2005. (in Croatian)
P. Hasse, J. Wiesinger, W. Zischank, Priručnik za zaštitu od munje i uzemljenje, Kigen d.o.o., Zagreb, 2009. (in Croatian)
G. Piani, A.Višković, B.Saftić, Protokol iz Kyota; Ostvarenje i budući razvoj, zakonodavstvo, strategije i tehnologije, Kigen d.o.o., Zagreb, 2011. (in Croatian)
Course materials in electronic form.

1.11. Optional / additional reading (at the time of proposing study programme)

R. Wolf, Osnove električnih strojeva, Školska knjiga, Zagreb, 1991. (in Croatian)
V. Srb, Električne instalacije i niskonaponske mreže, Tehnička knjiga, Zagreb, 1991. (in Croatian)
L. Ujević, Z. Buntić, Elektrane, Školska knjiga, Zagreb, 1993. (in Croatian)
Z. Morvaj, D. Gvozdenac, Ž. Tomšić, Sustavno gospodarenje energijom i upravljanje utjecajem na okoliš u industriji, EM d.o.o., Zagreb, 2014. (in Croatian)

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
H. Požar, Osnove energetike 1, 2 i 3, Školska knjiga, Zagreb, 1992.	1	60
B. Udovičić, Elektroenergetski sustav, Kigen, Zagreb, 2005.	1	60
P. Hasse, J. Wiesinger, W. Zischank, Priručnik za zaštitu od munje i uzemljenje, Kigen d.o.o., Zagreb, 2009.	1	60
G. Piani, A. Višković, B. Saftić, Protokol iz Kyota; Ostvarenje i budući razvoj, zakonodavstvo, strategije i tehnologije, Kigen d.o.o., Zagreb, 2011.	1	60

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Fundamentals of Robotics**	
Study programme	**University Undergraduate Study of Electrical Engineering**	
Course status	optional	
Year	3.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

1. COURSE DESCRIPTION

1.1. Course objectives

Knowledge about robotic manipulators, application of direct/inverse kinematics. Application of trajectory planning methods for robot motion from point to point and continuous motion along a path. Knowledge about actuators in robotics. Training students for independent simulations using the Python programming language. Developing abilities for independent work and collaboration in small groups, as well as presenting achieved results.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Describe types of robots. Describe designs and characteristics of robot components. Define the procedure of direct kinematics (Denavit-Hartenberg method) and inverse kinematics. Apply direct and inverse kinematics of a robot. Define trajectory planning methods for point-to-point movement and continuous path tracking of manipulators. Define and apply methods of interpolated motion, rectilinear motion (Taylor's method of limited deviation). Define types and characteristics of electric machines and electrical drives in robotics.

1.4. Course content

Types and characteristics of robots. Designs and characteristics of robot components. Position and orientation of rigid bodies. Denavit-Hartenberg algorithm. Direct and inverse kinematics of a robot. Trajectory planning of a robot for point-to-point movement and continuous path tracking. Different algorithms for controlling sequential systems of robots based on position and velocity.

1.5. Teaching method	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other _____
1.6. Comments		

1.7. Student's obligations

Course attendance, activity, simulation exercises, studying.

1.8. Evaluation of student's work

Course attendance	2	Activity/Participation		Seminar paper		Experimental work	
Written exam	1	Oral exam		Essay		Research	
Project		Sustained knowledge	1.5	Report		Practice	

		check					
Portfolio		Simulation exercises	1.5				

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Oral explanation of simulation exercises or project tasks, continuous knowledge assessment (two quizzes, written final exam).

1.10. Assigned reading (at the time of the submission of study programme proposal)

B. Siciliano, K. Oussama: Springer handbook of robotics. Springer, 2016.

1.11. Optional / additional reading (at the time of proposing study programme)

T. Yoshikawa: Foundations of Robotics, Analysis and Control, MIT Press, 1990.
Z. Kovačić, S.Bogdan, V.Krajči: Osnove robotike, Graphis, Zagreb 2002.
F. Lamb: Industrial automation: hands-on. McGraw-Hill Education, 2013.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
B. Siciliano, K. Oussama: Springer handbook of robotics. Springer, 2016.1	1	40

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution’s quality assurance system.

Basic description		
Course title	Industrial Automation	
Study programme	University Undergraduate Study of Electrical Engineering	
Course status	optional	
Year	3.	
ECTS credits and teaching	ECTS student 's workload coefficient	7
	Number of hours (L+E+S)	30+30+0

1. COURSE DESCRIPTION

1.1. Course objectives

Students will be introduced with basic categories of plant automation elements, and gain theoretical and practical knowledge for system analysis, by solving automation problems and by applying computers and programmable logic controllers (PLC) for automation of simple systems.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Define and distinguish between the basic elements of plant automation elements. Explain the implementation principles and mathematically analyse physical phenomena in plant automation elements. Define and analyse static and dynamic characteristics of plant automation elements. Analyse electromechanical, pneumatic and hydraulic actuators. Describe the implementation and computer operation in plant control. Apply the computer and the programmable logic controller (PLC) in automation of simple systems.

1.4. Course content

Introduction to programmable logic controllers (PLC) and their role in automated system. Design of basic automation systems. Static and dynamic characteristics of elements used in automated systems. Noise and disturbance in the measuring systems. Operational principle and characteristics of sensors: movement, position, fluid level, temperature, flow, and pressure. Operational principle of electromechanical, pneumatic, and hydraulic actuators.

1.5. Teaching method		
	☒ lectures	☐ individual assignment
	☐ seminars and workshops	☐ multimedia and network
	☒ exercises	☒ laboratories
	☐ long distance education	☐ mentorship
	☐ fieldwork	☐ other _____

1.6. Comments

1.7. Student's obligations

Course attendance, laboratory assignments, individual studying.

1.8. Evaluation of student's work

Course attendance	2	Activity/Participation		Seminar paper		Experimental work	
Written exam	2	Oral exam		Essay		Research	
Project		Sustained knowledge check	2	Report		Practice	1

Portfolio							

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Course attendance, laboratory assignments, continuous knowledge tests, written exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Clarence W. de Silva: Sensors and Actuators - Control System Instrumentation, CRC Press, 2007
Bela G. Liptak: Instrument Engineers Handbook, 4th Edition, CRC Press, 2003

1.11. Optional / additional reading (at the time of proposing study programme)

Radoslav Korbar: Pneumatika i hidraulika, Veleučilište u Karlovcu, 2007

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	Low-voltage Electrical Installations	
Study programme	University Undergraduate Study of Electrical Engineering	
Course status	optional	
Year	3.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

1. COURSE DESCRIPTION

1.1. Course objectives

To provide students with practical knowledge of electrical installations and the application of related electrotechnical regulations and standards. Also, to acquaint students with the types of grounding of low-voltage networks, switchgear used for electrical installations and types of loads. Highlight the importance of the correct selection of protection against direct and indirect contact in low-voltage installations. Through the procedure of testing electrical installations, develop students' awareness of the immediate application of acquired knowledge.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Upon successful completion of the course, students will:

5. correctly classify the grounding systems of low-voltage installations, and types of protection against direct and indirect contact voltage,
6. calculate the voltage drop and select the conductor cross-section, as well as set the protection against indirect contact,
7. apply the relevant electrotechnical regulations and standards for electrical installations,
8. examine the basic parameters of electrical installations using measuring equipment (insulation resistance, fault loop impedance, etc.).

1.4. Course content

Electrotechnical regulation and standards. Electrical diagrams and symbols. Basic types of low-voltage network grounding. Classification and characteristics of low-voltage loads. Reactive power compensation. Basics of lighting installations, units, illuminance quality criteria and regulations. Indoor and outdoor lighting. Installation and laying of low-voltage conductors. Selection of conductor type and cross-section. Line voltage drop. Switchgear and panelboards in low-voltage installations. Protective measures against direct and indirect contact voltage. Protection setting of low-voltage installations. Grounding and potential equalization. Lightning protection. Advanced electrical installations. Usage of renewable energy sources. Charging stations for electric vehicles. Testing of electrical installations.

1.5. Teaching method	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork	☐ individual assignment ☐ multimedia and network ☒ laboratories ☐ mentorship ☐ other _____
1.6. Comments		

1.7. Student's obligations

Attendance of classes and laboratory exercises, activity in class, continuous verification of knowledge, final exam.

1.8. Evaluation of student's work

Course attendance	2	Activity/Participation		Seminar paper		Experimental work	
Written exam	1	Oral exam		Essay		Research	
Project		Sustained knowledge check	2	Report		Practice	1
Portfolio							

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Attendance of classes and laboratory exercises, activity in class, continuous verification of knowledge, final exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Vjekoslav Srb: Električne instalacije i niskonaponske mreže, Tehnička knjiga, Zagreb, 1991.
Željko Novinc: Elektrotehničke instalacije, Kigen, Zagreb, 2007.

1.11. Optional / additional reading (at the time of proposing study programme)

Jacques Peronnet: Electrical installation guide - According to IEC international standards, Schneider Electric, 2018.
Alija Muharemović, Vlado Madžarević, Izet Džananović, Adnan Muharemović, Muhamed Ramić: Uzemljenje: Projektiranje i mjerenja, zakonska regulativa, Harfo-graf Tuzla, Tuzla, 2011.
Milo Mišković: Električne instalacije i osvetljenje, Građevinska knjiga, Beograd, 2007.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Vjekoslav Srb: Električne instalacije i niskonaponske mreže, Tehnička knjiga, Zagreb, 1991.	1	30
Željko Novinc: Elektrotehničke instalacije, Kigen, Zagreb, 2007.	1	30
1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences		
Through the Institution's quality assurance system.		

Basic description		
Course title	Materials in Electrical Engineering	
Study programme	University Undergraduate Study of Electrical Engineering	
Course status	compulsory	
Year	1.	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	30+15+0

1. COURSE DESCRIPTION		
1.1. Course objectives		
The students will be acquainted with the fundamentals of materials engineering and materials science. The students will be trained to select, evaluate, and apply materials in electrical engineering through gaining basic knowledge about materials for the production of conductors, insulators, semiconductors, batteries, and other electrical devices. The students will be capable to understand and apply new knowledge about the materials for electrical engineering. Additionally, they will familiarize themselves with the basics of soldering technology process.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
1. Determine the characteristics of basic electrical engineering materials and technologies. 2. Analyze the relationship between the structure and properties of materials. 3. Evaluate fundamental electrical engineering materials and technologies. 4. Recommend and select conductive, semiconductive, insulating, and magnetic materials in electrical engineering. 5. Describe the operating principles of a thermocouple and a bimetallic element. 6. Continuously monitor the development and application of materials in electrical engineering.		
1.4. Course content		
Introduction to the science and engineering of materials. Definition, systematization, and classification of materials in electrical engineering. The atomic structure of matter. The standard model of atoms. The intermolecular and interatomic bonds. The crystalline and amorphous materials structure. Metallic, ionic, covalent, molecular, and liquid crystals. Crystal lattice defects. The basics of crystallography and Miller indices. Crystallization and crystal growth. Diffusion. The basic mechanical properties of materials used in electrical engineering. Conductive metallic materials, properties, and applications in electrical engineering. Insulating polymer and ceramic materials, properties, and applications in electrical engineering. Magnetic materials, properties, and applications in electrical engineering. The semiconductive materials, properties, and applications in electrical engineering. Electrochemical phenomena and corrosion. Electrochemical sources of electrical energy. Batteries and fuel cells. 2D materials, properties and applications. The process of soldering technology. The means for protecting solder joints.		
1.5. Teaching method	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork	☐ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other _____
1.6. Comments		
1.7. Student's obligations		
Activity and independent learning.		

1.8. Evaluation of student's work

Course attendance	1.5	Activity/Participation	0.5	Seminar paper		Experimental work	
Written exam		Oral exam	1	Essay		Research	
Project		Sustained knowledge check	1.5	Report		Practice	
Portfolio		E-learning	0.5				

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Procedure and examples of learning outcome assessment in class and at the final exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Katavić, I., Uvod u materijale, RITEH, Rijeka, 2008.
Callister, W. D., Jr., Materials science and engineering: An Introduction, John Wiley & Sons, New York, 1996.
Filetin, I., Kovačiček, F., Indof, J., Svojstva i primjena materijala, FSB, Zagreb, 2007
Jones, I. P., Materials science for electrical and electronic engineers, Oxford Univ. Press, 2001

1.11. Optional / additional reading (at the time of proposing study programme)

Mittemeijer, E.J., Fundamentals of materials science, Springer, 2021
Hummel, R. E., Electronic properties of materials, Springer, 2000

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Katavić, I., Uvod u materijale, RITEH, Rijeka, 2008.	22	100
Callister, W. D., Jr., Materials science and engineering: An Introduction, John Wiley & Sons, New York, 1996.	1	100
Filetin, I., Kovačiček, F., Indof, J., Svojstva i primjena materijala, FSB, Zagreb, 2007	15	100
Jones, I. P., Materials science for electrical and electronic engineers, Oxford Univ. Press, 2001	1	100
Katavić, I., Uvod u materijale, RITEH, Rijeka, 2008.	22	100

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Mathematics 1**	
Study programme	**University Undergraduate Study of Electrical Engineering**	
Course status	compulsory	
Year	**1.**	
ECTS credits and teaching	ECTS student 's workload coefficient	7
	Number of hours (L+E+S)	45+45+0

1. **COURSE DESCRIPTION**							
1.1. Course objectives							
Acquiring basic knowledge and skills in linear algebra and calculus.							
1.2. Course enrolment requirements							
None.							
1.3. Expected course learning outcomes							
Define and correctly interpret basic notions in linear algebra, single-variable functions, and single-variable calculus. State and correctly interpret basic results in linear algebra and single-variable calculus. Carry out basic computations with matrices, vectors, determinants; determine solutions of systems of linear equations. Apply vector operations to compute some areas, volumes; determine equations of planes and lines. Compute limit values and derivatives of single-variable functions. Apply integration rules and evaluate indefinite and definite integrals of some function.							
1.4. Course content							
Solving systems of linear equations. Matrices. Determinants. Vectors and analytical geometry in space. Single-variable functions. Limit values and continuous functions. Elementary functions. Derivatives. Indefinite and definite integrals.							
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork		☐ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other				
1.6. Comments	-						
1.7. Student's obligations							
Course attendance, activity/participation, studying.							
1.8. Evaluation of student's work							
Course attendance	3	Activity/Participation		Seminar paper		Experimental work	
Written exam	1.5	Oral exam		Essay		Research	
Project		Sustained knowledge check	2.5	Report		Practice	
Portfolio							

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Course attendance, activity/participation, sustained knowledge check (mid-term exams, tests), and written exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Slapničar I.: Mathematics 1, Sveučilište u Splitu FESB, Split 2002, online book (in Croatian)
Slapničar I.: Mathematocs 1 – Workbook, Sveučilište u Splitu FESB, Split 2010, online book , (in Croatian)
Jurasić, K.-Dražić, I.: Mathematics I, Workbook, Tehnički fakultet, Rijeka, 2008. (in Croatian)
Štefan Trubić M., Sopta L., Črnjarić-Žic N., Maćešić S.: Mathematics, a collection of tasks: integrals, ordinary differential equations, functions of several variables, Rijeka 2012, (in Croatian)

1.11. Optional / additional reading (at the time of proposing study programme)

Elezović N., Aglić A., Linear algebra - a collection of tasks, Element, Zagreb 1999 (in Croatian)
Zill D., Wright W., Calculus: early transendentals, 4th edition, Jones and Bartlett publishers, 2011.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Slapničar I.: Mathematics 1, Sveučilište u Splitu FESB, Split 2002, online book (in Croatian)	100	100
Slapničar I.: Mathematocs 1 – Workbook, Sveučilište u Splitu FESB, Split 2010, online book , (in Croatian)	100	100
Jurasić, K.-Dražić, I.: Mathematics I, Workbook, Tehnički fakultet, Rijeka, 2008. (in Croatian)	18	100
Štefan Trubić M., Sopta L., Črnjarić-Žic N., Maćešić S.: Mathematics, a collection of tasks: integrals, ordinary differential equations, functions of several variables, Rijeka 2012, (in Croatian)	20	100

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Mathematics 2**	
Study programme	**University Undergraduate Study of Electrical Engineering**	
Course status	compulsory	
Year	**1.**	
ECTS credits and teaching	ECTS student 's workload coefficient	7
	Number of hours (L+E+S)	45+45+0

1. **COURSE DESCRIPTION**							
1.1. Course objectives							
Acquiring basic knowledge and skills in application of calculus for single-variable functions, calculus for multi-variable functions, and ordinary differential equations.							
1.2. Course enrolment requirements							
None.							
1.3. Expected course learning outcomes							
Correctly interpret and apply single-variable calculus. Define and correctly interpret basic notions of multi-variable calculus and ordinary differential equations (ODE). Compute derivatives and some integrals of multi-variable functions, and solutions of some ODE. Compute polynomial approximations; find local extremes of single-variable and multi-variable functions by applying differential calculus. Compute some lengths, areas, and volumes by applying integral calculus. Model vibrations in simple mechanical and electrical systems by applying ODE.							
1.4. Course content							
Applications of single-variable calculus. Multi-variable functions. Partial derivatives, differential calculus for two-variable functions and applications (approximations, local extremes, optimal control problems). Double integral and applications. First order ODE. Higher order ODE. Systems of ODE. Applications of ODE.							
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork		☐ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other				
1.6. Comments	-						
1.7. Student's obligations							
Course attendance, activity/participation, studying.							
1.8. Evaluation of student's work							
Course attendance	3	Activity/Participation		Seminar paper		Experimental work	
Written exam	1.5	Oral exam		Essay		Research	
Project		Sustained knowledge	2.5	Report		Practice	

		check					
Portfolio							

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Course attendance, activity/participation, sustained knowledge check (mid-term exams, tests), and written exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Slapničar I.: Mathematics 2, Sveučilište u Splitu FESB, Split 2002, online book, (in Croatian)
Štefan Trubić M., Sopta L., Črnjarić-Žic N., Maćešić S.: Mathematics, a collection of tasks: integrals, ordinary differential equations, functions of several variables, Rijeka 2012, (in Croatian)

1.11. Optional / additional reading (at the time of proposing study programme)

Kreyszig E., Advanced Engineering Mathematics, John Wiley & Sons, Inc., 1993.
Zill D., Wright W., Calculus: early transendentals, 4th edition, Jones and Bartlett publishers, 2011.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Slapničar I.: Mathematics 2, Sveučilište u Splitu FESB, Split 2002, online book, (in Croatian)	100	100
Štefan Trubić M., Sopta L., Črnjarić-Žic N., Maćešić S.: Mathematics, a collection of tasks: integrals, ordinary differential equations, functions of several variables, Rijeka 2012, (in Croatian)	20	100

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	Mathematics 3	
Study programme	Undergraduate University Study of Electrical Engineering	
Course status	compulsory	
Year	2	
ECTS credits and teaching	ECTS student 's workload coefficient	7
	Number of hours (L+E+S)	45+60+0

1. COURSE DESCRIPTION		
1.1. Course objectives		
Acquisition of basic knowledge and skills in Fourier analysis, Laplace transforms, vector analysis, descriptive statistics and probability theory. Acquisition of basic concepts of functions with complex arguments.		
1.2. Course enrolment requirements		
Mathematics 1.		
1.3. Expected course learning outcomes		
Develop the function in the Fourier series and represent the function in the form of the Fourier integral. Calculate the Fourier transform of the given function. Calculate the Laplace transform of the given function. Apply the Laplace transform when solving differential equations, integral equations and systems of differential equations. Formulate the basic theorems of the theory of scalar and vector fields. Interpret the physical meaning of gradient, directional derivative, divergence and rotor. Calculate curve and surface integrals of scalar and vector fields. Apply triple integrals to calculate the volume and mass of a body. Apply the divergence theorem and Stokes' theorem to some problems in physics. Application of basic vector calculus in engineering theory. Present basic knowledge of the field of complex numbers. Formulate the basic theorems of the theory of the function of a complex variable. Apply the Cauchy-Riemann equations and determine if the given complex function is differentiable. Calculate the integral of a function of a complex variable. Assess the nature of the isolated singularity of the analytic function. Apply the remainder theorem to calculate integrals of functions of one complex variable. Calculate the probabilities of a given event. Apply the complete probability formula and Bayes' formula. Select unbiased point estimates for the expected value and variance.		
1.4. Course content		
Fundamentals of series. Fourier series. Fourier integral and Fourier transform. Laplace transform. Elementary properties and application of the Laplace transform. Vector analysis. Curvilinear integrals. Surface integrals. Triple integral. Integral theorems. Application of vector analysis. Complex numbers. Functions of a complex variable. Fundamentals of statistical analysis. The concept of the random event. The probability of a random event. Bayes formula.		
1.5. Teaching method	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork	☐ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other _____
1.6. Comments	-	

1.7. Student's obligations

Participation in class, activities in class, independent learning

1.8. Evaluation of student's work

Course attendance	3.5	Activity/Participation		Seminar paper		Experimental work	
Written exam	0.5	Oral exam	1	Essay		Research	
Project		Sustained knowledge check	2	Report		Practice	
Portfolio							

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Attendance in class, activity in class, continuous assessment of knowledge (control tasks, tests, checks), written and oral examinations.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Elezović, N.: Fourierov red i integral, Laplaceova transformacija, (FER) Biblioteka Bolonja, Element, 2006.
Štefan Trubić M., Črnjarić-Žic N: Inženjerska matematika ET, zbirka riješenih zadataka, interna skripta dostupna putem e-kolegija
Črnjarić-Žic N.: Interna skripta iz Inženjerske statistike.
Elezović, N.: Kompleksna analiza, Element, 2018.

1.11. Optional / additional reading (at the time of proposing study programme)

Kreyszig, E.: Advanced Engineering Mathematics, John Wiley & Sons, Inc., 1993.
Črnjarić-Žic N.: Interna skripta iz statistike i uzoraka.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Elezović, N.: Fourierov red i integral, Laplaceova transformacija, Diskretna vjerojatnost (FER) Biblioteka Bolonja, Element, 2006.	5	70
Štefan Trubić M., Črnjarić-Žic N: Inženjerska matematika ET, zbirka riješenih zadataka, interna skripta dostupna putem e-kolegija	70	70
Črnjarić-Žic N.: Interna skripta iz Inženjerske statistike.	70	70
Elezović, N.: Kompleksna analiza, Element, 2018.	2	70

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Measurements in Electrical Engineering**	
Study programme	**University Undergraduate Study of Electrical Engineering**	
Course status	compulsory	
Year	**2.**	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	45+30+0

1. **COURSE DESCRIPTION**		
1.1. Course objectives		
Objectives of the course are to prepare the students to understand measurements, characteristics of electrical and electronic measurement instruments and measurement methods, to perform measurements independently ant to apply optimal measurement method, to develop ability to work in a small group (team work) and to present results of measurements.		
1.2. Course enrolment requirements		
Fundamentals of Electrical Engineering 1.		
1.3. Expected course learning outcomes		
After passing the exam, student is able to do following: 1. Interpret and explain measurement uncertainty 2. Apply the model of measurement uncertainty at simple examples 3. Analyze a measurement problem and determine sources of systematic and random errors 4. Apply measures to eliminate errors in measurements 5. Describe measurements methods for measurements of electrical quantities 6. Apply measurements methods for measurements of electrical quantities 7. Describe working principles of measurement instruments (electrical and electronic) 8. Apply measurements instruments for measurements of electrical quantities 9. Describe transducers for measurements of non-electrical quantities 10. Write complete measurement report, analyze and interpret measurement data		
1.4. Course content		
The international system of units. Measurement uncertainty. Measurement elements. Measurement sources. Electromechanical measurement instruments. Electrical and electronic energy meters. Measurement transformers. Measurement of electrical quantities. Magnetic measurements. Isolation testing. Point of cable failure determination. Measurements of non–electrical quantities. Transducers and sensors of non–electrical quantities. Function generators. Signal generators. Impulse generators. Electronic instruments. Measurement amplifiers and attenuators. Analog electronic measurement instruments. Oscilloscopes. Oscilloscope's measurements. Digital electronic measurement instruments. Communication instrument–computer.		
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☒ laboratories ☐ mentorship ☐ other
1.6. Comments		

1.7. Student's obligations

Course attendance, activity during course lectures, preparation for and attendance of laboratory exercises and studying.

1.8. Evaluation of student's work

Course attendance	2.5	Activity/Participation		Seminar paper		Experimental work	
Written exam	1	Oral exam		Essay		Research	
Project		Sustained knowledge check	1.5	Report		Practice	1
Portfolio		Homework					

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Assessment and evaluation of student's work will be based on sustained knowledge checks, laboratory exercises and final exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Bego, V.: Measurements in the Electrical Engineering, Graphis, Zagreb, 2003. (in Croatian)
Vujević, D.: Measurements in the Electrical Engineering, Laboratory exercises, Sveučilište u Zagrebu, Zagreb, 1993. (in Croatian)

1.11. Optional / additional reading (at the time of proposing study programme)

Vujević, D., Ferković, B.: Basics of Measurements in the Electrical Engineering, I. i II. part, Školska knjiga, Zagreb, 1996. (in Croatian)

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Bego, V.: Measurements in the Electrical Engineering, Graphis, Zagreb, 2003. (in Croatian)	6	80
Vujević, D.: Measurements in the Electrical Engineering, Laboratory exercises, Sveučilište u Zagrebu, Zagreb, 1993. (in Croatian)	2	80

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Mechanics and Structural Elements**	
Study programme	**University Undergraduate Study of Electrical Engineering**	
Course status	optional	
Year	**2.**	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

1. **COURSE DESCRIPTION**							
1.1. Course objectives							
Ability to establish the equilibrium equations for rigid and deformable bodies (structures). Ability to determine the resultant of forces in different kinds of force systems. Understanding the relations between internal forces and determine the internal forces in planar structures. Ability to determine the dimensions and materials of bearing structures or its individual parts under external load.							
1.2. Course enrolment requirements							
None.							
1.3. Expected course learning outcomes							
Define the concept of force and force system. Determine the momentum for the point, for the axis and for the couple of forces. Define the Coulomb friction law. Reduce the given system of forces to the simplest form and to the reduction point. Determine the equilibrium conditions of a given force system. Determine the reaction forces and the distribution of internal forces in trusses and beam structures. Calculate the geometric characteristics of the straight beam sections. Define the concept of stress and strain. Distinguish between basic and complex shapes of beam structures load cases. Calculate the stress and strain for the axial load, shear, torsion and bending of structures. Analyse the free body diagrams. Define the equilibrium states. Calculate the critical buckling force for compressive loaded rod. Check the dimensions of structure.							
1.4. Course content							
Planar and spatial force systems. Terms of equilibrium. Friction. Truss and beam structures. Stress and strain. Hooke's law. Axial load, shear, torsion, bending and buckling of structural elements.							
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork		☐ individual assignment ☐ multimedia and network ☒ laboratories ☐ mentorship ☐ other				
1.6. Comments							
1.7. Student's obligations							
Course attendance, class participation, laboratory exercises, final exam, independent learning.							
1.8. Evaluation of student's work							
Course attendance	2	Activity/Participation		Seminar paper		Experimental work	0.5
Written exam	1	Oral exam	0.5	Essay		Research	
Project		Sustained knowledge	2	Report		Practice	

		check					
Portfolio							

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Course attendance. Continuous knowledge testing (two mid-term exams). Laboratory exercises. Written and oral exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Brnić, J.: "Statics", University of Rijeka, Faculty of Engineering, Rijeka, 2004. (in Croatian)
Brnić, J., Turkalj, G.: "Strength of materials I", University of Rijeka, Faculty of Engineering, Rijeka, 2004. (in Croatian)

1.11. Optional / additional reading (at the time of proposing study programme)

Brnić, J.: "Mechanics and Structural Elements", Školska knjiga, Zagreb, 1996. (in Croatian)
Gross, D., Hauger, W., Schröder, J., Wall, W.A., Rajapakse, N.: "Engineering Mechanics 1", Springer, 2013.
Gross, D., Hauger, W., Schröder, J., Wall, W.A., Bonet, J.: "Engineering Mechanics 2", Springer, 2011

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Brnić, J.: "Statics", University of Rijeka, Faculty of Engineering, Rijeka, 2004.	12	40
Brnić, J., Turkalj, G.: "Strength of materials I", University of Rijeka, Faculty of Engineering, Rijeka, 2004.	7	40

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Physics**	
Study programme	**University Undergraduate Study of Electrical Engineering**	
Course status	compulsory	
Year	**1.**	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

1. **COURSE DESCRIPTION**							
1.1. Course objectives							
Students should gain the theoretical knowledge and develop an ability to differentiate the concepts of classical physics. They should be able to properly comprehend important physical phenomena in mechanical physics and their application in engineering field.							
1.2. Course enrolment requirements							
None.							
1.3. Expected course learning outcomes							
Evaluate kinematic quantities (position, velocity and acceleration vectors) in three-dimensional space. Evaluate simple mechanical systems and solve Newton's equation of motion. Apply the laws of conservation of energy and momentum to mechanical systems. Determine the basic principles (Newton's 2nd law) of complex mechanical phenomena (harmonic oscillator, waves). Evaluate the conditions for the statics of a rigid body. Apply of the equation of motion for the rotation of a body around a solid axis. Apply the continuity equation and Bernoulli's equation to simple problems in fluid mechanics. Evaluate fundamental physical phenomena, quantities and laws in the field of thermodynamics. Evaluate the fundamental laws of thermodynamics for the calculation of physical quantities. Determine simple physical problems from thermodynamics using a mathematical formulation. Critically evaluate the kinetic-molecular theory of heat.							
1.4. Course content							
Introduction. Motion of a material point. Rectilinear motion. Circular motion. Newton's laws. Law of conservation of momentum. Energy conservation law. Force. Relativity of motion. Inertial and non-inertial systems. Motion of a rigid body. Moment of force. Law of conservation of angular momentum. Fluid mechanics (statics and dynamics). Vibration (damped and forced) and waves (wave energy and intensity, Doppler effect). Heat and temperature, gas laws. Heat transfer. Kinetic-molecular theory of heat.							
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork		☐ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other				
1.6. Comments	-						
1.7. Student's obligations							
Course attendance, activity, consultations, studying.							
1.8. Evaluation of student's work							
Course	2	Activity/Participation		Seminar paper		Experimental	

attendance						work	
Written exam	1.5	Oral exam	0.5	Essay		Research	
Project		Sustained knowledge check	2	Report		Practice	
Portfolio		Homework					

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Activity, continuous knowledge testing, written and oral exam

1.10. Assigned reading (at the time of the submission of study programme proposal)

Dobrinić, J.: Physics (mechanics, vibration, heat), Tehnički fakultet, Rijeka, 1998. (in Croatian)
Dobrinić, J., Mandić, L.: Physics 1, Tehnički fakultet, Rijeka, 2002. (in Croatian)
Dobrinić, J. Mandić, L.: Solved examples in Physics1, Tehnički fakultet, Rijeka, 2001. (in Croatian)
Dobrinić, J. Mandić, L.: Solved examples in Physics 1, Tehnički fakultet, Rijeka, 2010.(in Croatian)

1.11. Optional / additional reading (at the time of proposing study programme)

Dobrinić, J., Bonato, J.: Physics , Pomorski fakultet, Rijeka, 2009.(in Croatian)
Horvat, D.: Fizika I - Mehanika i toplina, Hinus, 2005. (in Croatian)

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Dobrinić, J.: Physics (mechanics, vibration, heat), Tehnički fakultet, Rijeka, 1998. (In Croatian)	11	100
Dobrinić, J., Mandić, L.: Physics 1, Tehnički fakultet, Rijeka, 2002. (In Croatian)	9	100
Dobrinić, J. Mandić, L.: Solved examples in Physics1, Tehnički fakultet, Rijeka, 2001. (In Croatian)	16	100
Dobrinić, J. Mandić, L.: Solved examples in Physics 1, Tehnički fakultet, Rijeka, 2010.(In Croatian)	6	100

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Power Electronics**	
Study programme	**University Undergraduate Study of Electrical Engineering**	
Course status	compulsory	
Year	**3.**	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+45+0

1. **COURSE DESCRIPTION**			
1.1. Course objectives			
Presentation of power electronic converters from the theoretical and practical view, preparation for their design.			
1.2. Course enrolment requirements			
Electronics 1.			
1.3. Expected course learning outcomes			
Describing of standard topological structures of power electronics converters. Describing of power converter functions. Analysing of diode rectifiers' behaviour. Describing of commutation process connected with power electronics valves. Defining of output characteristics of diode rectifiers. Analysing of phase controlled rectifiers. Defining voltage and current transformer equations for DC/DC converters (volt-second balance). Analysing of inverter operation. Analysing a behaviour of direct and indirect AC/AC converters.			
1.4. Course content			
Applications of power electronics. Power flow in power converters and networks. Quality parameters of electric energy. Rectifier circuits. Conditions for reverse power flow in bidirectional rectifiers. Commutation. DC/DC converter with and without transformer. Inverters. AC/AC converters and their applications.			
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork	☐ individual assignment ☒ multimedia and network ☒ laboratories ☐ mentorship ☐ other	
1.6. Comments	Lectures are frequently improved by new laboratory models.		
1.7. Student's obligations			
Course attendance, working reports for laboratory exercises			
1.8. Evaluation of student's work			

Course attendance	2.5	Activity/Participation		Seminar paper		Experimental work	
Written exam	1.5	Oral exam		Essay		Research	
Project		Sustained knowledge check	2	Report		Practice	
Portfolio							

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Course attendance, activity, homework, continuous knowledge testing (three mid-term exams), written and oral exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

J.G. Kassakian, M.F.Schlecht, G.C.Verghese: Fundamentals of power electronics, 1. Part Topologies and power converter functions, Graphis, Zagreb, 2000. (in Croatian)

1.11. Optional / additional reading (at the time of proposing study programme)

Z.Benčić, Z.Plenković, Power electronics, semiconductor valves, Školska knjiga, Zagreb 1978. (in Croatian)
T. Brodić: Power electronics, Power electronic converters, Zigo, Rijeka 2005. (in Croatian)
D.W.Hart: Introduction to power electronics, Prentice Hall International Inc., 1997.
J.G. Kassakian, M.F.Schlecht, G.C.Verghese: Fundamentals of power electronics, 2. Part, Graphis, Zagreb, 2000. (in Croatian)

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
J.G. Kassakian, M.F.Schlecht, G.C.Verghese: Fundamentals of power electronics, 1. Part Topologies and power converter functions, Graphis, Zagreb, 2000. (in Croatian)	6	70

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Programming**	
Study programme	**University Undergraduate Study of Electrical Engineering**	
Course status	compulsory	
Year	**1.**	
ECTS credits and teaching	ECTS student 's workload coefficient	7
	Number of hours (L+E+S)	30+30+0

1. **COURSE DESCRIPTION**							
1.1. Course objectives							
The course provides basic knowledge of the C programming language. Students will work with basic algorithms and data structures.							
1.2. Course enrolment requirements							
None.							
1.3. Expected course learning outcomes							
Explain the storage formats of primitive data types. Understand and use of fundemantal commands in C programming language. Understand and use of commands for program control flow. Understand and use of primitive and complex data types. Understand principles of functions, recursive functions, pointers, and fields. Understand and use of pointers, dynamic memory allocation and self-referential structures. Understand formats of direct, textual, and binary files.							
1.4. Course content							
Primitive data types and storage formats. Programming in C computer language. Commands for program control flow. One-dimensional, two-dimensional and character fields. Functions. Pointers. Pointers and fields. Structures. File Input/Output. Dynamic memory allocation. Dynamic data structures. Pre-processor directives.							
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork			☒ individual assignment ☐ multimedia and network ☒ laboratories ☐ mentorship ☐ other			
1.6. Comments							
1.7. Student's obligations							
Course attendance, laboratory assignments, individual study.							
1.8. Evaluation of student's work							
Course attendance	2	Activity/Participation		Seminar paper		Experimental work	
Written exam	1	Oral exam		Essay		Research	
Project		Sustained knowledge check	3	Report		Practice	1
Portfolio							
1.9. Procedure and examples of learning outcome assessment in class and at the final exam							

Course attendance, laboratory assignments, continuous knowledge tests, written exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Mladen Jurak: Programski jezik C, skripta, ak. god 2003/04.
K. N. King: C Programming, A Modern Approach, 2nd Edition, W. W. Norton & Company, 2008.

1.11. Optional / additional reading (at the time of proposing study programme)

Dennis M. Ritchie, Brian W. Kernighan: The C Programming Language, Prentice Hall, Inc., 1988.
Rajko Vulin: Zbirka riješenih zadataka iz C-a, 3. izdanje, Školska knjiga, Zagreb 2003.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Signals and Systems**	
Study programme	**University Undergraduate Study of Electrical Engineering**	
Course status	compulsory	
Year	**3.**	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	45+15+0

1. **COURSE DESCRIPTION**							
1.1. Course objectives							
Understanding time and frequency analysis and processing methods of continuous and discrete-time signals, as well as basic input-output relationships of linear time-invariant (LTI) systems. Development of analysis, synthesis, and problem solving skills.							
1.2. Course enrolment requirements							
Mathematics 3.							
1.3. Expected course learning outcomes							
Define both elementary signals and basic system properties. Define the response of LTI systems, convolution integral and sum. Use the convolution for the time-domain analysis of LTI systems. Define Fourier series and Fourier transform. Use different Fourier representations in spectral analysis of signals. Define the frequency response of LTI systems. Study LTI systems in the frequency domain. Describe signal sampling and reconstruction procedures.							
1.4. Course content							
Signals and systems; classification, elementary signals, signal models, operations on signals, system properties. Continuous and discrete LTI systems; zero-input response, zero-state response, convolution of signals, properties of LTI systems. Fourier series; line spectrum, systems with periodic inputs. Fourier transform; signal energy, system frequency response, ideal filters. Signal sampling; aliasing, reconstruction filter. Discrete Fourier Transform (DFT); signal spectral analysis.							
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork		☐ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other				
1.6. Comments	-						
1.7. Student's obligations							
Course attendance, project work, individual studying.							
1.8. Evaluation of student's work							
Course attendance	2	Activity/Participation		Seminar paper		Experimental work	
Written exam	1	Oral exam		Essay		Research	

Project	1	Sustained knowledge check	2	Report		Practice	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Sustained knowledge check (written tests), project report, final written exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

B. P. Lathi: Linear Systems and Signals, 2/E, Oxford University Press, 2004.

1.11. Optional / additional reading (at the time of proposing study programme)

H. P. Hsu: Signals and Systems, 3/E, McGraw-Hill, 2014.
S. S. Soliman and M. D. Srinath: Continuous and Discrete Signals and Systems, 2/E, Prentice Hall, 1998.
B. Jeren: Signali i sustavi, Školska knjiga, 2021.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
B. P. Lathi: Linear Systems and Signals, 2/E, Oxford University Press, 2004.	3	80

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Software Applications**	
Study programme	**University Undergraduate Study of Electrical Engineering**	
Course status	compulsory	
Year	**1.**	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

1. **COURSE DESCRIPTION**		
1.1. Course objectives		
Acquiring knowledge of the historical overview of computer development, understanding the elements of computer systems, acquiring knowledge of computer hardware architecture, understanding the connection between hardware and software, acquiring knowledge of computer software, understanding the principles of software development, utilizing computer software in engineering, acquiring basic knowledge of relational databases, acquiring basic knowledge of computer networks, acquiring knowledge of risks and preventive measures in computer security.		
1.1. Course enrolment requirements		
None.		
1.2. Expected course learning outcomes		
To summarize historical overview of computer development; To describe computer hardware architecture; To classify computer software; To design relational databases; To understand the basics of computer networks; To list the risks and preventive measures in computer security; To understand connection between computer software and hardware; To possess skills in utilizing operating systems Windows and Linux; To understand basic principles of software development; To be able to use e-mail, internet browsers and search the Internet; To be able to use software for text processing at an advanced level; To possess knowledge on software for presentation design; To be able to utilize software for vector and raster image processing; To be able to use tools for website design; To be able to use spreadsheets; To be able to use and program in tools for matrix and numerical computing; To be able to use tools for engineering and mathematical calculations.		
1.3. Course content		
Historical overview of computer development. Basics of computer hardware architecture. Computer software. Relational databases. Operating systems. Computer networks. Computer security. Utilizing computer software in engineering. Introduction to programing.		
1.4. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork	☐ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
1.5. Comments		
1.6. Student's obligations		

Course attendance, activity, homework, studying.

1.7. Evaluation of student's work

Course attendance	2	Activity/Participation		Seminar paper		Experimental work	
Written exam	1.5	Oral exam		Essay		Research	
Project		Sustained knowledge check	2.5	Report		Practice	
Portfolio		Homework					

1.8. Procedure and examples of learning outcome assessment in class and at the final exam

Course attendance, activity/participation, independent learning, sustained knowledge check, written and/or oral exam.

1.9. Assigned reading (at the time of the submission of study programme proposal)

Darko Grundler: Applied Computing, Graphis Zagreb 2000, ISBN: 953-6647- 03-6 (in Croatian)

1.10. Optional / additional reading (at the time of proposing study programme)

V. Čerić (urednik): Business Computing, Znak, Zagreb, 1998. (in Croatian)

1.11. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Darko Grundler: Applied Computing, Graphis Zagreb 2000, ISBN: 953-6647- 03-6 (in Croatian)	1	90
V. Čerić (urednik): Business Computing, Znak, Zagreb, 1998. (in Croatian)	1	90

1.12. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.