University of Rijeka
Faculty of Engineering

CURRICULUM
UNDERGRADUATE VOCATIONAL STUDY OF ELECTRICAL ENGINEERING

Rijeka, March 2015

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 I	2	3			5	7
	Physics	2	1	1		4	6
	Fundamentals of Electrical Engineering VO I	3	1	1		5	8
	Materials and Production Processes	2		1		3	4
	Applied Computing VO	1		2		3	5
	TOTAL					**20**	**30**

L - lectures, aT – auditory tutorials, IT – laboratory tutorials, dT – design tutorials.

2. semester							
	Subject title	Hours / week					ECTS
		L	aT	IT	dT	L+T	
	Mathematics II	2	3			5	7
	Fundamentals of Electrical Engineering VO II	3	1	1		5	7
	Digital Logic VO	2	1	1		4	6
	Mechanics and Structural Elements VO	2	1			3	5
	Technical Documenting	1			2	3	5
	TOTAL					**20**	**30**

3. semester							
	Subject title	Hours / week					ECTS
		L	aT	IT	dT	L+T	
	Measurements in Electrical Engineering VO	3		2		5	7
	Semiconductor Devices and Basic Microelectronic Circuits	3	1	1		5	7
	Linear Electrical Circuits	3	1			4	7
	Mechatronics	2	1	1		4	6
	Foreign Language I[1]	1	1			2	3
	TOTAL					**20**	**30**

[1] elective: English or German - free choice

4. semester							
	Subject title	Hours / week					ECTS
		L	aT	IT	dT	L+T	
	Fundamentals of Power Electronics	3	1	1		5	7
	Fundamentals of Automatic Regulation	2	2			4	7
	Foreign Language II[1]	1	1			2	3
	Professional Practice I						5
Subject from elective group Communications:							
	Digital Computers	3	2			5	8
Subject from elective group Power Engineering:							
	Electric Power Plants	3	1		1	5	8
	TOTAL					**16**	**30**

5. semester							
	Subject title	Hours / week					ECTS
		L	aT	IT	dT	L+T	
	Organization and Economics	2	1			3	4
Subjects from elective group Communications:							
	Information and Communication	3	2			5	7
	Telecommunication Devices and Networks	2	1		1	4	7
	Computer Networks VO	2	1	1		4	7
	Fiber Optic Networks	3	1			4	5
Subjects from elective group Power Engineering:							
	Electrical Power Networks	3	1		1	5	7
	Electrical Power Facilities Equipment	3	1			4	7
	Power System Protection	2	1	1		4	6
	Fundamentals of Electrical Machines	2	2			4	6
	TOTAL					**20**	**30**

.

6. semester							
	Subject title	Hours / week					ECTS
		L	aT	IT	dT	L+T	
	Free Elective Subject					4	5
	Professional Practice II						10
	Final Work						10
Subject from elective group Communications:							
	Radiocommunications VO	3	1			4	5
Subject from elective group Power Engineering:							
	Construction and Maintenance of Power Plants	3			1	4	5
	TOTAL					**8**	**30**

Free Elective Subject							
	Subject title	Hours / week					ECTS
		L	aT	IT	dT	L+T	
	Fundamentals of Electric Power Facilities Design	3			1	4	5
	Hydraulics and Pneumatics	3		1		4	5
	Quality Assurance VO	3			1	4	5
	Production Systems	2	1		1	4	5
	Technological Processes in Process Industry	3	1			4	5
	Physical and Health Education[2]			2		2	1

[2] Subject can be enrolled as additional free elective subject

UNDERGRADUATE VOCATIONAL STUDY OF ELECTRICAL ENGINEERING TOTAL	Hours	ECTS
	104	**180**

Basic description		
Course title	**Applied Computing VO**	
Study programme	**Undergraduate Vocational 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)	15+30+0

1. COURSE DESCRIPTION

1.1. Course objectives

Obtaining theoretical knowledge and developing skills for active participation in the information society. Acquiring the knowledge required for using operating system for personal computers and using office program, using the internet, creating a website, using mathematical and graphical applications.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Using Microsoft Windows operating system, Microsoft Word, Microsoft Excel, Microsoft Access, Microsoft PowerPoint. Using the internet and electronic mail.Using open source programs Linux and OpenOffice.Using Microsoft Project, Microsoft Visio, Microsoft Frontpage. Using a graphic design software CorelDRAW. Using a raster graphics editor Adobe Photoshop. Using an engineering calculation software PTC Mathcad. Using a programming language Microsoft Visual Basic.

1.4. Course content

The basic concepts of information technology (computer architecture, computer networks). Using personal computers and managing data (Microsoft Windows). Word processing (Microsoft Word). Spreadsheet application (Microsoft Excel). Database management system (Microsoft Access). Slide show presentation program (Microsoft PowerPoint). Accessing the internet (CARNet). Internet research and using electronic mail (Microsoft Internet Explorer, Microsoft Outlook Express). Online data bases. Publishing (Microsoft Publisher). Image editing (Adobe Photoshop). Using Microsoft Project and Microsoft Visio. Create and work with web sites using Microsoft FrontPage. Open source programs (operating system Linux and office program OpenOffice). The basics of mathematical program Mathcad and CorelDRAW fundamentals. The basics of programming language Microsoft Visual Basic.

1.5. Teaching methods		
	☒ 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

Attending lectures, control tests.

1.8. Evaluation of student's work

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

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

Attending lectures, sustained knowledge check (control tests), written exam.

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

Grundler, D.: Applied Computing, Graphis, Zagreb, 2000. (In Croatian)
Maštruko, O.: Windows XP from beginners to expert, Bug, Zagreb, 2003. (In Croatian)

Sagman, S.: Microsoft Office 2003 for Windows, Miš, Zagreb, 2004. (In Croatian)

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

Tackett, J., Burnett, S.: Linux, Strijelac, Zagreb, 1999. (In Croatian)
Petric, D.: Research on Internet, Bug, Zagreb, 2002(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*
Grundler, D.: Applied Computing, Graphis, Zagreb, 2000. (In Croatian)	6	40
Maštruko, O.: Windows XP from beginners to expert, Bug, Zagreb, 2003. (In Croatian)	2	40
Sagman, S.: Microsoft Office 2003 for Windows, Miš, Zagreb, 2004. (In Croatian)	2	40

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

Through structured Faculty quality assurance system.

Basic description		
Course title	**Computer Networks VO**	
Study programme	**Undergraduate Vocational 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

Description and classification of computer networks and communication services structure and architecture. Computer networks working principles. Understanding and usage of basic network communication protocols and Internet services.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Define OSI reference model of computer networks architecture. Describe purpose of each layer of the OSI model. Compare OSI reference model to other network architectures (TCP/IP, hybrid). Describe important services and protocols on each network layer. Analyse well known Internet protocols. Describe problems in designing secure computer networks. Apply Internet application layer protocols using specific solutions. Implement simple network protocols.

1.4. Course content

Computer networks organization. OSI reference model. Physical layer: theoretical foundation, media. Physical layer implementation, cabling. Data link layer. Error detection and correction, protocol examples, HDLC, Internet data link layer. Media access control (MAC) sub-layer, transmission channel contention. IEEE 802 LAN standards. Network layer. Routing algorithms and congestion control algorithms. Connecting networks. Internet network layer. Transport layer services, transport protocol functioning. Internet transport layer. Application layer. Internet applications and protocols: DNS, em-mail, WWW. Data compression. Computer networks applications. Computer networks security.

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, midterm exams, laboratory work, essay.

1.8. Evaluation of student's work

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

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

Course attendance, midterm exams, laboratory work, essay, final exam.

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

Tanenbaum, A.S.: Computer Networks, 4th Edition. Prentice Hall, 2003.

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

Stallings, W.: Data and Computer Communications, 7th Edition, Pearson Education, 2004.
Turk, S.: Computer Networks, Školska Knjiga, Zagreb, 1991. (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*
Tanenbaum, A.S.: Computer Networks, 4th Edition. Prentice Hall, 2003.	1	10
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	**Construction and Maintenance of Power Plants**	
Study programme	**Undergraduate Vocational 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)	45+15+0

1. COURSE DESCRIPTION

1.1. Course objectives

Preparing students through knowledge and experience from the subject area. Development of capabilities for individual work through a project on Croatian or English and its presentation.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Define maintenance of technical systems according to set targets. Distinguish access, distribution, strategies, methods, organisation, planning models and modes of technical systems maintenance. Describe approaches for prevention and efficient maintenance. Analyse the strategy of preventive maintenance of facilities, equipment and installations considering conditions and quote types of diagnostic methods. Provide arguments for preventive maintenance with regard to conditions and according to examples in electricity facilities, installations and equipment. Give examples of the application of new technologies in the function of determining maintenance strategies. Describe the approach of the revitalization of complex electrical products and maintenance of electric drives. Analyze IT support regarding maintenance and construction of facilities for planning works and tracking of resources: human and material resources. Determine the requirements on the expertise of staff in the power system driven by technological development. Analyze requirements, professional standards and regulations for the construction of electrical facilities.

1.4. Course content

General information on maintenance (definitions, concepts). Access, distribution, strategies, methods, organization forms, planning models and ways of facilitating the maintenance of technical systems. Access to preventive and cost-effective maintenance. Maintenance strategy for machinery, equipment and installations according to real conditions. Access to the revitalization of complex electrical products and maintenance of electric drives. IT support for construction and maintenance of the plant. Requirements on the expertise of staff in the power system driven by technological development. Analysis of requirements, technical regulations and legal regulations for construction of facilities. Examples of making investment programs, project assignments and network construction and maintenance plans. Techno-economic analysis of construction and maintenance. Creation of a database for planning and construction of the maintenance and monitoring of resources: human and material resources.

1.5. Teaching methods		
	☒ 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, project, studying.

1.8. Evaluation of student's work

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

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

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

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

J. Karneluti: Construction and Maintenance of Electric Power Systems, work material (In Croatian)

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

N. Majdančić: Maintenance strategy and information systems maintenance, Udžbenik Strojarskog fakulteta u Slavonskom Brodu Sveučilišta u Osijeku, Slavonski Brod, 1999. (In Croatian)
Law on Spatial Planning and Construction, Narodne novine 76/07(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. Karneluti: Construction and Maintenance of Electric Power Systems, work material (In Croatian)	0	15

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 Computers**	
Study programme	**Undergraduate Vocational Study of Electrical Engineering**	
Course status	optional	
Year	**2.**	
ECTS credits and teaching	ECTS student 's workload coefficient	8
	Number of hours (L+E+S)	45+30+0

1. COURSE DESCRIPTION

1.1. Course objectives

Understanding basic concepts of organization and functioning of individual computer components. Understanding of interaction between computer and its environment.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Presentation of numbers in computer memory. Von Neumann model of computer. Addressing of memory. Simplified model of microprocessor. Basic instructions and their executions. Working of computer bus. Arithmetic-logical unit. Controlling unit. Sub-program calling. Stack. Interruption system. Flow. Hierarchical memory organization. . Speeding up data access in computer memory. Virtual memory. Input-output system. Communication with outside world. Serial and parallel input/output devices.

1.4. Course content

Describing data storage and basic operations in a computer. Apply Turing's machine. Describe fuctioning of controlling and arithmetic logical unit. Analyze functioning of simplified microprocessor SAP. Describe architectures CISC and RISC. Analyse microprocessor instruction pipeline. Describe computer bus and memory system. Apply the methods for speeding up data access in computer memory. Describe computer input-output system. Analyse interrupts and exceptions. Describe 8, 16, 32 and 64 bits computer architecture.

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, continuous knowledge testing, final exam.

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	4	Report		Practice	
Portfolio							

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

Course attendance, continuous knowledge testing, final exam.

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

Ribarić, S.: Advanced Microprocessor Architectures, Školska knjiga, Zagreb, 1990. (in Croatian)

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

Ribarić, S.: Computer Architecture RISC and CISC, 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*
Ribarić, S.: Advanced Microprocessor Architectures, Školska knjiga, Zagreb, 1990. (in Croatian)	5	20
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 Logic VO**	
Study programme	**Undergraduate Vocational 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

Obtain theoretical knowledge and develop skills to solve practical problems in the field of digital logic. Determine the behaviour of a digital logic circuit (analysis). Solve logical problems and develop the efficient digital logic circuits (synthesis). Participate as a member of a team-oriented design project.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Student is able to compare numerical notation in various numerical systems, analyse logical expression using the Boolean algebra. Apply the algebra for logical function minimization, describe the basic logical circuits. Analyse the functionality of basic and complex logical circuits.

1.4. Course content

Number systems. Coding. Boolean algebra. Basic logical circuits. Combinational logical circuits. Minimization of logical functions. Sequential circuits. Flip-flops, Counters, Registers. Digital arithmetic. Arithmetic circuits. Memory effects and circuits. A/D and D/A converters. Microelectronics implementations of logical 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, web test and quiz, homework, studying.

1.8. Evaluation of student's work

Course attendance	2	Activity/Participation		Seminar paper		Experimental work	
Written exam	0.75	Oral exam	0.75	Essay		Research	
Project	0.5	Sustained knowledge check	1.5	Report		Practice	0.5
Portfolio							

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

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

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

U. Peruško, V. Glavinić, Digital Systems, Školska knjiga Zagreb, Zagreb, 2005. (In Croatian)

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

A. Szabo: Digital electronics, FER, Zagreb, 2003. (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*
U. Peruško, V. Glavinić, Digital Systems, Školska knjiga Zagreb, Zagreb,2005 (In Croatian)	5	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	**Electric Power Plants**	
Study programme	**Undergraduate Vocational Study of Electrical Engineering**	
Course status	optional	
Year	**2.**	
ECTS credits and teaching	ECTS student 's workload coefficient	8
	Number of hours (L+E+S)	45+30+0

1. COURSE DESCRIPTION

1.1. Course objectives

Understanding of energetic concepts and principles and their explanation and use in frame or electric power system comprising generation, transmission, distribution and consumption of electrical energy. Gaining knowledge about electrical switchgears, transmission and distribution networks in electric power systems.

1.2. Course enrolment requirements

Attended courses Fundamentals of Electrical Engineering VO II.

1.3. Expected course learning outcomes

Define forms of energy according to meaning, appearance and classification. Distinguish natural forms of energy according to characteristics and stocks. Distinguish renewable natural forms of energy according to characteristics. Describe electric power system and set its energetic balance. Analyze significance and role of energy in development of society and its environmental impact. Explain specificities of electric power system. Describe electrical energy consumption through daily load profile. Distinguish electric power system parts in function of generation, transmission, distribution and consumption (use) of electrical energy using numerical examples. Define role, tasks, and types of switchgears. Define role, tasks and types of transmission and distribution networks. Describe characteristics of electric power system: losses of electrical energy and power, reactive power, stability. Describe basic elements and principle of operation for different sources of electrical energy: hydro power plants, thermal power plants, nuclear power plants, wind power plants, unconventional renewable sources and indirect transformations of other types of energy into electrical energy (photovoltaic power plants).

1.4. Course content

Energy and energy system: meaning and forms of energy. Classification of energy forms. Basic characteristics and stocks of natural forms of energy. Basic characteristics of renewable forms of energy. Energy system and energetic balance. Significance and role of energy in development of society. Use of energy and protection of environment.
Electrical energy and electric power system. Specificities of electric power system. Consumption of electrical energy. Daily load profile. Basic role and tasks of switchgears, transmission and distribution networks in electric power system (role and types of switchgears, transmission and distribution networks according to voltage levels, losses of power and energy, reactive power). Sources of electrical energy (basic elements and operating principles): hydro power plants, thermal power plants, nuclear power plants, wind power plants, unconventional renewable sources and indirect transformations of other types of energy into electrical energy (photovoltaic power plants).

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, construction assignment, fieldwork, mid-term exams, final exam.

1.8. Evaluation of student's work

Course attendance	2.5	Activity/Participation		Seminar paper		Experimental work	
Written exam	2.5	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

Course attendance, construction assignment, continuous knowledge testing and final exam.

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

B. Udovičić: Electrical Power System, Kigen, Zagreb, 2005. (In Croatian)

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

M. Kalea: Electrical Energy, Kigen, Zagreb 2007. (In Croatian)
B. Udovičić: Unsustainability of sustainable development, Kigen, Zagreb 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*
B. Udovičić: Electrical Power System, Kigen, Zagreb, 2005. (In Croatian)	3	20

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 Facilities Equipment**	
Study programme	**Undergraduate Vocational 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+15+0

1. COURSE DESCRIPTION

1.1. Course objectives

Introduction in electric power facilities equipment, its different types and its functions during operation in order to understand operation of the whole electric power system.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Describe the basic characteristics of the electric power facilities. Analyze the phenomena caused by interruption of electrical current. Explain switchgear selection. Describe the earthing. Describe the types of instrument transformers and measurements. Describe the sources of auxiliary power. Analyze the performance of standard and special electric power substations. Describe secondary equipment devices.

1.4. Course content

The division and main characteristics of high-voltage and low-voltage electric power substations. Description and design of electric power facilities. Elements of primary equipment. Switchgear selection. Phenomena caused by interruption of electrical current. Types and selection of circuit breakers. Disconnectors. High-voltage fuses. Instrument transformers. Surge arresters. Earthing in electric power substations.
Measurements in power plants and substations. Auxiliary power sources and auxiliary drives. The performances of standard and special electric power substations. Secondary equipment in electric substations: control, measuring, signaling, registration, protective and other devices.

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

Lectures, exercises, seminar paper, fieldwork.

1.8. Evaluation of student's work

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

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

Course attendance, activity, seminar paper, continuous knowledge testing, written and oral exam.

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

K. Meštrović: Switching devices in medium and high voltage Graphis, Zagreb, 1998. (In Croatian)
H. Požar: High-voltage switchgear, Tehnička knjiga, Zagreb, 1990. (In Croatian)
H. Požar: Fundamentals of Energy I, II i III, Školska knjiga, Zagreb, 1992. (In Croatian)

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

M. Ujević, I. Buntić: Power Plants, Školska knjiga, Zagreb, 1995. (In Croatian)
J.D. Glover, S. S. Mulukutla: Power System Analysis and Design, Thomson-Engineering, USA, 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*
K. Meštrović: Switching devices in medium and high voltage Graphis, Zagreb, 1998. (In Croatian)	4	20
H. Požar: High-voltage switchgear, Tehnička knjiga, Zagreb, 1990. (In Croatian)	5	20
H. Požar: Fundamentals of Energy I, II i III, Školska knjiga, Zagreb, 1992. (In Croatian)	4	20

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	**Undergraduate Vocational 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

Physical understanding of the electrical variables in the electric power network during different operating conditions. The ability of modeling, calculating and determining the electrical conditions in electric power networks. The ability to solve a problem regarding analysis or optimal development of electric power network.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Describe the elements of the electrical power network. Describe overhead and underground electric power lines. Make a mechanical calculation of the overhead line. Make a calculation of a cross-section of the cable line. Define the substitutional model of different elements of the electric power network. Analyze the electrical conditions in the electric power networks. Calculate a load flows in the electric power networks. Make calculations of voltage drops and losses in radial networks. Describe short circuit analysis and stability in the electric power networks. Analyze the reliability of the electric power network.

1.4. Course content

The definition and the basic structure of electric power networks. Types and division of the electric power network. Historical development of the electric power network. Elements of the electric power network. Design and technology of the overhead electric power lines. Mechanical calculation of overhead electric power lines. Design and technology of the electric power cable lines. Constants of electric power lines. Theory of transmission of electricity. Calculation of electricity transmission using the transmission equation and the substitutional model of electric power lines. Access to the electric power network calculations. Substitutional models of the electric power network elements. Load flow in the electric power networks. Calculation of short circuit in the electric power networks. Calculation of reliability in the electric power network. Calculation of the stability of the electric power network. Calculations of medium and low voltage networks. Problems in the transmission and the distribution networks. Planning the development of electricity consumption. Planning the development of electric power networks. Consumer substations and installations.

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

Lectures, exercises, project, continuous knowledge testing.

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	Continuous knowledge testing	2	Report		Practice	
Portfolio							

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

Course attendance, activity, project, continuous knowledge testing, 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-V, FESB Split,1996-2002. (In Croatian)
S. Nikolovski, D. Šljivac: Electrical Power Networks, workbook, ETF Osijek. (In Croatian)

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

S. Nikolovski, B. Štefić: Transmission and distribution of electrical energy, ETF Osijek. (In Croatian)
J. Grainger, W. Stevenson: Power System Analysis, McGrow- Hill 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*
M. Ožegović, K. Ožegović: Electrical Power Networks I-V, FESB Split,1996-2002. (In Croatian)	5	20
S. Nikolovski, D. Šljivac: Electrical Power Networks, workbook, ETF Osijek. (In Croatian)	4	20

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 I**	
Study programme	**Undergraduate Vocational 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+15+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 (up to B1 level).

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

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 (up to B1 level). They should be able to: compare general with technical English on the basis of selected texts and topics; recognize and explain grammatical structures and principles typical of the vocational jargon from examples (Tenses; Definite and Indefinite Article, Comparison of Adjectives, Relative Clauses); implement grammatical structures and aspects in written exercises; recognize terminology, key words and/or information in selected texts as well as differentiate and analyse relevant elements in them; describe and interpret accurately simple diagrams, charts, figures and mathematical formulae; formulate in writing summaries, arguments and definitions.

1.4. Course content

Topics: Engineering Profession. The Atom. Interaction in Atomic Systems. Materials in Electrical Engineering. Magnetic Materials and Electromagnetism. Energy. Characteristics of Capacitance. Lenz`s Law-Inductance. Ohm`s Law-Resistance. The A-C Cycle. Electric Quantities and Units.
Grammatical Structures: Tenses. Definite and Indefinite Article. Comparison of Adjectives. Relative Clauses.

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

Attendance, activity in class and independent learning.

1.8. Evaluation of student's work

Course attendance	1	Activity/Participation		Seminar paper	0.25	Experimental work	
Written exam	0.5	Oral exam		Essay		Research	
Project		Sustained knowledge check	1.25	Report		Practice	
Portfolio							

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

Attendance, seminar paper, continuous evaluation of knowledge (two tests), written exam.

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

Bartolić Lj.: Technical English in Electronics and Electrical Power Engineering. Školska knjiga Zagreb
Vince, M.: Intermediate Language Practice, Heinemann ELT, Oxford, 1998

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

Selected vocational articles and texts at the upper intermediate level of the Cambridge and Longman University Press.		
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*
Bartolić Lj.: Technical English in Electronics and Electrical Power Engineering. Školska knjiga Zagreb		30
Vince M.: Intermediate Language Practice, Heinemann Elt, Oxford 1998		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	**English Language II**	
Study programme	**Undergraduate Vocational 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+15+0

1. COURSE DESCRIPTION

1.1. Course objectives

Students should be able to use professional jargon independently, namely communicate with other experts in the field of the engineering profession and in an international environment, at the B2 level of the Common European Framework of Reference for Languages.

1.2. Course enrolment requirements

Attended course English Language I.

1.3. Expected course learning outcomes

Students should be able to use professional jargon like experts in Electrical Engineering who spend the most of their time in the plant, i.e. in the field, and to a lesser extent in the office, at the B2 level of the Common European Framework of Reference for Languages. Students should be able to: recognize and explain grammatical structures typical of the vocational jargon (Passive. Sequence of Tenses. Direct and Indirect Speech. Modals. Compounds. Word Formation. Conditional Clauses. Final Clauses); implement grammatical structures in written exercises; analyse and differentiate terminology and relevant elements in texts; paraphrase certain relevant parts in the text; write summaries of the text, arguments and definitions; analyse and describe complex diagrams, charts, figures, processes, experiments and mathematical formulae; defend orally their own positions as well as critically evaluate individual solutions of a problem.

1.4. Course content

Topics: Introduction to Electric Power Systems. Switches, Circuit Breakers and Fuses. Conduction and Transmission of Electric Current. Transformers. Electric Generators and Motors. Information Age. Introduction to Digital Computers and Microcomputers. Fundamentals of Transistor Physics. Transistors.
Grammatical Structures: Passive. Sequence of Tenses. Direct and Indirect Speech. Modals. Compounds. Word Formation. Conditional Clauses, Final Clauses. Writing Summaries.

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

Attendance, activity in class and independent learning.

1.8. Evaluation of student's work

Course attendance	1	Activity/Participation		Seminar paper	0.25	Experimental work	
Written exam	0.5	Oral exam		Essay		Research	
Project		Sustained knowledge check	1.25	Report		Practice	
Portfolio							

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

Attendance, seminar paper, continuous evaluation of knowledge (two tests), written exam.

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

Bartolić Lj.: Technical English in Electronics and Electrical Power Engineering. Školska knjiga Zagreb
Vince M.: Intermediate Language Practice, Heinemann ELT, Oxford 1998

Murphy R.: English Grammar in Use. Cambridge University Press, 1994

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

Selected vocational articles and texts at the upper intermediate level of the Cambridge and Longman University Press.

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*
Bartolić Lj.: Technical English in Electronics and Electrical Power Engineering. Školska knjiga Zagreb		30
Vince M.: Intermediate Language Practice, Heinemann Elt, Oxford 1998		30
Murphy R.: English Grammar in Use. Cambridge University Press, 1994		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	**Fibre Optic Networks**	
Study programme	**Undergraduate Vocational 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)	45+15+0

1. COURSE DESCRIPTION

1.1. Course objectives

Understanding terminology and use of fibre optic networks. Capability of planning and designing fibre optic systems in telecommunications. Capability to work on development and implementation for different cable networks in optical domain.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Describing physical principles of light propagation. Analyse various kinds of optic fibres and cables. Analyse influence of attenuation and dispersion. Describe passive and active optical components. Analysing different kinds and applications of optical systems for information transfer. Describe methods and instruments for measurements in optical systems. Describe methods of mathematical modelling of optical network. Analyse security and accessibility of optical network. Describe Planning and designing of fibre optic information transfer systems. Describe types of optical sensors and their use.

1.4. Course content

History of optical communication. Introduction in physical definition and principal laws of optics. Optical transmission systems – elements, production, parameters. Fibers and cables types, production and application. Application of fiber optics in telecommunications. Ship and undersea communications networks. Planning and constructing optical cable transmission systems. Measurement of optical parameters, definition and test methods for the relevant parameters of optical systems, measurement equipment. Availability and reliability of optical network. Mathematical availability models of network. Trends in optical network domain: WDM, DWDM, PON, FTTx.

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, written exams, final exam.

1.8. Evaluation of student's work

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

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

Course attendance, activity, homework, continuous knowledge testing (two written exams), written and oral exam

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

Betti, S., De Marchis, G., Iannone, E.: Coherent optical communications systems, J. Wiley & Sons, USA, 1994.
Koshiba, M.: Optical waveguide analysis, McGraw-Hill, New York, 1992.
Singh, J.: Semiconductor optoelectronics, McGraw-Hill, New York, 1995.

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

Wilson, J., Hawkes, J.F.B.: Optoelectronics: An Introduction, Prentice – Hall, USA.
John M. Senior: Optical Fiber Communications, Prentice-Hall, UK

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*
Betti, S., De Marchis, G., Iannone, E.: Coherent optical communications systems, J. Wiley & Sons, USA, 1994.	1	10
Koshiba, M.: Optical waveguide analysis, McGraw-Hill, New York, 1992.	1	10
Singh, J.: Semiconductor optoelectronics, McGraw-Hill, New York, 1995.	1	10

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	**Undergraduate Vocational Study of Electrical Engineering**	
Course status	compulsory	
Year	**3.**	
ECTS credits and teaching	ECTS student 's workload coefficient	10
	Number of hours (L+E+S)	-

1. COURSE DESCRIPTION

1.1. Course objectives

The Final Work is an individual assignment and verification of student vocational knowledge, which should show the appropriate level of engineering skills for individually solving specific professional tasks.

1.2. Course enrolment requirements

Enrolled course from which the Final Work is selected.

1.3. Expected course learning outcomes

Apply acquired knowledge and skills of the vocational content of Final Work 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 vocational studies. Final thesis can be specified from a particular course specific vocational content and exceptionally from course that belongs to the group of shared vocational content, when it represents a broader entity with a particular course specific vocational 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	8	Final work in written form	2		

1.9. Assessment and evaluation of student's work during classes and on 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 Regulation**	
Study programme	**Undergraduate Vocational 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)	30+30+0

1. COURSE DESCRIPTION

1.1. Course objectives

Understanding of basic principles of automatic control and training students for applications. Developing skills of individual and group work.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Define basic terms in automation control field. Apply control systems. Describe dynamic systems in time domain. Determine mathematical models of control systems. Determine system transfer function. Describe standard input functions. Determiine step response and basic control system time responses. Analyse and synthesise linear control systems in time and frequency domain. Analyse stability of linear control systems. Analyse conventional PID control. Apply error compensation control and cascade control.

1.4. Course content

Introduction to control systems field. Application of control systems. Description of dynamic systems in time domain. Mathematical models of control systems. Transfer function. Standard input functions. Step response and basic control systems time responses. Analysis and synthesis of linear control systems in time and frequency domain. Stability of linear control systems. Conventional PID control, error compensation control and cascade control.

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, homeworks, studying for partial exams.

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	2.5	Report		Practice	
Portfolio		Homeworks	0.5				

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

Written knowledge testing, 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)

Z. Vukić: 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: Fundamental of regulation, Tehnički fakultet Rijeka, 2004. (in Croatian)
T. Šurina: Automatic regulation, Školska knjiga, Zagreb, 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*
Z. Vukić: Automatic control, Fakultet elektrotehnike i računarstva, Zagreb, 2001. (in Croatian)	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	**Fundamentals of Electric Power Facilities Design**	
Study programme	**Undergraduate Vocational 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)	45+15+0

1. COURSE DESCRIPTION

1.1. Course objectives

Introduction to activities during all phases of an electric power substation design. Substation's electric parameter calculation and selection of primary and secondary equipment. Ability to establish substation's essential technical requirements, and define typical configurations and solutions. Legal obligations.

1.2. Course enrolment requirements

Attended course Electric Power Plants.

1.3. Expected course learning outcomes

Describe necessary designing basis. Define design types and contents. Define textual and graphical design content. Describe designing methodologies. Compose a MV/LV transformer substation design. Analyze designs of complex electric power plants. Design of an underground cable line. Design of an overhead line. Design of a low voltage distribution network. Design of a low voltage consumer installation.

1.4. Course content

Terms definition: basic principles of design. Types and structures of electric power plants. Design types and levels. Legal obligations in designing. Basics of civil engineering regulations. Electrical regulations. Technical documentation. Project development through different stages. Design contents. Textual and graphical parts of project documentation. Symbols and labelling system. Primary and secondary equipment selection criteria. Designing substations. Design of power lines and networks. Designing consumer plants and installations.

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, studying.

1.8. Evaluation of student's work

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

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

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

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

Badanjak, S.: Fundamentals of engineering in construction, Energetika marketing, Zagreb, 1996. (in Croatian)

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

Law on spatian planning and constructioni, NN RH 76/07, Zagreb 2007. (in Croatian)
1127-1998 IEEE Guide for Design, Construction and Operation of Electric Power Substations for Community Acceptance and

Environmental, Inst. of Elect. & Electronic Eng. 1999.

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*
Badanjak, S.: Fundamentals of engineering in construction, Energetika marketing, Zagreb, 1996. (in Croatian)	1	15

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 VO I**	
Study programme	**Undergraduate Vocational 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+30+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	☐ 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, activity, studying.

1.8. Evaluation of student's work

Course attendance	2.5	Activity/Participation		Seminar paper		Experimental work	
Written exam	1.5	Oral exam	0.5	Essay		Research	
Project		Sustained knowledge check	3	Report		Practice	0.5
Portfolio							

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

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

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

Kuzmanović, B.: Fundamentals of electrical engineering 1, Element, Zagreb, 2005. (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)

Pinter, V.: Fundamentals of electrical engineering - part I, Tehnička knjiga, Zagreb, 1994. (in Croatian)
Jajac, B.: Theoretical fundamentals of electrical engineering, Part I-III, Graphis, Zagreb, 2001-2007. (in Croatian)
Šehović, E., Tkalić, M., Felja, I.: Fundamentals of electrical engineering - collection of examples (part 1), Tehnička knjiga, Zagreb, 1987. (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*
Kuzmanović, B.: Fundamentals of electrical engineering 1, Element, Zagreb, 2005. (in Croatian)	5	75
Đurović, G.: Electrical engineerging I, Školska knjiga, Zagreb, 2004. , (in Croatian)	11	75

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 VO II**	
Study programme	**Undergraduate Vocational 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+30+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	☐ 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, activity, studying.

1.8. Evaluation of student's work

Course attendance	2.5	Activity/Participation		Seminar paper		Experimental work	
Written exam	1.5	Oral exam	0.5	Essay		Research	
Project		Sustained knowledge check	2	Report		Practice	0.5
Portfolio							

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

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

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

Kuzmanović, B.: Fundamentals of electrical engineering 2, Element, Zagreb, 2005. (in Croatian)
Đurović, G.: Electrical engineerging II, Školska knjiga, Zagreb, 2004. , (in Croatian)

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

Pinter, V.: Fundamentals of electrical engineering – part II, Tehnička knjiga, Zagreb, 1994. (in Croatian)
Jajac, B.: Theoretical fundamentals of electrical engineering, Part I-III, Graphis, Zagreb, 2001-2007. (in Croatian)
Felja, I., Koračin, D.: A collection of assignments and solved examples from Fundamentals of Electrical Engieering, part 1. and 2., Školska knjiga, Zagreb, 1991. (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*
Kuzmanović, B.: Fundamentals of electrical engineering 2, Element, Zagreb, 2005. (in Croatian)	5	79
Đurović, G.: Electrical engineerging II, Školska knjiga, Zagreb, 2004. , (in Croatian)	11	79

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 Machines**	
Study programme	**Undergraduate Vocational 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 of the conversion process of mechanical energy to electrical and vice versa. Physical basics of different types of electrical machines, their build and modes for the calculations of their basic operational states.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Distinguish between different types of transformers and electrical machines. Describe the working principle of transformers, asynchronous generators and motors. Distinguish the construction options and cooling of the transformer. To adequately use a transformer in practice and distinguish operational states of asynchronous machines. To calculate voltage, current and efficiency for different loads of asynchronous machines. Describe the outer characteristics of asynchronous machines. Use the adequate protection for transformers and electrical machines.

1.4. Course content

The law of magnetic induction and generating alternating current. Basic alternations of mechanical and electrical energy. Transformers: aerial, ideal and realistic transformer, changes in the secondary voltage due to load fluctuations, efficiency, parallel operation, three-phase transformer, construction and faults. Magnetic circle: the law of flux, current coil. Synchronous machines: operation principle, idle motion, short circuit, vector diagram and load diagrams, synchronous machine on a solid network and island operation, synchronisation, types of excitation, reinforcing coils, different versions. Asynchronous machines: operation principle, voltage equations, replacement network, idle motion, short circuit and load, torque performance, rotation speed control, starting and braking, generator operation, single-phase motors. Cooling, noise, vibrations and protection of electrical machines. Construction of electrical machines and norms.

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		Sustained knowledge check	2	Report		Practice	
Portfolio		Homework	1				

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

R. Wolf: Fundamentals od Electrical Machines, Školska knjiga, 1985. (In Croatian)
A. Dolenc: Transformers I i II, Sveučilište u Zagrevu, 1981.(In Croatian)
Z. Sirotić, Z. Maljković: Synchronous Machines, Sveučilište u Zagrebu 1996.(In Croatian)

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

H. Merz: Electric Machines and Drives – Fundamentals and Calculation Examples for Beginners, VDE Verlag, Berlin, 2002.
R. Fischer: Elektrische Machinen, Carl Hanser Verlag, Munchen, 1979.

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*
R. Wolf: Fundamentals od Electrical Machines, Školska knjiga, 1985. (In Croatian)	7	20
A. Dolenc: Transformers I i II, Sveučilište u Zagrevu, 1981.(In Croatian)	4	20
Z. Sirotić, Z. Maljković: Synchronous Machines, Sveučilište u Zagrebu 1996.(In Croatian)	1	20

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 Power Electronics**	
Study programme	**Undergraduate Vocational 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

Presentation of power electronic converters from the theoretical and practical view, preparation for their design.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Describing of models of components which can be found in power converters. Defining of factors which describes processes in power conversion. 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. Generating of FFT analysis for output voltages and current targeting autonomous inverters. Analysing 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

1.8. Evaluation of student's work

Course attendance	2.5	Activity/Participation		Seminar paper		Experimental work	
Written exam	2	Oral exam		Essay		Research	
Project		Sustained knowledge check	1.5	Report		Practice	1
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on 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)
J.G. Kassakian, M.F.Schlecht, G.C.Verghese: Fundamentals of power electronics, 2. Part, Graphis, Zagreb, 2000. (in Croatian)
Z.Benčić, Z.Plenković, Power electronics, Semiconductor valves, Školska knjiga, Zagreb 1978. (in Croatian)

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

Mohan, N., Underland, T.M., Robins, W.P.: Power Electronics, John Wiley & Sons. Inc, 1995.
Rashid, M.H.: Power Electronics Handbook, Academic Press, 2001.

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)	1	80
J.G. Kassakian, M.F.Schlecht, G.C.Verghese: Fundamentals of power electronics, 2. Part, Graphis, Zagreb, 2000. (in Croatian)	1	80
Z.Benčić, Z.Plenković, Power electronics, Semiconductor valves, Školska knjiga, Zagreb 1978. (in Croatian)	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	**German Language I**	
Study programme	**Undergraduate Vocational 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+15+0

1. COURSE DESCRIPTION

1.1. Course objectives

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

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Students should be able to use general purpose German as well as technical jargon at the elementary level according to the Common European Framework of Reference for Languages (up to B1 level). They should be able to: compare general with technical German on the basis of selected texts and topics from the field of mechanical engineering, naval architecture and electrical engineering; recognize and explain grammatical structures and principles typical of the vocational jargon from examples (Tenses; Modals, Compounds, Word Formation, Dependent Clauses, Relative Clauses, Passive); implement grammatical structures and aspects in written exercises; recognize key words and/or information in selected texts as well as differentiate and analyse relevant elements in them; describe and interpret accurately simple diagrams, charts, figures and mathematical formulae.

1.4. Course content

Topics: Development and Manufacture of Technical Products. Basics of Mechanics. Basics of Thermodynamics. Basics of Fluids. Basics of Electrical Engineering. Energy. Electrical Energy. Current Circuit. Conductors and Insulators. Electricity in Households. Materials in Mechanical Engineering and Naval Architecture. Metal Forming. Tools and Machinery. Fittings.
Grammatical Structures: Tenses. Modals. Compounds. Word Formation. Dependent Clauses. Relative Clauses. Passive.

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

Attendance, activity in class, independent learning.

1.8. Evaluation of student's work

Course attendance	1	Activity/Participation		Seminar paper	0.25	Experimental work	
Written exam	0.5	Oral exam		Essay		Research	
Project		Sustained knowledge check	1.25	Report		Practice	
Portfolio							

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

Attendance, seminar paper, continuous evaluation of knowledge (two tests), written exam.

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

Grujoski / Kovačić: Texts, exercises ans assignments in German language for electrical engineering. Školska knjiga Zagreb. (in Croatian)
Lardšnajder, R.: Texts, exercises ans assignments in German language for mechanical engineering. Školska knjiga,

Zagreb. (in Croatian)
Štambuk / Marinić: Deutsch und Technik. Školska knjiga 1993.

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

Zettl / Jansen / Müller: Aus moderner Technik und Naturwissenschaft. Hueber 2003.
Selected texts.

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*
Grujoski / Kovačić: Texts, exercises ans assignments in German language for electrical engineering. Školska knjiga Zagreb. (in Croatian).	1	10
Lardšnajder, R.: Texts, exercises ans assignments in German language for mechanical engineering. Školska knjiga, Zagreb. (in Croatian).	0	10
Štambuk / Marinić: Deutsch und Technik. Školska knjiga 1993	0	10

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	**German Language II**	
Study programme	**Undergraduate Vocational 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+15+0

1. COURSE DESCRIPTION

1.14. Course objectives

Students should be able to use professional jargon independently, namely communicate with other experts in the field of the engineering profession and in an international environment, at the B2 level of the Common European Framework of Reference for Languages.

1.1. Course enrolment requirements

Attended course German Language I.

1.2. Expected course learning outcomes

Students should be able to use professional jargon independently, namely communicate with other experts in the field of the engineering profession and in an international environment, at the B2 level of the Common European Framework of Reference for Languages. They should be able to: recognize and explain grammatical structures typical of the vocational jargon (Conditional Clauses. Infinitive Forms. Present and Past Participle. Comparison of Adjectives); implement grammatical structures in written exercises; differentiate and analyse relevant elements in the text; paraphrase certain relevant parts in the text; write summaries of the text; analyse and describe complex diagrams, charts, figures, processes and mathematical formulae; defend orally their own positions as well as critically evaluate individual solutions of a problem.

1.3. Course content

Topics: Sources of Energy and Environment Protection. Information Technology. Data Processing. Computer and Microcomputer. Generators and Motors. Semiconductors. Transistors. Electromagnetic Waves. Internal Combustion Engines. Diesel Engines
Grammatical Structures: Conditional Clauses. Infinitive Forms. Present and Past Participle. Comparison of Adjectives. Specific vocabulary, grammatical and communication structures of German technical jargon.

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

Attendance, activity in class, independent learning.

1.7. Evaluation of student's work

Course attendance	1	Activity/Participation		Seminar paper	0.25	Experimental work	
Written exam	0.5	Oral exam		Essay		Research	
Project		Sustained knowledge check	1.25	Report		Practice	
Portfolio							

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

Attendance, seminar paper, continuous evaluation of knowledge (two tests), written exam.

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

Grujoski / Kovačić: Texts, exercises ans assignments in German language for electrical engineering. Školska knjiga Zagreb. (in Croatian)

Lardšnajder, R.: Texts, exercises ans assignments in German language for mechanical engineering. Školska knjiga, Zagreb. (in Croatian)
Štambuk / Marinić: Deutsch und Technik. Školska knjiga 1993.

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

Zettl / Jansen / Müller: Aus moderner Technik und Naturwissenschaft. Hueber 2003.
Selected texts.

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*
Grujoski / Kovačić: Texts, exercises ans assignments in German language for electrical engineering. Školska knjiga Zagreb. (in Croatian).	1	10
Lardšnajder, R.: Texts, exercises ans assignments in German language for mechanical engineering. Školska knjiga, Zagreb. (in Croatian).	0	10
Štambuk / Marinić: Deutsch und Technik. Školska knjiga 1993	0	10

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

Through the Institution`s Quality Assurance System.

Basic description		
Course title	**Hydraulics and Pneumatics**	
Study programme	**Undergraduate Vocational 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)	45+15+0

1. COURSE DESCRIPTION

1.1. Course objectives

Mastering the basics of hydrostatic and pneumatic power transmissions, the application of knowledge to assemble circuits and simulations on commercial computer program.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Explain the mode of power transmission in hydraulic and pneumatic systems. Define sources of hydraulic and compressed air energy. Distinguish components for control in hydraulic and pneumatic systems. Describe auxiliary devices in hydraulic and pneumatic systems. Define logic circuits and types of control. Connect hydraulic and pneumatic components into simple systems. To implement the acquired knowledge in complex hydraulic and pneumatic systems.

1.4. Course content

Development and application of hydraulic and pneumatic equipment and systems. Standardized symbols of hydraulic and pneumatic components. Working fluids. Energy and power in hydraulic and pneumatic systems. Sources of the hydraulic energy and compressed air (pumps and compressors). Actuators (motors and cylinders). Control components of hydraulic and pneumatic systems (valves, pressure valves, flow control valves). Auxiliary devices for the transmission of energy (pipelines, fittings, filters, tanks, hydro accumulators, devices for maintaining the temperature of the fluid, the elements of air treatment, contact-free sensors, pneumatic gates and reflex nozzles, switches, indicators, signal converters, silencers). Hydro-pneumatic devices. Vacuum devices. Pneumatic logic circuits. Designing of the fluid power 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, laboratory work, the application of knowledge to a specific system for fluid power transmission through an essay.

1.8. Evaluation of student's work

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

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

Course attendance, activity, assembling circuits in laboratory, continuous knowledge testing (two mid-term exams), essay, written and oral exam.

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

Nikolić. J.: Pneumatic Control, Zagreb, 1976. (in Croatian)
Bauer, G.: Ölhydraulik, B. G. Teubner, Stuttgart, 1992.

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

Krist, T.: Hydraulik, Fluidtechnik, Vogel Buchverlag, 1997.
Haug, R.: Pneumatische Steuerungstechik, Teubner, Stuttgart, 1991.

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*
Nikolić. J.: Pneumatic Control, Zagreb, 1976. (in Croatian)	3	8
Bauer, G.: Őlhydraulik, B. G. Teubner, Stuttgart, 1992.	-	8

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	**Information and Communication**	
Study programme	**Undergraduate Vocational 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

2. COURSE DESCRIPTION

1.1. Course objectives

Understanding the basics concepts connected with information transfer. Ability to solve problems connected to support and planning of information systems.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Describing general model and components of communication system. Analysing discrete and continuous communication system. Compare basic properties of communication channels. Differentiate between various methods of information transfer. Define the architecture of telecommunication network, its evolution and ability to describe basic elements of telecommunication networks. Describe flow of information and the traffic in telecommunication network. Explain the protocols and processes for managing telecommunication network. Differentiate network services and telecommunication protocols.

1.4. Course content

Basic model of communication system. Discrete communication system. Entropy. Transfer of information through communication channel. Capacity of channel. Communication channel in continuous time. Multiplexing in space, time and frequency. Space, time and frequency commutation. Telecommunication network. Flow of information and traffic in the network. Evolution of telecommunication network. Managing the network: protocols and processes. Network services. Telecommunication protocols.

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, midterm exams, homework.

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		Homework	2				

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

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

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

Sinković, V.; Kos, M. Vrdoljak, Z.; i drugi: Introduction to Information Theory and Coding, Element, Zagreb, 2007. (in Croatian)
Bažant, A.; Gledec, G.; Ilić, Ž.; i drugi: Network Architecture Basics, Element, Zagreb, 2004. (in Croatian)

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

Župan, J.: Uvod u komutacijske sustave, Školska knjiga, Zagreb, 1978. (in Croatian)
Župan, J., Tkalić, M., Kunšutić, M.: Logičko projektiranje digitalnih sustava, Školska knjiga, Zagreb, 1995. (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*
Sinković, V.; Kos, M. Vrdoljak, Z.; i drugi: Introduction to Information Theory and Coding, Element, Zagreb, 2007. (in Croatian)	2	10
Bažant, A.; Gledec, G.; Ilić, Ž.; i drugi: Network Architecture Basics, Element, Zagreb, 2004. (in Croatian)	1	10

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	**Linear Electrical Circuits**	
Study programme	**Undergraduate Vocational 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

None.

1.3. Expected course learning outcomes

Describe elements of electrical circuits. Circuits' analysis in order to determine time responses. Apply circuits' theorems. Analysis of circuits' frequency responses. Analysis of circuits contains two-ports. Analysis of circuits contains transmission lines.

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. 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		Sustained knowledge check	3	Report		Practice	
Portfolio		Homework	0.5				

1.9. Assessment and evaluation of student's work during classes and on 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: Circuit and line theory, Tehnički fakultet, Rijeka, 2005. (In Croatian)
N. Stojković: Circuit nad line theory - workbook, 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.

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: Circuit and line theory, Tehnički fakultet, Rijeka, 2005. (In Croatian)	10	80
N. Stojković: Circuit nad line theory - workbook, Tehnički fakultet, Rijeka, 2005. (In Croatian)	8	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	**Materials and Production Processes**	
Study programme	**Undergraduate Vocational 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+15+0

1. COURSE DESCRIPTION

1.1. Course objectives

Student will be informed with the fundamentals of material science. Student will be skilled for appropriate materials selection in electrical engineering practice. Moreover, student will acquire basic methods of manufacturing processes.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Compare the basic material groups in electrical engineering. Analyse the material microstructure. Analyse the relation between microstructure and material properties. Define basic material properties. Analyse the basic manufacturing processes of materials. Proper material selection on the basis of construction and technological requirements.

1.4. Course content

Introduction. Materials in electrical engineering. Microstructure. Crystal and amorphous microstructure. Equilibrium diagrams of alloys. Microstructure and properties of metals. Essential properties of macromolecule. Basic properties of polymers. Ceramics. Microstructure and properties of ceramics. Microstructure and properties of composites. Electrical and magnetic properties of materials. Definition of conductors, semiconductors and resistors. Mechanical properties of materials. Corrosion and anti-corrosion properties of materials. Basic manufacturing processes of materials. Heat treatment. Advance technologies. Materials types and possibility of application of a manufacturing processes. Aspects of materials application. Methods of materials selection.

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, participation in teaching, mid-term exams, homework.

1.8. Evaluation of student's work

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

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

Course attendance, homework, sustained knowledge check (two mid-term exams), written exam.

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

Bek, V., Technology of electric material, Sveučilište u Zagrebu, 1991. (In Croatian)

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

Polak, J., Srb, N., Izolacijski materijali i izoliranje električnih strojeva (priručnik), R. Končar, Tehnička knjiga, Zagreb, 1987.

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*
Bek, V., Technology of electric material, Sveučilište u Zagrebu, 1991. (In Croatian)	2	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	**Mathematics I**	
Study programme	**Undergraduate Vocational 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+45+0

1. COURSE DESCRIPTION

1.1. Course objectives

Understanding the basic concepts of linear algebra and differential calculus. Acquiring knowledge and skills necessary to develop the ability to solve mathematical problems set.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Describe and define basic mathematical operations with matrices and determinants. Describe the methods of solving systems of linear equations to solve the system and discuss the resulting solutions. Define the vector and arithmetic operations with vectors and correctly applied to calculate the sum of vectors, scalar and vector product of the concrete examples. Define the function, explain the basic concepts of functions of one variable (definition, parity, periodicity, the limit value, continuity) and define, draw and correctly interpret the elementary functions. Define the derivative of functions of one variable to calculate the derivatives of elementary and some complex functions. Apply derivatives in optimization and analysis of complex functions and draw their graphs.

1.4. Course content

Matrices. Determinants. Solving systems of linear equations. Vector in the plane and in the space. The functions of one variable. Limits and continuity of functions. Elementary functions (properties and graphs). The definition of derivation and their properties. Derivatives of elementary and complex functions. Taylor's theorem. Application of derivatives (linear approximation, the determination of extremes, flow testing functions, optimization).

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, studying, activity, homework, control tasks and tests.

1.8. Evaluation of student's work

Course attendance	2.5	Activity/Participation		Seminar paper		Experimental work	
Written exam	0.75	Oral exam	0.75	Essay		Research	
Project		Sustained knowledge check	2	Report		Practice	
Portfolio		Homework	1				

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

Course attendance, homework assignments, continuous knowledge testing, written and oral exam.

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

Štambuk, Lj.: Mathematics I, Tehnički fakultet Sveučilišta u Rijeci, Rijeka, 2002. (in Croatian)
Jurasić, K.-Dražić, I.: Mathematics I, Workbook, Tehnički fakultet Sveučilišta u Rijeci, Rijeka, 2008. (in Croatian)
Demidovič, B. P.: Tasks and solved examples from mathematics, Tehnička knjiga, Zagreb, sva izdanja, (in Croatian)

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

Slapničar I.: Mathematics 1, Sveučilište u Splitu FESB, Split 2002, online textbook
Finney, R. L., Thomas, G. B.: Calculus, Addison-Wesley Publishing Company, New York, 1992.

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*
Štambuk, Lj.: Mathematics I, Tehnički fakultet Sveučilišta u Rijeci, Rijeka, 2002. (in Croatian)	14	40
Jurasić, K.-Dražić, I.: Mathematics I, Workbook, Tehnički fakultet Sveučilišta u Rijeci, Rijeka, 2008. (in Croatian)	5	40
Demidovič, B. P.: Tasks and solved examples from mathematics, Tehnička knjiga, Zagreb, sva izdanja, (in Croatian)	6	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	**Mathematics II**	
Study programme	**Undergraduate Vocational 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+45+0

1. COURSE DESCRIPTION

1.1. Course objectives

Understanding the basic concepts of integral calculus, differential equations, Laplace transform, and Taylor and Fourier polynomials. Acquiring knowledge and skills necessary to develop the ability to solve mathematical problems.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Define and correctly interpret the fundamental concepts of integral calculus of functions of one variable, show the basic properties of indefinite and definite integrals of functions of one variable. Calculate some integrals of functions of one variable. Explain and apply the numerical method for compute integrals. Apply the definite integral to calculate the area of plane figures, arc length, volume and area of the rotation body. Define and correctly interpret the fundamental concepts of ordinary differential equations of first and second order. Calculate general and individual solution of some ordinary differential equations of the first and linear differential equations of second order. Define the fundamental concepts of the Laplace transform and express the basic properties of Laplace transform. Calculate the Laplace transform of simple functions and determine the solutions of differential equations using Laplace transform. Explain the idea of some numerical methods for solving differential equations of the first order and properly apply them. Define and correctly interpret the fundamental concepts of function approximation by Taylor and Fourier polynomial, and applied in individual cases.

1.4. Course content

Indefinite Integral. Definite integral and its applications. Numerical methods of computing integrals. Ordinary differential equations of the first order. Linear differential equations of second order. Laplace transform. Application Laplace transform to solve differential equations. Numerical methods for solving differential equations of the first order. Taylor approximation of functions and Fourier polynomial.

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, studying, activity, homework, control tasks and tests.

1.8. Evaluation of student's work

Course attendance	2.5	Activity/Participation		Seminar paper		Experimental work	
Written exam	0.75	Oral exam	0.75	Essay		Research	
Project		Sustained knowledge check	2	Report		Practice	
Portfolio		Homework	1				

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

Course attendance, homework assignments, continuous knowledge testing, written and oral 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)
Demidovič, B. P. : Tasks and solved examples from mathematics, Tehnička knjiga, Zagreb, (in Croatian)
Kreyszig, E.: Advanced Engineering Mathematics, John Wiley&Sons, Inc.1993.

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

Sopta, L.: Mathematics 2, Tehnički fakultet Sveučilišta u Rijeci, Rijeka,1995. (In Croatian)
Kamenarović, I.: Mathematics for engineers I, Tehnički fakultet Sveučilišta u Rijeci, Rijeka,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*
Slapničar I.: Mathematics 2, Sveučilište u Splitu FESB, Split 2002, online book (in Croatian)	45	40
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)	15	40
Demidovič, B. P. : Tasks and solved examples from mathematics, Tehnička knjiga, Zagreb, (in Croatian)	6	40
Kreyszig, E.: Advanced Engineering Mathematics, John Wiley&Sons, Inc.1993.	4	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	**Measurements in Electrical Engineering VO**	
Study programme	**Undergraduate Vocational 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

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

None.

1.3. Expected course learning outcomes

Interpret and explain measurement uncertainty. Apply the model of measurement uncertainty at simple examples. Analyze a measurement problem and determine sources of systematic and random errors. Apply measures to eliminate errors in measurements. Describe measurements methods for measurements of electrical quantities. Apply measurements methods for measurements of electrical quantities. Describe working principles of measurement instruments (electrical and electronic). Apply measurements instruments for measurements of electrical quantities. Describe transducers for measurements of non-electrical quantities. 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	2	Report		Practice	1.5
Portfolio		Homework					

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

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

Bego, V.: Measurements in the Electrical Engineering, Graphis, Zagreb, 2003. (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*
Vujević, D., Ferković, B.: Basics of Measurements in the Electrical Engineering, I. i II. part, Školska knjiga, Zagreb, 1996. (in Croatian)	4/7	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 VO**	
Study programme	**Undergraduate Vocational 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

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

1.9. Assessment and evaluation of student's work during classes and on 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)
Brnić, J.: "Mechanics and Structural Elements", Školska knjiga, Zagreb, 1996. (in Croatian)

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

Beer, F. P., Johnston, E.R., Eisenberg, E.R.:"Vector Mechanics for Engineers: Statics", McGraw-Hill, 2003.
Nash, W.: "Strength of Materials", Schaum's Outline Series, McGraw-Hill, New York, 1998.

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.	19	50
Brnić, J., Turkalj, G.: "Strength of materials I", University of Rijeka, Faculty of Engineering, Rijeka, 2004.	19	50
Brnić, J.: "Mechanics and Structural Elements", Školska knjiga, Zagreb, 1996. (in Croatian)	15	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	**Mechatronics**	
Study programme	**Undergraduate Vocational 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 of mechanic, electric and electro-mechanic components in frame of mechatronic system. Capability of determination of system response in time and frequency domain. Understanding of principle of operation and programing for programmable controllers.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Defining and explaining of mechatronic principle. Describing mechatronic systems and their properties. Differing components of mechatronic systems. Describing and applying mechanic, electric and electro-mechanic models in mathematic model of mechatronic system. Describe and explain the mechatronic approach to robot and an active magnetic bearing as a mechatronic device. Describe and explain principles and properties of electro-mechanic actuators. Describe diferent electronic power converters for different mechatronic applications. Describing and comparing different programable controlers and their programing. Explaining design approaches for mechatronic systems.

1.4. Course content

Model of different mechatronic components and system. Real system, model, differential equations, block diagrams, simulations. Mechatronic systems. Rotational and translation motion transformers. Mechanic gears. Mechanic energy storages. Mechanic regulation elements. Hydraulic and pneumatic systems. Functionality plan, functional diagrams. Pneumatic systems. Hydraulic systems. Electro-hydraulics. Electric systems. Control and regulation, automatic control in technical systems (open and closed loop), static and dynamic regulation properties, classic control. Static and dynamic properties of mechatronic systems. Synthesis of mechatronic system: given values, chosen components, testing and applications, other possibilities. Simulations (Matlab, Simulink, ITISim).

1.5. Teaching methods		
	☒ 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, lecture activity, individual assignment, partial 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. Assessment and evaluation of student's work during classes and on 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)

Bishop, R.H.: The Mechatronics Handbook, CRC Press, Washington, D.C., 2005
Wolf, R.: Fundamentals of electric machines, Školska knjiga, Zagreb, 1991. (in Croatian)

_: Fackunde Mechatronics, Verlag Europa-Lehrmittel, Haan-Gruiten, 2004. (in German)

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

Younkin, G. W.:Industrial Servo Control Systems, Marcel Dekker, Basel, 2003.
Kuo, B. C.: Step Motors and Control Systems, SRLO Illinois, Urbana-Champaign, 1979.

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*
Bishop, R.H.: The Mechatronics Handbook, CRC Press, Washington, D.C., 2005 (in Croatian)	1	50
Wolf, R.: Osnove električnih strojeva, Školska knjiga, Zagreb, 1991. (in Croatian)	11	50
_: Fackunde Mechatronik, Verlag Europa-Lehrmittel, Haan-Gruiten, 2004. (in German)	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	**Organization and Economics**	
Study programme	**Undergraduate Vocational Study of Electrical Engineering**	
Course status	compulsory	
Year	**3.**	
ECTS credits and teaching	ECTS student 's workload coefficient	4
	Number of hours (L+E+S)	30+15+0

1. COURSE DESCRIPTION

1.1. Course objectives

Assuming theoretical concepts and knowledge of the organization and business economics.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Explain the concept of business systems and building the business system. Define the basic principles of the organization. Define the management of systems and information in the enterprise. Analyze the types of organizational structures. Analyze the evaluation of jobs. Distinguish the ownership, the management and the leadership. Define the principles of management and leadership. Analyze the teamwork. Define the business policies. Describe the principles and methods of planning. Define the long-term and operational plans. Analyze network planning technique. Define the plant as an economic system. Analyze income and expenses. Distinguish the Income Statement and Balance Sheet. Define the effects of the business.

1.4. Course content

The definition of a business system. The evolution of the business system. Factory as a business system. Building the business system. The basic principles of the organization. Definition and managing of business system. The information in the enterprise. Types of organizational structures. Design of the business system. Evaluation of jobs. Ownership. Management. Leadership. The principles of management and leadership. Teamwork. Business policy. Planning. Principles and methods of planning. Network planning techniques. Plans of the business system. Long-term and operational plans. Using of computers in planning. Factory as an economic system. Income and expenses. Types of costs. Break even. Income Statement. Balance Sheet. Effects of business.

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

Attendance, class participation, independent learning.

1.8. Evaluation of student's work

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

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

Attendance, class participation, continuous assessment (two mid-term exams), written exam.

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

Mikac, T., Ikonić, M.: Organization of bussines systems, Faculty of Engineering, University of Rijeka, Rijeka, 2008. (In Croatian)

1.11. Optional / additional reading (at the time of proposing study programme)		
Novak, M., Sikavica, PBussines organization, Informator, Zagreb, 1999.		
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*
Mikac, T., Ikonić, M.: Organization of bussines systems, Faculty of Engineering, University of Rijeka, Rijeka, 2008. (In Croatian)	2	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	**Physical and Health Education**	
Study programme	**Undergraduate Vocational Study of Electrical Engineering**	
Course status	optional	
Year	**3.**	
ECTS credits and teaching	ECTS student 's workload coefficient	1
	Number of hours (L+E+S)	0+30+0

1. COURSE DESCRIPTION

1.1. Course objectives

The general objective of the educational field of Physical and Health Education is to satisfy man`s biosocial need for movement through appropriate kinetic activities, thus satisfying this general need by increasing the adaptive and creative capabilities in contemporary life and work conditions.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Through appropriate kinetic activities satisfy man`s biosocial need for movement.

1.4. Course content

The course content of the educational field of Physical and Health Education shall be implemented through regular (field athletics, football, basketball, volleyball, handball, swimming and water- polo, fitness) and optional (skiing, sailing, rowing, trekking, tennis and rafting) programmes.

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.

1.8. Evaluation of student's work

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

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

Regular course attendance.

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

Medved, R.: Sports medicine, Medicinska knjiga, Zagreb. (in Croatian)
Tuka, K.:Physiology of sport, Sportska tribina, Zagreb. (in Croatian)

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*
Medved, R.: Sports medicine, Medicinska knjiga, Zagreb. (in Croatian)	1	
Tuka, K.:Physiology of sport, Sportska tribina, Zagreb. (in Croatian)	1	

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	**Undergraduate Vocational 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

Adoption of theoretical knowledge and develop the ability to differentiate properties and concepts of classical and modern physics. Forming a proper view of the interpretation of physical phenomena and their applications in engineering.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Specify and analyze areas of classical physics and modern physics. Compare classical and special relativity. Define the causes of motion, and relationships in space and time. Define and describe the periodic motion and waves in mechanics. Describe the causes gas pressure and thermal processes. Apply learned knowledge to problem-solving tasks. Corrected image of the world on the basis of knowledge of classical and modern physics.

1.4. Course content

Motion. Curvilinear motion; circular motion. Mass and force, law of universal gravitation. Energy, labor and conservation laws. Inertial forces. Classic and special relativity. The motion of a rigid body. Fluid Mechanics. Harmonic oscillator. Muted and forced oscillation. The waves, the speed of the waves, Doppler effect. Heat, gas laws. Heat transfer. Kinetic molecular theory. Fundamentals of Thermodynamics

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, sustained knowledge check, homework, activity, studying.

1.8. Evaluation of student's work

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

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

Course attendance, 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)

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	60
Dobrinić, J., Mandić, L.: Physics 1, Tehnički fakultet, Rijeka, 2002. (In Croatian)	9	60
Dobrinić, J. Mandić, L.: Solved examples in Physics1, Tehnički fakultet, Rijeka, 2001. (In Croatian)	16	60
Dobrinić, J. Mandić, L.: Solved examples in Physics 1, Tehnički fakultet, Rijeka, 2010.(In Croatian)	6	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	**Power System Protection**	
Study programme	**Undergraduate Vocational 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 the protection of devices and equipment and substation construction in order to ensure safe operation and protection of assets.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Define basic concepts of relay protection. Describe the principles, construction and the role of the protection system. Define relays by measurable variables. Analyze relay protection of power substation equipment. Settings of relay protection. Describe the modernization of relay protection. Describe surge protection.

1.4. Course content

Basic concepts. Surge protection. Overvoltage protection. Relay protection. Principles, construction and the role of relay protection and protection system. Technical and technological historical development. Types of relay: current, voltage, frequency, thermal, etc. Relay protection of power substation equipment, generators, transformers, bus, electric motors, capacitors, and overhead lines and cables of medium and high voltage. Calculation and setting relay protection. Modernization and reconstruction of relay protection in existing substations.

1.5. Teaching methods		
	☒ 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

Lectures, exercises, laboratories, fieldwork.

1.8. Evaluation of student's work

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

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

Course attendance, activity, project, continuous knowledge testing, written and oral exam.

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

F. Božuta:Automatic protection devices in electrical power facilities, Svetlost, Sarajevo
H. Požar: High-voltage switchgear, Tehnička knjiga, Zagreb

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

Technical material from ABB, Siemens, Alsthom, Končar, Iskra i dr.

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*
F. Božuta:Automatic protection devices in electrical power facilities, Svetlost, Sarajevo	2	20
H. Požar: High-voltage switchgear, Tehnička knjiga, Zagreb	5	20
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	**Production Systems**	
Study programme	**Undergraduate Vocational 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)	30+30+0

1. COURSE DESCRIPTION

1.1. Course objectives

Qualified for the design of production systems. Ability to analyze models of production structures. Understanding the principles of grouping the articles.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Define the production system. Describe the characteristics of the production program. Explain the production availability of equipment and manpower. Analyze capacity utilization and system: technical and economic. Distinguish the models the flow of material and processing workflows. Define the correlation coefficient of operations and equipment. Explain the handling and transport of the workpiece, the input, between operations and exit transport. Define the processing cycle: explain the processing time, time of transport and waiting. Explain the models of production systems, a single or multi-workpiece lines, serial and flexible systems. Explain the organization of the work flow through the production system. Explain the method of grouping articles. Describe the layout of the plant, equipment and organization of the warehouse. Develop the project of production system: the task, analysis the variables, the concept of the project, plans of processing, optimization solutions, and the choice of the production model (lines, serial or flexible system). Choose of the transportation system.

1.4. Course content

Definition of the production system. Characteristics of the production program. Production availability of equipment and manpower. Capacity and systems utilization: technical and economic. Models flow of material: current, wavy, linear, and flexible. Workflow processing: one-way, two-way. The correlation coefficient of operations and equipment. Handling and transport of the workpiece. Input, between operations and exit transport. The level of automation of transport. Workpiece processing cycle: during processing, time of transport and waiting. Models of production systems. Single or multi-workpiece line, serial and flexible systems. The organization of the work flow through the production system. Methods of grouping of workpieces. The process of designing production systems: the task, analysis of variables, the concept of the project, plans processing, optimization solutions, the choice of the production model (lines, serial or flexible system). Choosing of the transportation system.

1.5. Teaching methods		
	☒ 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 and activity on class, seminar work.

1.8. Evaluation of student's work

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

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

Attendance, class participation, seminar work, written exam.

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

Mikac, T., Ikonić, M.: Organization of bussiness systems, Graphic, Zagreb, 2008. (In Croatian)
Mikac, T.: Optimization of the concept of the production system, disertation, Faculty of Engineering, Rijeka, 1994.

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

Veža, J.: Production systems design, Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture, Split, 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*
Mikac, T., Ikonić, M.: Organization of bussiness systems, Graphic, Zagreb, 2008. (In Croatian)	2	16
Mikac, T.: Optimization of the concept of the production system, disertation, Faculty of Engineering, Rijeka, 1994.	1	16

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	**Professional Practice I**	
Study programme	**Undergraduate Vocational Study of Electrical Engineering**	
Course status	compulsory	
Year	**2.**	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	-

1. COURSE DESCRIPTION

1.1. Course objectives

Student verifies and complements his own professional knowledge, along with a comprehensive view of the work process.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Apply acquired professional knowledge and skills from studied courses. Gain working process experience. Develop and further improve competence for solving practical engineering problems.

1.4. Course content

Professional practice within Undergraduate Vocational Study of Naval Architecture is carried out individually in work organization that is engaged in the student's field of study, and with activities in accordance with the Professional Practice Rules and with Study Program curriculum. Within professional practice, student meets with the corresponding jobs that are studied through programs of education, with the task of verifying and complementing their own expertise, along with a comprehensive view of the work process.

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

Conducting professional practice in duration of 15 working days, or 120 hours, and writing the corresponding 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	1	Practice	4
Portfolio							

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

Assesses and evaluates student work and dedication, and written report.

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	**Professional Practice II**	
Study programme	**Undergraduate Vocational Study of Electrical Engineering**	
Course status	compulsory	
Year	**3.**	
ECTS credits and teaching	ECTS student 's workload coefficient	10
	Number of hours (L+E+S)	-

1. COURSE DESCRIPTION

1.1. Course objectives

Student verifies and complements his own professional knowledge, along with a comprehensive view of the work process.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Apply acquired professional knowledge and skills from studied courses. Gain working process experience. Develop and further improve competence for solving practical engineering problems.

1.4. Course content

Professional practice within Undergraduate Vocational Study of Naval Architecture is carried out individually in work organization that is engaged in the student's field of study, and with activities in accordance with the Professional Practice Rules and with Study Program curriculum. Within professional practice, student meets with the corresponding jobs that are studied through programs of education, with the task of verifying and complementing their own expertise, along with a comprehensive view of the work process.

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

Conducting professional practice in duration of 30 working days, or 240 hours, and writing the corresponding 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	1	Practice	9
Portfolio							

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

Assesses and evaluates student work and dedication, and written report.

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	**Quality Assurance VO**	
Study programme	**Undergraduate Vocational 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)	45+15+0

1. COURSE DESCRIPTION

1.1. Course objectives

The course is designed to provide the student with basic knowledge in quality assurance topics. Through exercises students are introduced with practical application of several course objectives.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

To interpret the meaning and importance of quality assurance. Explain the basic concepts of quality assurance and quality control. Classify quality characteristics of products, processes and services. Quality cost analysis. Interpret basic requirements of ISO 9001 standard. Apply basic quality tools. Assess results of statistical process control. Analyse R&R of measurement system. Measure process reliability and select acceptance sampling.

1.4. Course content

Definitions of quality. Quality of products, processes and services. Quality costs. Pareto principle. Economical level of quality. Optimal quality. Quality inspection. Quality assurance. International quality standards ISO 9000. Quality management. Total quality. Planning for quality. Quality improvement. Quality engineering. Method and tools for quality assurance and improvement. Cause-and-effect relationships. Causes of quality variability. Statistical process control methods. Common probability distributions. Control charts. Specification limits and tolerances. Products and processes quality assessment methods. Demerit method. Quality of measurement system. Acceptance sampling. Reliability.

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, active participation in the course, attendance at laboratory exercises, homework and independent learning.

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	
Portfolio							

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

Sustained knowledge check (three midterm exams) and final written exam.

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)

Juran, J. M., Gryna, F. M.: Planning and quality analysis, Mate, Zagreb, 1999.

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*
Juran, J. M., Gryna, F. M.: Planning and quality analysis, Mate, Zagreb, 1999.	1	1
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	**Radiocommunications VO**	
Study programme	**Undergraduate Vocational 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)	45+15+0

2. COURSE DESCRIPTION

1.1. Course objectives

Students will acquire knowledge of the nature of radio-wave communications and major components of radiocommunication systems, from the source to a receiver. The course will provide the knowledge of key principles, phenomena, techniques, and components of the system.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Apply decibels and nepers. Distinguish the characteristics and implement key relations to analyze the wave propagation through an unguided medium. Explain the wave behavior on the boundary of two media. Apply the basics of wave propagation over a transmission line. Apply the Smith chart. Design a quarter-wavelength and binomial impedance transformer. Distinguish and apply the most used antenna parameters. State the propagation effects in a communication channel. Analyze simple RF link budgets. Evaluate frequency up- and down- conversion and image frequency.

1.4. Course content

Electromagnetic spectrum. Types of electromagnetic waves. A basic scheme of a radiocommunication system. Decibels and nepers. Plane wave in various media. Perpendicular and oblique wave incidence on media boundary. Transmission line model. The Smith chart. Quarter-wave impedance transformer. Binomial transformer. Fundamental antenna parameters. Communication channel and effects on the wave propagation. RF link budget. A brief overview of propagation models for field prediction. Intermodulation products. Frequency conversion. Image frequency.

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

Class attendance, literature reading, class preparation, and continuous 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	0.5
Portfolio		Homework					

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

Continuous knowledge examination (midterms) and final exam.

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

D. M. Pozar, *Microwave Engineering*, 3rd ed., Wiley, 2005.

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

J. D. Parsons, *The Mobile Radio Propagation Channel*, 2nd ed, Wiley, 2000.
E. Zenter: Anthens and Radios Systems, Graphis, Zagreb, 2001.

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*
D. M. Pozar, *Microwave Engineering*, 3rd ed., Wiley, 2005.	1	20

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	**Semiconductor Devices and Basic Microelectronic Circuits**	
Study programme	**Undergraduate Vocational 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

Obtain theoretical knowledge and develop skills to solve practical problems in the field of semiconductor devices and microelectronic circuits. Determine the behavior of a semiconductor devices and microelectronic circuits (analysis). Solve problems and develop the efficient microelectronic circuits (synthesis). Participate as a member of a team-oriented design project.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Student is able describe the physical properties of semiconductor devices. Describe and analyse the devices behaviour regard their structure and use the incremental model in various operational conditions. Analyse and describe the basic linear electronics circuits

1.4. Course content

Semiconductor electrical properties. Physical and electrical properties of semiconductor pn junctions, diodes, bipolar transistors, unipolar transistors. Relation of semiconductor devices electrical behaviour to internal physical processes. Development of semiconductor devices incremental models and understanding the uses and limitations of various models. Implementation of incremental models in analysis and design of single-stage amplifiers, differential linear amplifiers and other integrated 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, web test and quiz, homework, studying.

1.8. Evaluation of student's work

Course attendance	2.5	Activity/Participation		Seminar paper		Experimental work	
Written exam	2	Oral exam		Essay		Research	
Project		Sustained knowledge check	1.5	Report		Practice	0.5
Portfolio		Homework	0.5				

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

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

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

P.Biljanović, Semiconductor devices, Školska knjiga Zagreb, 2004. (In Croatian)
P.Biljanović, Electronic circuits, Školska knjiga Zagreb, 2001. (In Croatian)
J. Šribar, J. Divković-Pukšec, Semiconductor devices, workbook, I i II dio, Element, Zagreb, 1996. (In Croatian)

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*
P.Biljanović, Semiconductor devices, Školska knjiga Zagreb, 2004. (In Croatian)	9	80
P.Biljanović, Electronic circuits, Školska knjiga Zagreb, 2001. (In Croatian)	14	80
J. Šribar, J. Divković-Pukšec, Semiconductor devices, workbook, I i II dio, Element, Zagreb, 1996. (In Croatian)	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	**Technical Documenting**	
Study programme	**Undergraduate Vocational 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)	15+30+0

1. COURSE DESCRIPTION

1.1. Course objectives

The development of the ability to produce and communicate technical documentation in standard drafting formats, by means of traditional and computer techniques.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Interpret and apply traditional and CAD techniques for the generation of engineering graphics. Compare and distinguish methods of shape description. Compare 3D primitives and interpret the generation of complex objects. Note the role of standardization and standards. Recognise and implement the kinds of electrical documentation. Interpret engineering graphics. Organize engineering documentation in accordance with the standards. Estimate personal contribution and the contribution of lecturer to the acquisition of contents.

1.4. Course content

The significance and possibilities of graphical communications. The design process and the role of the design model. Traditional, 2D and 3D CAD techniques for the development of documentation, components description and utilization of CAD system. The shape description. Standardization and standards. Symbols of electrical and electronic elements and assemblies, elements description in accordance with IEC. Technical documentation graphics.

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 and activity (lectures, exercises), constructive work, continuous knowledge testing, homework, studying.

1.8. Evaluation of student's work

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

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

Course attendance, homework, constructive work, continuous knowledge testing (1 exam), written exam.

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

M. Kljajin, M. Opalić: *Engineering Graphics,* Strojarski fakultet u Slavonskom Brodu,Slavonski Brod, 2010. (in Croatian)
G. Marunić, J. Butorac, S. Troha: *Engineering Graphics, Collection of Shape Description Problems*, Zigo Rijeka, Rijeka, 2008. (in Croatian)
L. Padovan: *Engineering Graphics and Documenting,* Sveučilište u Zagrebu, Zagreb, 1999. (in Croatian)

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.
G. Scott Owen et al.: Hypergraph (on-line), ACM SIGGRAPH Education Committee, http://www.siggraph.org/education/materials/HyperGraph/hypergraph.htm, 2005.

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: *Engineering Graphics,* Strojarski fakultet u Slavonskom Brodu,Slavonski Brod, 2010. (in Croatian)	10	50
G. Marunić, J. Butorac, S. Troha: *Engineering Graphics, Collection of Shape Description Problems*, Zigo Rijeka, Rijeka, 2008. *(in Croatian)*	10	50
L. Padovan: *Engineering Graphics and Documenting,* Sveučilište u Zagrebu, Zagreb, 1999. (in Croatian)	6	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	**Technological Processes in Process Industry**	
Study programme	**Undergraduate Vocational 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)	45+15+0

1. COURSE DESCRIPTION

1.1. Course objectives

Developing skills and competencies involvement in technical issues and solving them during the design, construction and operation. Developing the capacity to identify technical problems, analyzing and making proposals for technical improvements.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Describe the technological processes in the process industry. Define and explain the main operating parameters of technological processes in the process industry. Develop and explain the basic scheme of technological process. Analyze and explain the factors influencing the efficiency of technological processes. Define and describe the main equipment of process plants. Calculate the main dimensions and operational parameters of equipment, machinery and devices in process plants. To analyze the economic size of technological processes in the process industry. Define and explain the safety requirements of process plants.

1.4. Course content

The introduction of technological processes in the process industry. Basic technological processes (physical and chemical): filtration, separation, aeration, degassing, degasification, evaporation, adsorption, desorption, extraction, neutralization, ion exchange, distillation, fractionation, rectification, thermal cracking, catalytic cracking, hydrocracking, reforming, hydrogenation. Biological processes. Technological installations in the oil industry, the petrochemical industry, the chemical industry and in other process industries. Automation of technological processes. Optimization. Advanced management, monitoring and analysis of technological process control, product quality, operating costs. The economic analysis of technological processes.

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

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

Course attendance, activity, continuous knowledge testing, written and oral exam.

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

Janović Z., Petroleum and petrochemical processes, HDGM, Zagreb, 2005. (In Croatian)
Beer E.: Manual for chemical and process industries equipment, SKTH Zagreb, 1985. (In Croatian).

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

Ludwig E.E.: Design for Chemical and Petrochemical Plants, Gulf Publishing Co., 1980. (In Croatian)
Cerić E.: Oil Technology, Školska knjiga Zagreb,1986. (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*
Janović Z., Petroleum and petrochemical processes, HDGM, Zagreb, 2005. (In Croatian)	-	10
Beer E.: Manual for chemical and process industries equipment, SKTH Zagreb, 1985. (In Croatian).	1	10

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

Through the Institution's system of quality control

Basic description		
Course title	**Telecommunication Devices and Networks**	
Study programme	**Undergraduate Vocational 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

3. COURSE DESCRIPTION

1.1. Course objectives

Understand relationships between different information flows in network. Become capable to plan, design and maintain modern telecommunication networks. Become able to monitor and administer information flows in network.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Define telecommunication network and services. Describe switching and transmission network segments. Analyze network bandwidth through channel switching. Analyze package switched network delay. Describe transport level of telecommunication network. Describe types of telecommunication devices. Describe local and broadband access networks. Construct local and access network projects.

1.4. Course content

Network architecture. Information flows in network. Circuit switched and packet switched transmission networks. Transmission and switching in networks. Digital transmission. Synchronous digital hierarchy. Optical transmission systems and wave division multiplex. Integrated services network. Synchronisation and signalization. Internet protocol and Internet services. New generation of Internet network. Local and access networks. xDSL technologies. Mobile 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, tests, homework, seminar.

1.8. Evaluation of student's work

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

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

Course attendance, homework, tests, seminar, final exam.

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

Bažant, A., i dr.: Network Architecture Fundamentals, Element, Zagreb, 2004. (in Croatian)
Brodić, T., Jurin, G.: Fiberoptic Techniques, Tehnički fakultet Rijeka, 1995. (in Croatian)
Kos, M., Lovrek, I.: Telecommunication Networks, FER, Zagreb, 2000. (in Croatian)

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

Bošnjak, I.: Telekomunikacijski promet I i II, Fakultet prometnih znanosti, Zagreb, 2001.
Mikula, M., Kavran, Z.: Terminalni uređaji u telekomunikacijskom prometu, FPZ, Zagreb, 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*
Bažant, A., i dr.: Network Architecture Fundamentals, Element, Zagreb, 2004. (in Croatian)	2	10
Brodić, T., Jurin, G.: Fiberoptic Techniques, Tehnički fakultet Rijeka, 1995. (in Croatian)	4	10
Kos, M., Lovrek, I.: Telecommunication Networks, FER, Zagreb, 2000. (in Croatian)	3	10
1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences		
Through the Institution's quality assurance system		