University of Rijeka
Faculty of Engineering

CURRICULUM
UNIVERSITY UNDERGRADUATE STUDY IN MECHATRONICS AND ROBOTICS

Rijeka, February 2024.

1. CURRICULUM DESCRIPTION

1.1. The list of mandatory and elective courses with the number of active teaching hours required for their implementation and the corresponding ECTS credits

1. Semester							
Course	Hours / Week						ECTS
	L	AT	IT	DT	S	L+T+S	
Mathematics 1	3	3				6	7
Materials 1	2	2				4	4
Electrical Engineering	3	2	1			6	8
Computer Software in Engineering	1		2			3	5
Digital Logic	2	2				4	6
TOTAL						**23**	**30**

L – Lectures, AT – Auditory Tutorials, IT – Laboratory Tutorials, DT – Design Tutorials, S – Seminars

2. Semester							
Course	Hours / Week						ECTS
	L	AT	IT	DT	S	L+T+S	
Mathematics 2	3	3				6	7
Engineering Mechanics 1	3	1	1			5	6
Hydraulics and Pneumatics	3		1			4	6
Programming	2	1	1			4	6
Engineering Design	2			2		4	5
TOTAL						**23**	**30**

3. Semester							
Course	Hours / Week						ECTS
	L	AT	IT	DT	S	L+T+S	
Mathematics 3	3	3				6	7
Electrical Circuits	3	1				4	7
Engineering Mechanics 2	3	2				5	6
Computational Methods	2		2			4	5
Elective Course 1 – group A-W [1]							5
TOTAL							**30**

4. Semester							
Course	Hours / Week						ECTS
	L	AT	IT	DT	S	L+T+S	
Mechatronic System Design	3			2		5	7
Electronics	2	1	1			4	6
Fundamentals of Automatic Control	2	1	1			4	6
Elective Course 2 – group A-S [1]							11
Elective Course 3 – group A-S or B-S [1]							
TOTAL							**30**

5. Semester							
Course	Hours / Week						ECTS
	L	AT	IT	DT	S	L+T+S	
Industrial Automation	2	1	1			4	7
Applied Mechatronic Systems	3		2			5	7
Elective Project [2]				3		3	5
Elective Course 4 – group A-W [3]							11
Elective Course 5 – group A-W or B-W [3]							
TOTAL							**30**

6. Semester							
Course		Hours / Week					ECTS
	L	AT	IT	DT	S	L+T+S	
Robotic Systems	2		2			4	6
Undergraduate Thesis							10
Professional Practice							5
Elective Course 6 – group A-S [3]							9
Elective Course 7 – group A-S or B-S [3]							
TOTAL							**30**

Elective courses group A-W (winter semester)							
Course	Hours / Week						ECTS
	L	AT	IT	DT	S	L+T+S	
Algorithms and Data Structures	2		2			4	6
Electrical Machines	3	1	1			5	6
Power Electronics	2	2	1			5	6
Computer Architecture	2	2				4	6
Fundamentals of Electrical Engineering and Sustainable Development	3	1				4	5
Production Machines, Tools, Jigs and Fixtures	2	1	1			4	5
Signals and Systems	3	1				4	6
Introduction to Object-Oriented Programming	2		2			4	6

Elective courses group B-W (winter semester)							
Course	Hours / Week						ECTS
	L	AT	IT	DT	S	L+T+S	
Database Systems	2		2			4	6
Designing and Product Shaping	2			2		4	4
Machine Elements Design 2	3			3		6	7
Fluid Mechanics	3	2				5	5
Measurement and Quality Control	2			1		3	5
Ship Equipment	3		1			4	6
Computer-Aided Measurements	2		2			4	6
Web Application Development	2		2			4	6
Technological Processes	2	2				4	4
Thermodynamics	3	2				5	7
Introduction to Marine Vessels	2	2				4	5

Elective courses group A-S (summer semester)							
Course	Hours / Week						ECTS
	L	AT	IT	DT	S	L+T+S	
Automatic Control	3	1	1			5	7
Electrical Drives	2	1	1			4	5
Energy Systems	2	2				4	4
Engineering Statistics	2		2			4	5
Programming 2	3		2			5	7
Computer Simulations in Engineering	1			2	1	4	6
Embedded Systems	3		2			5	7
Introduction to Artificial Intelligence	2		2			4	6

Elective courses group B-S (summer semester)							
Course	Hours / Week						ECTS
	L	AT	IT	DT	S	L+T+S	
English in Engineering	1		2			3	4
Communication Networks	2	1	1			4	6
Machine Elements Design 1	3			2		5	7
Modelling of Process Information Systems	2		2			4	6
Operating Systems 1	2		2			4	6
Organization of Business Systems	2	2				4	6
Basics of Ship Production	2			1		3	5
Introduction into Finite Element Method	1			2		3	4
Production Technologies	3	1				4	5
Computational Engineering	2			2		4	4
Computational Modelling in Shipbuilding	1		2	1		4	4
Environment Protection	3					3	4

UNIVERSITY UNDERGRADUATE STUDY IN MECHATRONICS AND ROBOTICS TOTAL	ECTS 180

Remarks:

[1] A minimum of 16 ECTS credits is required for the combined total of three selected elective courses, or the sum of ECTS credits from both mandatory and elective courses in the 3rd and 4th semesters must be at least 60 ECTS credits.

[2] The elective project is enrolled from any mandatory course in the study program.

[3] A minimum of 20 ECTS credits is required for the combined total of four selected elective courses, or the sum of ECTS credits from both mandatory and elective courses in the 5th and 6th semesters must be at least 60 ECTS credits.

1.2. Groups of elective courses for obtaining micro-qualifications

By successfully completing the designated groups of elective subjects within the program, students have the opportunity to attain micro-qualifications as outlined in the following table.

Groups of elective subjects for obtaining micro-qualifications			
Specialist in the Design of Mechatronic Systems	Machine Elements Design 1	Designing and Product Shaping or Machine Elements Design 2	Introduction into Finite Element Method
Specialist in Production Technologies in Engineering	Production Machines, Tools, Jigs and Fixtures	Technological Processes or Measurement and Quality Control	Production Technologies
Specialist in Mechatronics in Maritime Objects	Ship Equipment or Introduction to Marine Vessels	Basics of Ship Production	Computational Modelling in Shipbuilding
Specialist in Sustainable Energy Systems	Thermodynamics or Fluid Mechanics	Energy Systems	Fundamentals of Electrical Engineering and Sustainable Development
Specialist in Electric Machines in Mechatronic Systems	Electrical Machines	Electrical Drives	Automatic Control or Power Electronics
Specialist in Programming Mechatronic and Robotic Systems	Programming 2	Algorithms and Data Structures	Introduction to Artificial Intelligence or Introduction to Object-Oriented Programming

1.3. Course description

Below is a description of each course in alphabetical order.

LIST OF COURSES						
Year of study: 1st year of the Undergraduate University Study in Mechatronics and Robotics						
Semester: 1st (winter)						
COURSE	INSTRUCTOR	L	E	S	ECTS	STATUS
Mathematics 1	Assoc. Prof. Dr. Sc. Loredana Simčić	45	45	0	7	C
Materials 1	Assoc. Prof. Dr. Sc. Sunčana Smokvina Hanza Assist. Prof. Dr. Sc. Matej Fonović	30	30	0	4	C
Electrical Engineering	Prof. Dr. Sc. Nino Stojković	45	45	0	8	C
Computer Software in Engineering	Prof. Dr. Sc. Siniša Družeta	15	30	0	5	C
Digital Logic	Assoc. Prof. Dr. Sc. Jonatan Lerga	30	30	0	6	C

COURSE DESCRIPTION

GENERAL INFORMATION		
Teacher	Assoc. Prof. Dr. Sc. Loredana Simčić	
Course title	**Mathematics 1**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	compulsory	
Year	1st	
ECTS credits and teaching	ECTS student 's workload coefficient	7
	Number of hours (L+E+S)	45+45+0

COURSE DESCRIPTION		
1.1. Course objectives		
Acquiring basic knowledge and skills in linear algebra and calculus.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Define and correctly interpret basic notions in linear algebra, single-variable functions, and single-variable calculus. State and correctly interpret basic results in linear algebra and single-variable calculus. Carry out basic computations with matrices, vectors, determinants; determine solutions of systems of linear equations. Apply vector operations to compute some areas, volumes; determine equations of planes and lines. Compute limit values and derivatives of single-variable functions. Apply integration rules and evaluate indefinite and definite integrals of some function.		
1.4. Course content		
Solving systems of linear equations. Matrices. Determinants. Vectors and analytical geometry in space. Single-variable functions. Limit values and continuous functions. Elementary functions. Derivatives. Indefinite and definite integrals.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education ☐ fieldwork	☐ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other _____
1.6. Student's obligations		

Course attendance, activity/participation, studying.

1.7. Evaluation of student's work

Course attendance	3	Activity/Participation		Seminar paper		Experimental work	
Written exam	1,5	Oral exam		Essay		Research	
Project		Sustained knowledge check	2,5	Report		Practice	
Portfolio							

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

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

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

Title	*Number of copies*	*Number of students*
Slapničar I.: Matematika 1, Sveučilište u Splitu FESB, Split 2002., online udžbenik (in Croatian)	123	40
Slapničar I.: Matematika 1 – zbirka zadataka, Sveučilište u Splitu FESB, Split 2010., e-book (in Croatian)	123	40
Jurasić, K.-Dražić, I.: Matematika I, zbirka zadataka, Tehnički fakultet, Rijeka, 2008. (in Croatian)	18	40
Štefan Trubić M., Sopta L., Črnjarić-Žic N., Maćešić S.: Matematika, zbirka zadataka: integrali, obične diferencijalne jednadžbe, funkcije više varijabli, Rijeka 2012. (in Croatian)	20	40

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

Elezović N., Aglić A., Linearna algebra – zbirka zadataka, Element, Zagreb 1999. (in Croatian)
Zill D., Wright W., Calculus: early transcendentals, 4th edition, Jones and Bartlett publishers, 2011.

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

Through the Institution's quality assurance system.

GENERAL INFORMATION		
Teacher	Assoc. Prof. Dr. Sc. Sunčana Smokvina Hanza Assist. Prof. Dr. Sc. Matej Fonović	
Course title	**Materials I**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	compulsory	
Year	1st	
ECTS credits and teaching	ECTS student 's workload coefficient	4
	Number of hours (L+E+S)	30+30+0

COURSE DESCRIPTION
1.1. Course objectives
Introduction of different types of materials, their structure, properties and specificities and their application in engineering.
1.2. Course enrolment requirements
None.
1.3. Expected course learning outcomes
Compare interatomic bonds, structure, properties, and application of technical materials: metals, polymers, ceramics, and composites. To determine the influence of the imperfections of the crystal structure on the properties of metallic materials. Distinguish two-component phase diagrams. Calculate the amount of phases in the binary system. Determine the influence of the structure on the properties and application of polymer, ceramic, and composite materials. Classify polymer, ceramic, and composite materials.
1.4. Course content
Definition and classification of materials. Trends in the application of technical materials. Structure of matter. Interatomic and intermolecular bonding and properties of materials. Amorphous and crystal structure. Crystal systems. Directional indices and Miller indices. Crystal imperfections. Solid solutions. Intermetallic compound. Metal solidification. Diffusion. Phase diagrams. Cooling curves. Phase transformations. Equilibrium two-component diagrams. Classification of polymer materials. Polymerization. Structure of macromolecules, properties and application of thermoplastics, thermosets and elastomers. Ceramic materials in engineering. Structure, properties and processing of ceramic materials. Classification, structure, properties and application of composite materials in engineering.

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

1.6. Student's obligations

Course attendance, participation in teaching, studying.

1.7. Evaluation of student's work

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

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

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

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

Title	*Number of copies*	*Number of students*
Smokvina Hanza, S., E-Lectures: Materials I, RITEH, Rijeka, 2020. (Croatian)	available on Merlin	40
Katavić, I., Introduction to materials, Sveučilište u Rijeci, 1997. (Croatian)	22	40
Filetin, T., Kovačiček, F., Indolf, J., Properties and application of materials, FSB, Zagreb, 2011. (Croatian)	5	40

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

Askeland, D. R., Wright, W. J., The science and engineering of materials, Boston [etc.]: Cengage Learning, cop. 2016.
Callister, W. D., Jr., Materials science and engineering: An Introduction, John Wiley & Sons, New York, Chichester, etc., 1996.
Raos, P., Šercer, M., Theoretical bases of polymer production, Strojarski fakultet, Slavonski Brod, 2010. (in Croatian)
Filetin, T., Kramer, I., Technical ceramics, FSB, Zagreb, 2005. (in Croatian)

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

Through the Institution's quality assurance system.

GENERAL INFORMATION		
Teacher	Prof. Dr. Sc. Nino Stojković	
Course title	**Electrical Engineering**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	compulsory	
Year	1st	
ECTS credits and teaching	ECTS student 's workload coefficient	8
	Number of hours (L+E+S)	45+45+0

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		
1. Evaluate the basic laws of electrostatics. 2. Analyze direct current electrical networks. 3. Evaluate the basic laws of electromagnetism. 4. Analyze alternating current electrical networks. 5. Plan and conduct measurements in electrical circuits.		
1.4. Course content		
Basic concepts and laws of electrostatics: force, field, potential. Capacitive networks. Basic concepts and laws of direct current circuits. Analysis of direct current networks: solving methods and theorems. Basic concepts and laws of electromagnetism. Magnetic materials and circuits. Basic concepts and laws of alternating current circuits. Analysis of alternating current networks: solving methods and theorems. Power and resonance in alternating current networks. Three-phase system.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education ☐ fieldwork	☑ individual assignment ☐ multimedia and network ☑ laboratories ☐ mentorship ☐ other _____

1.6. Student's obligations

Course attendance, activity, studying.

1.7. Evaluation of student's work

Course attendance	2	Activity/Participation		Seminar paper		Experimental work	1
Written exam	1	Oral exam		Essay		Research	
Project	1	Sustained knowledge check	3	Report		Practice	
Portfolio		Laboratories		Final exam			

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

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

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

Title	*Number of copies*	*Number of students*
N. Stojković, V. Sučić, S. Vlahinić, Osnove elektrotehnike I, Tehnički fakultet Sveučilišta u Rijeci i Fintrade, Rijeka, 2007.	Available on MERLIN	40
N. Stojković, S. Vlahinić, V. Sučić, Osnove elektrotehnike 2, Tehnički fakultet Sveučilišta u Rijeci i Fintrade, Rijeka, 2007.	Available on MERLIN	40

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

V. Pinter, Osnove elektrotehnike - Knjiga prva, Tehnička knjiga, Zagreb, 1980.
V. Pinter, Osnove elektrotehnike - Knjiga druga, Tehnička knjiga, Zagreb, 1989.

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

Through the Institution's quality assurance system.

GENERAL INFORMATION		
Teacher	Prof. Dr. Sc. Siniša Družeta	
Course title	**Computer Software in Engineering**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	compulsory	
Year	1st	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	15+30+0

COURSE DESCRIPTION		
1.1. Course objectives		
Adopting knowledge and skills necessary for active participation in a computerized engineering environment primarily involves understanding basic computer technologies, utilizing office software, and having a grasp of programming fundamentals in high-level programming languages.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Understand the concept of the operating system and development platforms. Explain the basic principles on which the Internet and related technologies are based, such as cloud computing, web applications, IoT. Define and correctly interpret the basic concepts of computer security. Adopt the usage of standard spreadsheet calculators in engineering applications. Adopt the usage of high-level programming languages for general engineering calculations. Apply high-level programming languages for visualizing numerical data in engineering applications.		
1.4. Course content		
Basic concepts of computer technology (types of computers, computer architecture, operating systems, Internet, computer security). Spreadsheet calculations. Programming in a high-level programming language for engineering needs.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education ☐ fieldwork	☑ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other _____
1.6. Student's obligations		

Course attendance, project assignment, individual studying.

1.7. 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		Laboratories		Final exam			

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

Sustained knowledge check (two tests), project, written exam

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

Title	*Number of copies*	*Number of students*
Računarsko inženjerstvo uz programski jezik Python (skripta), Tehnički fakultet, 2018. (in Croatian)	e-books	40

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

Oliphant, T. E.: Guide to NumPy: 2nd Edition, CreateSpace Independent Publishing Platform, 2015.
McGreggor, D. M.: Mastering matplotlib, Packt Publishing, 2015.

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

Through the Institution's quality assurance system.

GENERAL INFORMATION		
Teacher	Assoc. Prof. Dr. Sc. Jonatan Lerga	
Course title	**Digital Logic**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	compulsory	
Year	1st	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

COURSE DESCRIPTION		
1.1. Course objectives		
Understanding basic concepts of digital logic and the operation of logic circuits. Understanding basic methods of analysis and design of combinational and sequential digital circuits and systems. Developing the ability to analyze, synthesize, and solve problems in the field of digital logic.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Defining logic levels and basic characteristics of digital signals. Applying different number systems. Using various codes to represent digital data. Defining axioms and basic theorems of Boolean algebra. Minimizing logical functions. Distinguishing between AND, OR, AND-NOT, XOR, and XNOR logic. Utilizing various combinational logic circuits and functions. Explaining the operation principles and applications of basic sequential logic circuits.		
1.4. Course content		
Basic digital concepts; digital and analog quantities, logic levels, digital signals, digital systems. Number systems and operations; decimal, binary, octal, and hexadecimal systems, number complement. Error detection and correction codes; weighted and non-weighted codes, Hamming code. Boolean algebra; axioms and theorems, Boolean functions, canonical form of a function, truth tables. Minimization of logical functions; Karnaugh maps, Quine-McCluskey method. Combinational logic circuits; AND, OR, AND-NOT, XOR, and XNOR logic. Universal properties of NAND and NOR logic gates. Combinational logic functions; adders, comparators, encoders, decoders, multiplexers, demultiplexers. Flip-flops; S-R, D, J-K, and edge-triggered flip-flops, applications. Counters; asynchronous, synchronous, counter design, applications. Shift registers; basic and bidirectional registers, applications.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises	☑ individual assignment ☐ multimedia and network ☐ laboratories

	☐ long distance education ☐ fieldwork	☐ mentorship ☐ other _____

1.6. Student's obligations

Attending classes, completing laboratory exercises, and self-study.

1.7. Evaluation of student's work

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

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

Continuous assessment (assignments), projects, written exams.

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

Title	*Number of copies*	*Number of students*
A. P. Godse and D. A. Godse: Digital Logic Circuits, Technical Publications, 2011.	1	40
U. Peruško i V. Glavinić: Digitalni sustavi, Školska knjiga, 2005. (in Croatian)	5	40

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

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

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

Through the Institution's quality assurance system.

LIST OF COURSES						
Year of study: 1st year of the University Undergraduate Study in Mechatronics and Robotics						
Semester: 2nd (summer)						
COURSE	INSTRUCTOR	L	E	S	ECTS	STATUS
Mathematics 2	Prof. Dr. Sc. Nelida Črnjarić Assist. Prof. Dr. Sc. Angela Bašić-Šiško	45	45	0	7	C
Engineering Mechanics 1	Prof. Dr. Sc. Domagoj Lanc Assoc. Prof. Dr. Sc. Sanjin Kršćanski	45	30	0	6	C
Hydraulics and Pneumatics	Prof. Dr. Sc. Lado Kranjčević Assoc. Prof. Dr. Sc. Goran Gregov	45	15	0	6	C
Programming	Assist. Prof. Dr. Sc. Ivan Volarić	30	30	0	6	C
Engineering Design	Assoc. Prof. Dr. Sc. Kristina Marković	30	30	0	5	C

COURSE DESCRIPTION

GENERAL INFORMATION		
Teacher	Prof. Dr. Sc. Nelida Črnjarić / Assist. Prof. Dr. Sc. Angela Bašić-Šiško	
Course title	**Mathematics 2**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	compulsory	
Year	1st	
ECTS credits and teaching	ECTS student 's workload coefficient	7
	Number of hours (L+E+S)	45+45+0

COURSE DESCRIPTION		
1.1. Course objectives		
Acquiring basic knowledge and skills in application of calculus for single-variable functions, calculus for multivariable functions, and ordinary differential equations.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Correctly interpret and apply single-variable calculus. Define and correctly interpret basic notions of multivariable calculus and ordinary differential equations (ODE). Compute derivatives and some integrals of multivariable functions, and solutions of some ODE. Compute polynomial approximations; find local extrema of single-variable and multivariable functions by applying differential calculus. Compute some lengths, areas, and volumes by applying integral calculus. Model vibrations in simple mechanical and electrical systems by applying ODE.		
1.4. Course content		
Applications of single-variable calculus. Multi-variable functions. Partial derivatives, differential calculus for two-variable functions and applications (approximations, local extremes, optimal control problems). Double integral and applications. First order ODE. Higher order ODE. Systems of ODE. Applications of ODE.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education ☐ fieldwork	☐ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other _____

1.6. Student's obligations

Course attendance, activity/participation, studying.

1.7. Evaluation of student's work

Course attendance	3	Activity/Participation		Seminar paper		Experimental work	
Written exam	1,5	Oral exam		Essay		Research	
Project		Sustained knowledge check	2,5	Report		Practice	
Portfolio		Laboratories		Final exam			

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

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

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

Title	*Number of copies*	*Number of students*
Slapničar I.: Mathematics 2, Sveučilište u Splitu FESB, Split 2002, online book, (in Croatian)	123	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)	20	40

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

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

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

Through the Institution's quality assurance system.

GENERAL INFORMATION		
Teacher	Prof. Dr. Sc. Domagoj Lanc / Assoc. Prof. Dr. Sc. Sanjin Kršćanski	
Course title	**Engineering Mechanics 1**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	compulsory	
Year	1st	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	45+30+0

COURSE DESCRIPTION		
1.1. Course objectives		
Students are trained to independently establish equilibrium equations for rigid and deformable bodies (structures), and to determine the dimensions and materials of load-bearing structures or individual components under the influence of external loads.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Analyzing the equilibrium conditions of a given system of forces. Determine the reactions of supports and distribution of internal forces in beams. Differentiate between types of supports and possible loads, as well as types of internal forces. Define Coulomb's laws of friction. Determine the geometric characteristics of cross-sectional areas of beams. Define the concepts of deformation and stress. Calculate stress and deformation under axial loading, shear, torsion, and bending. Determine the deflection curve of the beam. Calculate the critical buckling load of a compression-loaded column. Analyze a beam under various complex loading combinations.		
1.4. Course content		
Planar and spatial force systems. Resolving a force into two and three components. Moment of a force about a point. Moment rule. Couple of forces and its properties. Moment of a force about an axis. Determining the resultant and reducing force systems to simpler forms. Equilibrium conditions for plane and spatial force systems. Friction. Truss structures. Beam structures. Centers of gravity of bodies, areas, and lines. Geometric properties of flat cross-sections of beams. Stress and deformation. Axial loading. Hooke's law. Shear. Torsion. Bending. Deflection lines. Buckling of axially loaded rods. Inclined bending. Eccentric loading. Bending and torsion.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education	☑ individual assignments ☐ multimedia and network ☑ laboratories ☐ mentorship

	☐ fieldwork	☐ other _____

1.6. Student's obligations

Course attendance, class participation, laboratory exercises, final exam, independent learning

1.7. Evaluation of student's work

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

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

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

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

Title	*Number of copies*	*Number of students*
Brnić, J.: „Statika", Sveučilište u Rijeci, Tehnički fakultet, Rijeka, 2004.	12	40
Brnić, J., Turkalj, G.: „Nauka o čvrstoći I", Sveučilište u Rijeci, Tehnički fakultet, Rijeka, 2004.	7	40
Brnić, J., Turkalj, G.: „Nauka o čvrstoći 2", Zigo, Rijeka, 2006.	15	40

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

Brnić, J.: "Mehanika i elementi konstrukcija", Školska knjiga, Zagreb, 1996.
Gross, D., Hauger, W., Schröder, J., Wall, W.A., Rajapakse, N.: "Engineering Mechanics 1", Springer, 2013.
Gross, D., Hauger, W., Schröder, J., Wall, W.A., Bonet, J.: "Engineering Mechanics 2", Springer, 2011.
Meriam, J. L., Kraige, L. G.: „Engineering Mechanics – Statics (SI version)", John Wiley & Sons, New York, 2020.
Alfirević, I.: "Nauka o čvrstoći I", Tehnička knjiga, Zagreb, 1995.
Šimić, V.: "Otpornost materijala I", Školska knjiga, Zagreb, 1992.
Gere, J. M.: "Mechanics of Materials", Brooks/Cole – Thomson Learning, Belmont, CA, 2004.

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

Through the Institution's quality assurance system.

GENERAL INFORMATION		
Teacher	Prof. dr. sc. Lado Kranjčević / Assoc. Prof. Dr. Sc. Goran Gregov	
Course title	**Hydraulics and pneumatics**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	compulsory	
Year	1st	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	45+15+0

COURSE DESCRIPTION
1.1. Course objectives
Understanding the physical meaning of laws and equations of fluid mechanics and developing students' abilities to solve problems related to the field of fluid mechanics. Acquiring knowledge about hydraulic and pneumatic systems as parts of mechatronic and robotic systems, as well as methodologies and tools for their design and simulation using computer programs and laboratory systems.
1.2. Course enrolment requirements
None.
1.3. Expected course learning outcomes
To properly list and interpret the statics of fluids and the basic laws of fluid dynamics: Euler's equation, relative fluid rest, forces on flat and curved surfaces, the law of conservation of mass, the law of conservation of momentum, the law of conservation of angular momentum, the law of conservation of energy, and Bernoulli's equation. To properly explain laminar and turbulent flow of viscous fluid. To explain the transmission of power and signals in hydraulic and pneumatic systems as integral parts of mechatronic and robotic systems. To be familiar with the operating principle of hydraulic and pneumatic actuators and machinery. To analyze valves for regulation in hydraulic and pneumatic systems. To define electro-hydraulic and electro-pneumatic control systems.
1.4. Course content
Introduction to fluid mechanics. Properties of fluids. Fluid statics. Euler's equation of fluid statics. Relative fluid rest. Buoyancy. Forces on flat and curved surfaces. Lift. Fluid kinematics. Velocity and acceleration. Circulation and flow. Fluid dynamics. Basic laws of fluid dynamics. Conservation of mass. Conservation of momentum. Conservation of angular momentum. Conservation of energy. Euler's and Bernoulli's equations. Applications of Bernoulli's equation: flow through narrow and wide openings, Venturi tube, Pitot tube. Viscosity and viscosity measurement. Relationship between laminar and turbulent flow. Principle of operation, advantages, disadvantages, and applications of hydraulic systems in mechatronic and robotic systems. Physical and working properties of hydraulic oils. Hydraulic machinery: pumps, hydraulic motors, and hydraulic cylinders. Hydraulic valves: directional, pressure, flow control, and check valves. Basics of proportional and servo hydraulics. Pipes and pipe fittings. Auxiliary hydraulic devices. Sealing in hydraulic and pneumatic systems. Calculation of hydraulic components and systems. Principle of operation, advantages, disadvantages, and applications of pneumatic systems in mechatronic and robotic systems. Gas laws. Compressed air production and preparation. Pneumatic actuators. Designing pneumatic and electro-pneumatic systems using pneumatic laboratory didactic systems.

1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education ☐ fieldwork	☑ individual assignments ☐ multimedia and network ☑ laboratories ☐ mentorship ☐ other _____

1.6. Student's obligations

Attending classes, participating actively in class activities, completing laboratory exercises, and self-study.

1.7. Evaluation of student's work

Course attendance	3	Activity/Participation	1	Seminar paper		Experimental work	
Written exam	1	Oral exam		Essay		Research	
Project		Sustained knowledge check	0,5	Report		Practice	0,5
Portfolio		Laboratories		Final exam			

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

Attending classes, active participation in class activities, solving individual tasks and laboratory exercises, continuous assessment (two midterm exams), final written exam.

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

Title	*Number of copies*	*Number of students*
L. Sopta, L. Kranjčević, Mehanika fluida, skripta. Tehnički fakultet Rijeka, 2004.	available online	40
Bruce R. Munson, D. F. Young, T. H. Okiishi, Fundamentals of Fluid Mechanics, 4th Updated Edition, John Wiley and Sons, 2003.	1	40
Siminiati, D.: Uljna hidraulika, Tehnički fakultet Sveučilišta u Rijec, 2012.	13	40
Gregov, G.: Pneumatsko upravljanje, skripta za vježbe, Tehnički fakultet Sveučilišta u Rijeci, Rijeka, 2023	available online	40

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

Streeter, V.L, Wylie E.B., Fluid mechanics, 8th edition, McGraw Hill, 1985.
Jelali, K., Kroll, A.: Hydraulic Servo-systems, Springer, 2008.
Beater, P.: Pneumatic drives: System Design, Modelling and Control, Springer, 2006.

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

Through the Institution's quality assurance system.

GENERAL INFORMATION		
Teacher	Assist. Prof. Dr. Sc. Ivan Volarić	
Course title	**Programming**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	compulsory	
Year	1st	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

COURSE DESCRIPTION		
1.1. Course objectives		
Acquiring fundamental knowledge of the C programming language. Familiarization and working with basic algorithms and data structures.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Explain in which way the simple data types are stored in the computer. Understand and apply basic commands of the C programming language. Understand and apply control flow commands. Differentiate between simple and complex data types. Understand the working principle of functions, recursive functions, pointers, and arrays. Assess advantages of using pointers, dynamic memory allocation, and self-referential structures. Differentiate between operations with direct, textual, and binary files.		
1.4. Course content		
Data storage in computers. Programming in the C programming language. Program flow control. One-dimensional, two-dimensional, and character arrays. Functions. Pointers. Pointers and arrays. Structures. Working with files. Dynamic memory allocation. Dynamic data structures. Preprocessor directives.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education ☐ fieldwork	☑ individual assignments ☐ multimedia and network ☑ laboratories ☐ mentorship ☐ other _____
1.6. Student's obligations		

Attending classes, independently performing laboratory exercises, self-study.

1.7. 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		Laboratories		Final exam			

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

Attending classes, independently performing laboratory exercises, continuous assessment, written exam.

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

Title	*Number of copies*	*Number of students*
Mladen Jurak: Programski jezik C, skripta, ak. god 2003/04.		40
K. N. King: C Programming, A Modern Approach, 2nd Edition, W. W. Norton & Company, 2008.		40

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

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

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

Through the Institution's quality assurance system.

GENERAL INFORMATION		
Teacher	Assoc. Prof. Dr. Sc. Kristina Marković	
Course title	**Engineering Design**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	compulsory	
Year	1st	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	30+30+0

COURSE DESCRIPTION		
1.1. Course objectives		
Understanding of engineering design and familiarization with 2D and 3D geometrical modeling computer techniques.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Anticipate the process of object modeling in accordance with the design intent. Analyze 2D and 3D computer techniques for 2D and 3D object modeling. Plan and create parametric geometry models. Generate 3D object model database and technical documentation.		
1.4. Course content		
Engineering design and application of CAD techniques in 2D and 3D geometry modeling. Geometrical entities and relations, 3D primitives, transformations. Types of 3D CAD models: wireframe, surface and solid model. Parametric modeling. Application of 3D model database. Merging physical and virtual world – new technologies		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education ☐ fieldwork	☑ individual assignments ☑ multimedia and network ☐ laboratories ☐ mentorship ☐ other _____
1.6. Student's obligations		
Course attendance and activity (lectures, exercises), constructive work, continuous knowledge testing, studying.		
1.7. Evaluation of student's work		

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

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

Constructive work, continuous knowledge testing, written exam.

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

Title	*Number of copies*	*Number of students*
M. Kljajin, M. Opalić: Inženjerska grafika, Strojarski fakultet u Slavonskom Brodu, Slavonski Brod, 2016. – drugo dopunjeno izdanje	3	40
M. Kljajin, M. Opalić: Inženjerska grafika, Strojarski fakultet u Slavonskom Brodu, Slavonski Brod, 2010.	10	40
Materijali s predavanja	web	40

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

T. Kishore: Learn Autodesk Inventor 2018 Basics, Apress, Berkeley, CA, USA, 2017
Randy H. Shih, Parametric Modeling with Autodesk Inventor 2018, SDC Publications, USA, 2017
Dennis K. Lieu, Sheryl A. Sorby: The Fundamentals of Visualization, Modeling, and Graphics for Engineering
Design, Delmar cengage learning, 2009.
James Leake: Engineering Design Graphics : Sketching, modeling and visualization, New York : John Wiley & Sons, Inc., 2008.

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

Through the Institution's quality assurance system.

LIST OF COURSES						
Year of study: 2nd year of the University Undergraduate Study in Mechatronics and Robotics						
Semester: 3rd (winter)						
COURSE	INSTRUCTOR	L	E	S	ECTS	STATUS
Mathematics 3	Assoc. Prof. Dr. Sc. Ivan Dražić	45	45	0	7	C
Electrical Circuits	Prof. Dr. Sc. Nino Stojković	45	15	0	7	C
Engineering Mechanics 2	Prof. dr. sc. Sanjin Braut Prof. dr. sc. Roberto Žigulić	45	30	0	6	C
Computational Methods	Prof. Dr. Sc. Jerko Škifić Assoc. Prof. Dr. Sc. Stefan Ivić	30	30	0	5	C
Elective Course 1 - group A-W					5	E

COURSE DESCRIPTION

GENERAL INFORMATION		
Teacher	Assoc. Prof. Dr. Sc. Ivan Dražić	
Course title	**Mathematics 3**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	compulsory	
Year	2nd	
ECTS credits and teaching	ECTS student 's workload coefficient	7
	Number of hours (L+E+S)	45+45+0

COURSE DESCRIPTION		
1.1. Course objectives		
Acquiring basic knowledge and skills in Fourier analysis, Laplace transforms, and vector analysis. Acquiring basic concepts of functions of complex variables.		
1.2. Course enrolment requirements		
Mathematics 1, Mathematics 2		
1.3. Expected course learning outcomes		
Defining and properly interpreting fundamental concepts of Fourier analysis, Laplace transforms, and expressing and proving basic properties of Laplace transforms. Calculating Fourier series and integrals, and Laplace transforms of some functions. Determining solutions of some differential equations using Laplace transforms. Defining and properly interpreting fundamental concepts of vector analysis, recognizing the physical meaning of gradient, directional derivatives, divergence, and curl. Calculating gradient, directional derivative, divergence, and curl and applying these differential operators in solving problems in vector analysis. Defining and interpreting the concept of line and surface integrals through their physical meanings, expressing basic integral theorems, and recognizing their physical significance. Calculating some line and surface integrals and applying integral theorems. Defining and properly interpreting fundamental concepts of functions of complex variables. Calculating derivatives and some integrals of functions of complex variables.		
1.4. Course content		
Basics of series. Fourier series. Fourier integral and Fourier transform. Laplace transform. Elementary properties and applications. Vector analysis. Line integrals. Surface integrals. Triple integral. Integral theorems. Applications. Functions of complex variables.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education	☐ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship

	☐ fieldwork	☐ other _____

1.6. Student's obligations

Course attendance, activity, mid-term exams, tests.

1.7. Evaluation of student's work

Course attendance	3	Activity/Participation		Seminar paper		Experimental work	
Written exam	0,5	Oral exam	1,5	Essay		Research	
Project		Sustained knowledge check	2	Report		Practice	
Portfolio		Laboratories		Final exam			

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

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

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

Title	*Number of copies*	*Number of students*
Elezović, N.: Fourierov red i integral, Laplaceova transformacija, (FER) Biblioteka Bolonja, Element, 2006.	12	40
Korkut, L., Krnić, M., Pašić, M.: Vektorska analiza, (FER) Biblioteka Bolonja, Element, 2006.	10	40
Elezović, N.: Kompleksna analiza, Element, 2018.	2	40
Štefan Trubić M., Črnjarić-Žic N: Inženjerska matematika ET, zbirka riješenih zadataka, interna skripta dostupna putem e-kolegija	70	40
Dražić, I.: Interna skripta iz Laplaceovih transformacija i Fourierove analize, dostupna putem e-kolegija	40	40

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

Kreyszig, E.: Advanced Engineering Mathematics, John Wiley & Sons, Inc., 1993.

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

Through the Institution's quality assurance system.

GENERAL INFORMATION		
Teacher	Prof. Dr. Sc. Nino Stojković	
Course title	**Electrical Circuits**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	compulsory	
Year	2nd	
ECTS credits and teaching	ECTS student ‘s workload coefficient	7
	Number of hours (L+E+S)	45+15+0

COURSE DESCRIPTION		
1.1. Course objectives		
Acquiring specific competencies to understand the relationships between electrical parameters within electrical circuits and the ability to solve circuit responses in the time and frequency domain and determine the behavior of electrical circuits. From general competencies, the ability to analyze and fundamental calculation skills will be developed.		
1.2. Course enrolment requirements		
Electrical Engineering		
1.3. Expected course learning outcomes		
1. Choose and apply a proper method for solving and analyzing linear and time continued electrical circuits in term to obtain time responses. 2. Valorize solutions obtained by circuit analysis. 3. Apply circuit theorems and assess obtained solutions. 4. Calculate immittance functions and transfer functions and on that basis assess circuit frequency response. 5. Calculate basic and mirror two ports parameters. 6. Analyze circuits which contain transmission lines and assess obtained results.		
1.4. Course content		
Definition and principal laws of electrical circuits. Elements of circuits. Kirchhoff's laws. Circuits equations at time domain and frequency domain. Free and forced circuit response. Topology analysis. Circuits theorems. Circuit functions and it's properties. First and second order circuits. Equations and parameters of two-port and multi-port circuits. Mirror parameters. Characteristics and connections of two-ports. Electrical filters. Circuits with distributed parameters. Ideal line and special cases of lines.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education	☑ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship

				☐ fieldwork		☐ other _____	
1.6. Student's obligations							
Course attendance, homework, written exam.							
1.7. Evaluation of student's work							
Course attendance	2	Activity/Participation		Seminar paper		Experimental work	
Written exam	1,5	Oral exam		Essay		Research	
Project	0,5	Sustained knowledge check	3	Report		Practice	
Portfolio		Laboratories		Final exam			
1.8. Procedure and examples of learning outcome assessment in class and at the final exam							
Course attendance, activity, homework, continuous knowledge testing, written exam.							
1.9. Assigned reading (at the time of the submission of study programme proposal)							

Title	*Number of copies*	*Number of students*
N. Stojković, V. Naglić, N. Mijat: Teorija mreža i linija, Tehnički fakultet, Rijeka, 2005.	10	40
N. Stojković: Teorija mreža i linija - zbirka zadataka, Tehnički fakultet, Rijeka, 2005.	10	40

1.10. Optional / additional reading (at the time of proposing study programme)
Ivanšić, I.: Funkcije kompleksne varijable i Laplaceova transformacija, Sveučilišna naklada Liber, Zagreb, 1978.
1.11. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences
Through the Institution's quality assurance system.

GENERAL INFORMATION		
Teacher	Prof.dr.sc. Roberto Žigulić / Prof.dr.sc. Sanjin Braut	
Course title	**Engineering Mechanics 2**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	compulsory	
Year	2nd	
ECTS credits and teaching	ECTS student ‘s workload coefficient	6
	Number of hours (L+E+S)	45+30+0

COURSE DESCRIPTION
1.1. Course objectives
Acquiring basic knowledge necessary for mathematically describing the planar and spatial motion of particles and rigid bodies. Understanding the relationships between the motion of dynamic systems and the causes that induce such motion (forces, moments).
1.2. Course enrolment requirements
None.
1.3. Expected course learning outcomes
Mathematically describe the spatial motion of a particle in Cartesian and other coordinate systems. Define degrees of freedom of motion and types of motion of rigid bodies. Analyze the rotational motion of a rigid body about a fixed axis. Analyze the motion of planar mechanisms. Define and explain Newton's laws and the concept of inertial force. Analyze motion of particle and systems of particles based on the principles of conservation of momentum, angular momentum, and energy. Set up differential equations of motion using Lagrange's equations of the second kind. Define the mass moment of inertia of a rigid body. Analyze simple vibrational systems using linear differential equations.
1.4. Course content
Kinematics: Position vectors, displacements, velocities, and accelerations of particles. Law of motion. Rectilinear motion. Harmonic and damped oscillations. Curvilinear motion. Spatial motion of a particle in different coordinate systems. Complex motion of particles. Degrees of freedom of motion of rigid bodies. Rotation around a fixed axis. Planar motion of rigid bodies. Determination of velocities and accelerations of planar mechanisms. Motion of bodies around a fixed point. General case of motion. Complex motion of rigid bodies. Dynamics: Newton's laws. Inertial and non-inertial coordinate systems. D'Alembert's principle. Mass moments of inertia. Linear and angular momentum of particles and rigid bodies. Mechanical work, kinetic and potential energy of material particles and rigid bodies. Power. Motion of the center of mass of a system. Conservation of momentum. Virtual work. Lagrange-D'Alembert principle. Generalized coordinates and Lagrange's equations of the second kind. Planar motion of rigid bodies. Determination of reactions at joints and balancing moments in planar mechanisms. Dynamic pressures on rotation axes. Motion of a rigid body around a fixed point - gyroscopic effect. Systems with variable mass. Free and forced vibrations of systems with one degree of freedom.

1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education ☐ fieldwork	☑ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other _____

1.6. Student's obligations

Course attendance, activity, homework, studying.

1.7. Evaluation of student's work

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

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

Course attendance, activity, 3 constructional exercises, continuous knowledge testing (three mid-term exams), written and oral exam.

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

Title	*Number of copies*	*Number of students*
Žigulić, R., Braut, S.: Kinematika, Tehnički fakultet Sveučilišta u Rijeci, 2012.	10	40
Krpan, M., Butković, M., Žigulić, R., Braut, S., Franulović, A., Dinamika, TFR, Rijeka, 2001.	16	40

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

Beer , F., Johnston, E.R., Cornwell, P.: Vector Mechanics for Engineers: Dynamics, McGraw Hill Education, New York, 2012.

Pustaić, D., Wolf, H., Tonković, Z. Uvod u analitičku mehaniku s osnovama teorije vibracija, Golden marketing / Tehnička knjiga, Zagreb, 2005.

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

Through the Institution's quality assurance system.

GENERAL INFORMATION		
Teacher	Prof. Dr. Sc. Jerko Škifić, Assoc. Prof. Dr. Sc. Stefan Ivić	
Course title	**Computational Methods**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	compulsory	
Year	2nd	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	30+30+0

COURSE DESCRIPTION		
1.1. Course objectives		
Identification of numerical problems in engineering. Understanding and application of basic numerical methods. Basic knowledge of the Python programming language and relevant numerical and visualization modules. Independent writing of short computer programs and use of existing software for solving numerical tasks.		
1.2. Course enrolment requirements		
Mathematics 1		
1.3. Expected course learning outcomes		
Identify appropriate computational methods for simple mathematical formulations of engineering problems. Properly interpret the fundamental idea of each computational method. Correctly assess the advantages and disadvantages of each computational method. Compare computational methods applicable to the same type of problem. Apply existing computer programs to simple problems. Develop simple computer programs in the Python programming language for specific computational methods following instructions. Evaluate the results of computational methods.		
1.4. Course content		
Examples in engineering for nonlinear equations with one unknown. Corresponding numerical methods and comparison. Convergence criteria of iterative algorithms. Computer programs in Python. Optimization of a single-variable function with examples from engineering. Corresponding numerical methods and comparison. Computer programs in Python. Examples in engineering for systems of linear equations. Corresponding exact and numerical methods and their comparison. Error in solving using computers. Computer programs in Python. Examples in engineering for curve fitting to data. Regression analysis. Interpolation and spline curves in computer graphics. Computer programs in Python. Examples in engineering for definite integrals. Corresponding numerical methods. Increasing the accuracy of calculations versus accumulation of rounding errors. Computer programs in Python. Examples in engineering for ordinary differential equations and systems of ordinary differential equations. Corresponding numerical methods. Local and global errors. Computer programs in Python.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops	☐ individual assignments

	☑ exercises ☐ long distance education ☐ fieldwork	☐ multimedia and network ☑ laboratories ☐ mentorship ☐ other _____

1.6. Student's obligations

Course attendance, mid-term exams, computer knowledge checks.

1.7. 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		Sustained knowledge check	2	Report		Practice	
Portfolio		Laboratories		Final exam			

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

Course attendance, mid-term exams, computer knowledge checks, written and/or oral exam

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

Title	*Number of copies*	*Number of students*
Chapra, Steven C., Canale, Raymond P., Numerical methods for engineers, Eighth edition. New York, NY: McGraw-Hill Education, 2021.	6	40
Press, W., et al: Numerical Recipes for C/C++/Pascal/fortran, Cambridge University Press, 1992.	6	40
Alex Martelli, Python in a nutshell, O'Reilly & Associates Inc., 2003.	1	40
Računarsko inženjerstvo uz programski jezik Python, (skripta), Tehnički fakultet, 2018. (elektronsko izdanje).	e-copy	40

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

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

Through the Institution's quality assurance system.

LIST OF COURSES						
Year of study: 2nd year of the University Undergraduate Study in Mechatronics and Robotics						
Semester: 4th (summer)						
COURSE	INSTRUCTOR	L	E	S	ECTS	STATUS
Mechatronic System Design	Assist. Prof. Dr. Sc. Jelena Srnec Novak	45	30	0	7	C
Electronics	Prof. Dr. Sc. Miroslav Vrankić	30	30	0	6	C
Fundamentals of Automatic Control	Prof. Dr. Sc. Neven Bulić	30	30	0	6	C
Elective Course 2 - group A-S					11	E
Elective Course 3 - group A-S or B-S						E

COURSE DESCRIPTION

GENERAL INFORMATION		
Teacher	Assist. Prof. Dr. Sc. Jelena Srnec Novak	
Course title	**Mechatronic System Design**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	compulsory	
Year	2nd	
ECTS credits and teaching	ECTS student 's workload coefficient	7
	Number of hours (L+E+S)	45+30+0

COURSE DESCRIPTION		
1.1. Course objectives		
Learn types of loads and stresses in mechatronic systems. Familiarization with the type, function, forms, material, and calculation of machine elements in mechatronics and their integration into mechatronic and robotic systems. Developing the ability to work independently and in small groups (teamwork) and present achieved results.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Distinguish between types of loads and stresses, define static and dynamic loading in mechatronic systems. Be able to list the basic elements of mechatronic systems. Differentiate between machine elements for force and torque transmission in linear and circular motion, and list mechanical actuators in mechatronic and robotic systems. Explain the method of calculation of machine elements used in mechatronic and robotic systems. Implement acquired knowledge on practical examples.		
1.4. Course content		
Basics of strength calculation of machine elements in mechatronics. Types of loads, allowable stresses, critical speed in mechatronic systems. Fundamental material properties. Friction and lubrication in mechatronic systems. Machine elements in mechatronics and robotics. Assembly processes of mechanisms. Software tools for design and simulation in mechatronics and robotics. Exercise content: Work on a project task to be carried out in small groups.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education ☐ fieldwork	☑ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other _____

1.6. Student's obligations

Course attendance, activity, solving of design problems during exercises and at home, studying.

1.7. Evaluation of student's work

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

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

Course attendance. Written or oral mid-term exams. Continuous assessment of accuracy, precision, completeness and creativity when solving construction design projects. Final written and/or oral exam.

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

Title	*Number of copies*	*Number of students*

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

E. F. Kececi, Mechatronic components: Roadmap to design. Butterworth-Heinemann, 2018.

J.E. Shigley, C.R. Mischke, Mechanical Engineering Design, McGraw Hill, New York.

W. Bolton, Mechatronics: electronic control systems in mechanical and electrical engineering, Pearson, 7th Ed.

B. Križan, Osnove proračuna i oblikovanja konstrukcijskih elemenata, Školska knjiga, Zagreb, 2008.

K.-H. Decker, Elementi strojeva, Golden marketing-Tehnička knjiga, Zagreb, 2006.

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

Through the Institution's quality assurance system.

GENERAL INFORMATION		
Teacher	Prof. Dr. Sc. Miroslav Vrankić	
Course title	**Electronics**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	compulsory	
Year	2nd	
ECTS credits and teaching	ECTS student ‘s workload coefficient	6
	Number of hours (L+E+S)	30+20+0

COURSE DESCRIPTION		
1.1. Course objectives		
Students will be able to describe and analyze transistor circuits in typical configurations.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Analyze the transistor using the large signal model. Analyze the transistor using the small signal model. Analyze different transistor amplifier configurations. Analyze amplifier's frequency response. To know amplifiers with feedback loops. Analyze operational amplifier. Evaluate and analyze CMOS logic circuits.		
1.4. Course content		
Circuits with bipolar transistors. Basic transistor amplifier configurations. Differential amplifiers. Cascaded amplifiers. Power amplifiers. Operational amplifiers. Amplifier frequency response. Feedback amplifiers. Stability of feedback amplifiers. Basic CMOS logic circuits. ECL circuits.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education ☐ fieldwork	☑ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other _____
1.6. Student’s obligations		
Course attendance, activity, homework, studying.		
1.7. Evaluation of student’s work		

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

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

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

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

Title	*Number of copies*	*Number of students*
Ž. Butković: Elektronika 2, Zagreb 2010.	5	40
P. Biljanović: Elektronički sklopovi, 2 iz., Školska knjiga, Zagreb, 1993.	5	40

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

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

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

Through the Institution's quality assurance system.

GENERAL INFORMATION		
Teacher	Prof. Dr. Sc. Neven Bulić	
Course title	**Fundamentals of Automatic Control**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	compulsory	
Year	2nd	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

COURSE DESCRIPTION		
1.1. Course objectives		
Acquiring theoretical fundamentals and practical knowledge for solving problems in the area of automatic control. Usage of program tools for solving control problems. Understanding the principle of a control loop. Knowledge of how to describe control loops using transfer functions. Understanding the basic concepts of stability theory.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Analyze the basic properties of the control system and the control principle. Define, analyze, and compare mathematical models of control system components using the Laplace transform. Define the transfer function and transient characteristics of basic components and complex dynamic systems. Determine the amplitude-phase frequency characteristics of basic dynamic components as well as complex dynamic systems. Define and analyze system stability using analytical and grapho-analytical methods. Calculate the indicators of the control system behavior. Apply analytical and numerical methods of simulation software packages to analyze and solve problems of control systems. Understand the structure of the regulator and synthesize the regulator parameters of simple control circuits.		
1.4. Course content		
Basic terminology. Mathematical description of control system components. Laplace transform. Transfer functions and time responses of control system components. Amplitude- and phase-frequency characteristics of control system components. Algebraic and graph-analytical stability criteria. Controller structure and parameters. Control system design examples. Control system accuracy. Control system quality indicators.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education	☐ individual assignments ☐ multimedia and network ☑ laboratories ☐ mentorship

				☐ fieldwork		☐ other _____	
1.6. Student's obligations							
Course attendance, activities in class, individual attending of laboratory exercises, studying.							
1.7. Evaluation of student's work							
Course attendance	2	Activity/Participation		Seminar paper		Experimental work	
Written exam	1	Oral exam		Essay		Research	
Project		Sustained knowledge check	2,5	Report		Practice	0,5
Portfolio		Laboratories		Final exam			
1.8. Procedure and examples of learning outcome assessment in class and at the final exam							
Course attendance, activities in class, writing laboratory exercise reports, sustained knowledge checks (two tests), written exam.							
1.9. Assigned reading (at the time of the submission of study programme proposal)							
Title			*Number of copies*		*Number of students*		
Kuljača, Lj., Vukić, Z., Automatsko upravljanje – analiza linearnih sustava. Zagreb; Kingen, d.o.o., 2004			5		40		
Matika, D., Brnobić, D., Osnove regulacijske tehnike, Skripta, Tehnički fakultet Rijeka, 2004			14		40		
1.10. Optional / additional reading (at the time of proposing study programme)							
Nise, N., Control System Engineering. New York; John Wiley and Sons., 2000 Kuljača V., Vukić Z., Automatsko upravljanje sistemima. Zagreb; Školska knjiga., 1985 Šurina, T., Automatska regulacija. Zagreb; Školska knjiga., 2001							
1.11. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences							
Through the Institution's quality assurance system.							

LIST OF COURSES						
Year of study: 3rd year of the University Undergraduate Study in Mechatronics and Robotics						
Semester: 5th (winter)						
COURSE	INSTRUCTOR	L	E	S	ECTS	STATUS
Industrial Automation	Assist. Prof. Dr. Sc. Ivan Volarić	30	30	0	7	C
Applied Mechatronic Systems	Assoc. Prof. Dr. Sc. Ervin Kamenar	45	30	0	7	C
Elective project *		0	45	0	5	C
Elective Course 4 - group A-W					11	E
Elective Course 5 - group A-W or B-W						E

* The elective project is enrolled from any mandatory course in the study program.

GENERAL INFORMATION		
Teacher	Assist. Prof. Dr. Sc. Ivan Volarić	
Course title	**Industrial Automation**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	compulsory	
Year	3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	7
	Number of hours (L+E+S)	30+30+0

COURSE DESCRIPTION		
1.1. Course objectives		
Students will be introduced with basic categories of plant automation elements, and gain theoretical and practical knowledge for system analysis, by solving automation problems and by applying computers and programmable logic controllers (PLC) for automation of simple systems.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Define and distinguish between the basic categories of plant automation elements. Explain the implementation principles and mathematically analyze physical phenomena in plant automation elements. Define and analyze static and dynamic characteristics of plant automation elements. Analyze electromechanical, pneumatic and hydraulic actuators. Describe the implementation and computer operation in plant control. Apply the computer and the programmable logic controller (PLC) in automation of simple systems.		
1.4. Course content		
Introduction to programmable logic controllers (PLC). Static and dynamic characteristics of automation elements. Noise sources in the measuring systems. Operational principle and characteristics of sensors: movement, position, fluid level, temperature, flow, and pressure. Operational principle of electromechanical, pneumatic, and hydraulic actuators.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education ☐ fieldwork	☐ individual assignments ☐ multimedia and network ☑ laboratories ☐ mentorship ☐ other _____

1.6. *Student's obligations*							
Course attendance, laboratory assignments, individual studying.							
1.7. *Evaluation of student's work*							
Course attendance	2	Activity/Participation		Seminar paper		Experimental work	
Written exam	2	Oral exam		Essay		Research	
Project		Sustained knowledge check	2	Report		Practice	1
Portfolio		Laboratories		Final exam			
1.8. *Procedure and examples of learning outcome assessment in class and at the final exam*							
Course attendance, laboratory assignments, continuous knowledge tests, written exams.							
1.9. *Assigned reading (at the time of the submission of study programme proposal)*							

Title	*Number of copies*	*Number of students*
Clarence W. de Silva: Sensors and Actuators - Control System Instrumentation, CRC Press, 2007		40
Bela G. Liptak: Instrument Engineers Handbook, 4th Edition, CRC Press, 2003		40

1.10. *Optional / additional reading (at the time of proposing study programme)*
Radoslav Korbar: Pneumatika i hidraulika, Veleučilište u Karlovcu, 2007
1.11. *Quality monitoring methods which ensure acquirement of output knowledge, skills and competences*
Through the Institution's quality assurance system.

GENERAL INFORMATION		
Teacher	Assoc. Prof. Dr. Sc. Ervin Kamenar	
Course title	**Applied Mechatronic Systems**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	compulsory	
Year	3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	7
	Number of hours (L+E+S)	45+30+0

COURSE DESCRIPTION
1.1. Course objectives
Understanding and programming basic components and their integration into mechatronic systems. Familiarization, modeling, and simulation of mobile robotic systems and manipulators. Development of teamwork skills and presentation of achieved results.
1.2. Course enrolment requirements
Mathematics 1 i Mathematics 2
1.3. Expected course learning outcomes
To know the basic concepts in mechatronics and robotics. Analyze types of control units and microcontrollers, as well as sensors and actuators used in mechatronics and robotics. Select components for integration into mechatronic systems. Connect actuators, sensors, and control units using simple algorithms. Design simple mechatronic robotic systems and describe their kinematics. Apply Python and the Robot Operating System (ROS) for modeling and simulating robotic systems.
1.4. Course content
Introduction to Mechatronics: Familiarization with basics and examples of mechatronic systems. Classification of control units and microcontrollers and their programming. Classification and application of actuators and sensors. Examples of connecting and programming actuators and sensors. Designing mechatronic systems and integrating components. Overview of mechatronic robotic systems with a focus on mobile robots and manipulators. Robot Operating System programming environment. Simulating and modeling simple examples of robotic systems using Python and ROS programming environments. Modeling robots and visualization using the ROS Visualization (Rviz) tool. Examples of manipulator and mobile robot kinematics.

1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education ☑ fieldwork	☑ individual assignments ☐ multimedia and network ☑ laboratories ☐ mentorship ☐ other _____

1.6. Student's obligations

Attendance, participation in class activities, completion of programming assignments, self-study.

1.7. Evaluation of student's work

Course attendance	3	Activity/Participation		Seminar paper		Experimental work	
Written exam	1	Oral exam		Essay		Research	
Project		Sustained knowledge check	1	Report		Practice	
Portfolio		Laboratories	2	Final exam			

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

Attendance, laboratory exercises, project assignments, quizzes, individual and teamwork, presentations, written exam.

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

Title	*Number of copies*	*Number of students*

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

R. H. Bishop: "Mechatronics: an introduction", CRC Press, 2017.

R. H. Bishop: „The Mechatronics Handbook" – 2nd ed., CRC Press, 2007.

R. M. Schmidt, G. Schitter, A. Rankers, J van Eijk: „The Design of High Performance Mechatronics" – 2nd ed., Delft University Press, 2014.

Y. Pyo, H. Cho, R. Jung, T. Lim: "ROS Robot Programming" ROBOTIS Co.,Ltd., 2017

S. Zelenika, E. Kamenar: "Precizne konstrukcije i tehnologija mikro i nanosustava I – Precizne konstrukcije", Tehnički fakultet Sveučilišta u Rijeci, 2015.

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

Through the Institution's quality assurance system.

LIST OF COURSES						
Year of study: 3rd year of the University Undergraduate Study in Mechatronics and Robotics						
Semester: 6th (summer)						
COURSE	INSTRUCTOR	L	E	S	ECTS	STATUS
Robotic Systems	Dr. Sc. Nikola Anđelić	30	30	0	6	C
Bachelor's thesis					10	C
Internship 1					5	C
Elective Course 6 - group A-S					9	E
Elective Course 7 - group A-S or B-S						E

GENERAL INFORMATION		
Teacher	dr. sc. Nikola Anđelić	
Course title	Robotic Systems	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	compulsory	
Year	3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

COURSE DESCRIPTION
1.1. Course objectives
Defining the types and characteristics of serial, parallel, and mobile robots used in industrial environments. Understanding the modeling of robot kinematics and dynamics, as well as trajectory planning. Acquiring knowledge about navigation and mapping for mobile robots. Application of numerical simulations of robotic systems. Application of software packages for robotics simulations. Modeling of multi-robot collaborative systems.
1.2. Course enrolment requirements
Mathematics 1 and 2, Applied Mechatronic Systems
1.3. Expected course learning outcomes
After successfully completing the course, students will be able to analyze the types, characteristics, and components of serial, parallel, and mobile robots. They will have the skills to define and apply algorithms for direct and inverse kinematics of robots, as well as for path planning. Additionally, they will be able to define and apply algorithms for modeling robot dynamics and create simulations of robotic systems using appropriate software packages. Furthermore, students will have the knowledge to define and apply algorithms for simultaneous localization and mapping (SLAM), as well as algorithms for space exploration. Finally, they will be able to classify multi-robot systems of various types and their characteristics.
1.4. Course content
Overview of types of robotic manipulators: serial, parallel, and mobile robots. Review of robot kinematics. Dynamics of different types of robots. Denavit-Hartenberg method. Newton-Euler and Lagrange-Euler algorithms. Continuous path planning. Point-to-point path planning. Algorithms for simultaneous localization and manipulation. Application of Python programming language and NumPy library for numerical simulations in robotics. Simulations of robotic systems in existing software packages. Cooperative robotic systems.

1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education ☑ fieldwork	☑ individual assignments ☐ multimedia and network ☑ laboratories ☐ mentorship ☐ other _____

1.6. Student's obligations

Attendance, participation in activities, completion of programming tasks, self-studying.

1.7. Evaluation of student's work

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

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

Attendance, laboratory exercises, quizzes (3), self-work, presentation of work, written exam.

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

Title	*Number of copies*	*Number of students*
B. Siciliano, K. Oussama: Springer handbook of robotics. Springer, 2016.	1	40
Kelly, Alonzo. Mobile robotics: mathematics, models, and methods. Cambridge University Press, 2013.	1	40
Yoshikawa, T. (2010). Foundations of robotics: analysis and control. 3rd ed. MIT press.	1	40

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

Tsai, Lung-Wen. Robot analysis: the mechanics of serial and parallel manipulators. John Wiley & Sons, 1999.

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

Through the Institution's quality assurance system.

Elective course -group A-W (winter semester)

LIST OF COURSES						
Year of study: 2nd and 3rd year of the University Undergraduate Study in Mechatronics and Robotics						
Semester: 3rd and 5th (winter)						
COURSE	INSTRUCTOR	L	E	S	ECTS	STATUS
Algorithms and Data Structures	Prof. Dr. Sc. Kristijan Lenac	30	30	0	6	E
Electrical Machines	Assoc. Prof. Dr. Sc. Rene Prenc	45	30	0	6	E
Power Electronics	Prof. Dr. Sc. Nino Stojković	30	45	0	6	E
Computer Architecture	Prof. Dr. Sc. Ivo Ipšić	30	30	0	6	E
Fundamentals of Electrical Engineering and Sustainable Development	Assist. Prof. Dr. Sc. Vladimir Franki	45	15	0	5	E
Production Machines, Tools, Jigs and Fixtures	Prof. Dr. Sc. Zoran Jurković	30	30	0	5	E
Signals and Systems	Assist. Prof. Dr. Sc. Ivan Volarić	45	15	0	6	E
Introduction to Object-Oriented Programming	Assoc. Prof. Dr. Sc. Goran Mauša	30	30	0	6	E

COURSE DESCRIPTION

GENERAL INFORMATION		
Teacher	Prof. Dr. Sc. Kristijan Lenac	
Course title	**Algorithms and Data Structures**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	2nd/3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

COURSE DESCRIPTION		
1.1. Course objectives		
Basic knowledge of simple and abstract data types. Ability to analyze algorithm complexity. Familiarity with important sorting and searching algorithms. Ability to solve more challenging programming problems.		
1.2. Course enrolment requirements		
Programming 2.		
1.3. Expected course learning outcomes		
Utilize knowledge of simple and abstract data types. Be able to describe the performance of an algorithm using natural language or pseudocode. Analyze and estimate the time complexity of algorithms. Employ techniques for implementing basic data structures. Know and correctly apply fundamental sorting and searching algorithms. Utilize libraries with pre-made algorithms and data structures.		
1.4. Course content		
Introduction: problem solving, algorithm, pseudo code, data types, time complexity of algorithms. Abstract data type. List. Stack. Queue. Recursion and iteration. Sorting and searching algorithms. Trees. Graphs. Hash tables.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education ☐ fieldwork	☑ individual assignments ☐ multimedia and network ☐ laboratories ☑ mentorship ☐ other _____
1.6. Student's obligations		

Class attendance, homework, studying.

1.7. 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	3	Report		Practice	
Portfolio		Laboratories		Final exam			

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

Midterm exams, sustained knowledge check, written exam.

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

Title	*Number of copies*	*Number of students*

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

Thomas H. Cormen Charles E. Leiserson Ronald L. Rivest Clifford Stein: Introduction to Algorithms Third Edition Wikibooks: Data structures , Algorithms http://en.wikibooks.org/wiki/Algorithms

Mark Allen Weiss: Data structures and algorithm analysis in C++ / Edition:3rd ed. Publication:Boston: Pearson, Addison Wesley, 2006.

Robert Sedgewick: Algorithms in C, Parts 1-5: Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms, Addison-Wesley Professional, 2001.

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

Through the Institution's quality assurance system.

GENERAL INFORMATION		
Teacher	Assoc. Prof. Dr. Sc. Rene Prenc	
Course title	**Electrical Machines**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	2nd/3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	45+30+0

COURSE DESCRIPTION

1.1. Course objectives

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

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Upon successful completion of the course, students will:

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

1.4. Course content

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

operation and types of DC machines. Types of excitation circuits and description of their external characteristics. Speed regulation of DC motors.

1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education ☐ fieldwork	☐ individual assignments ☐ multimedia and network ☑ laboratories ☐ mentorship ☐ other _____

1.6. Student's obligations

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

1.7. Evaluation of student's work

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

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

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

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

Title	*Number of copies*	*Number of students*
R. Prenc: Električni strojevi, electronic teaching materials, 2020.	(internet)	40
B. Skalicki, J. Grilec: Električni strojevi i pogoni, Fakultet strojarstva i brodogradnje, Sveučilište u Zagrebu, 2005.	5	40
I. Mandić, V. Tomljenović, M. Pužar: Sinkroni i asinkroni električni strojevi, Tehničko veleučilište u Zagrebu, 2012.	(internet)	40
R. Wolf: Osnove električnih strojeva, Školska knjiga, Zagreb, 1991.	5	40

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

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

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

Through the Institution's quality assurance system.

GENERAL INFORMATION		
Teacher	Prof. Dr. Sc. Nino Stojković	
Course title	**Power Electronics**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	2nd/3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+45+0

COURSE DESCRIPTION		
1.1. Course objectives		
Introducing students to energy-efficient electronic converters from both theoretical and practical perspectives, preparing them for their design.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Describing of standard topological structures of power electronics converters. Describing of power converter functions. Describing of commutation process connected with power electronics valves. Defining of output characteristics of diode rectifiers. Analysing of phase controlled rectifiers. Analysing a behaviour of direct and indirect AC/AC converters.		
1.4. Course content		
Area of application of power electronics. Power flow in electrical networks (converters). Quality parameters of electric energy. Rectifier (rectifying) circuits. Conditions for transitioning to converter operation. Commutation. DC converters with and without galvanic isolation. Inverters. AC converters and their application.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education ☐ fieldwork	☐ individual assignments ☑ multimedia and network ☑ laboratories ☐ mentorship ☐ other _____
1.6. Student's obligations		
Attendance in class, completion of laboratory reports.		

COURSE DESCRIPTION

1.1. Course objectives

1.7. 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	1	Report		Practice	0,5
Portfolio		Laboratories		Final exam			

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

Attendance in class, participation in activities, completion of homework assignments, continuous assessment through five quizzes, written and oral exams.

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

Title	*Number of copies*	*Number of students*
J.G.Kassakian, M.F.Schlecht, G.C.Verghese: Osnove energetske elektronike, I dio Topologije i funkcije pretvarača, Graphis, Zagreb, 2000.	6	40

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

Z. Benčić, Z. Plenković, Energetska elektronika – Poluvodički ventili, Školska knjiga, Zagreb, 1978.
T. Brodić: Osnove energetske elektronike – Energetski poluvodički pretvarači, Zigo, Rijeka 2005.
D.W. Hart: Introduction to Power Electronics, Prentice Hall International Inc., 1997.
J. G. Kassakian i dr., Osnove energetske elektronike 2., Graphis, Zagreb, 2008.

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

Through the Institution's quality assurance system.

GENERAL INFORMATION		
Teacher	Prof. Dr. Sc. Ivo Ipšić	
Course title	**Computer Architecture**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	2nd/3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

COURSE DESCRIPTION		
1.1. Course objectives		
Obtaining basic knowledge of computer hardware.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Describe and classify different computer architectures. Understand the working principle of a Turing machine. Compare components of a computer system. Understand the basic features of von Neumann architecture. Adopt the working principle of the arithmetic-logic unit of a computer. Understand the instruction execution principle of a microprocessor. Understand the working principle of pipelined architecture of a microprocessor. Evaluate the memory hierarchy of a computer system. Be familiar with programs written in assembly language.		
1.4. Course content		
Computer Architecture definition and classification. Historical overview of computer development. Turing machine. Coding data and operations in a computer. Model of von Neumann Computer Architecture. Control unit. Simple microprocessor model instruction execution. RICS and CISC architecture. Pipeline architecture of microprocessors. Computer Buses. Computer memory system and Cache memory. Memory organization and virtual memory system. Input/output control system. Interrupt handling techniques. Overview of 8, 16, 32 and 64 bits computer architecture.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education ☐ fieldwork	☑ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other _____

1.6. *Student's obligations*

Course attendance, activity, homework, studying

1.7. *Evaluation of student's work*

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

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

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

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

Title	*Number of copies*	*Number of students*
Ribarić, S.:Građa računala, Arhitektura i organizacija računarskih sustava. Algebra d.o.o. 2011.	2	40
Ribarić, S.: Arhitektura računala RISC i CISC, Školska knjiga, Zagreb, 1996.	1	40
Ribarić, S.: Napredne arhitekture mikroprocesora, Školska knjiga, Zagreb, 1997.	5	40

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

Ribarić, S.: Arhitektura mikroprocesora, Tehnička knjiga, Zagreb, 1988.

Peruško, U., Glavinić, V.: Digitalni sustavi, Školska knjiga Zagreb, 2005.

Hennessey, J.L., Patterson D.A.: Computer Organization and Design : The Hardware/Software Interface, Morgan Kauf. Pub., San Mateo, 2013.

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

Through the Institution's quality assurance system.

GENERAL INFORMATION		
Teacher	Assist. Prof. Dr. Sc. Vladimir Franki	
Course title	**Fundamentals of electrical engineering and sustainable development**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	2nd/3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	45+15+0

COURSE DESCRIPTION		
1.1. Course objectives		
The main goals of the course are to familiarize students with the fundamentals of electrical engineering and the concept of sustainable development. From general competencies, the ability to analyze, basic computing skills and problem solving will be developed.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Describe energy sources and energy conversions. Explain principles of operation of the most important types of power plants. Explain basic principles of electromechanical energy conversion. Explain principles of operation of electric rotating machines and transformers. Apply knowledge of low voltage electrical installations and lighting. Explain the structure and most significant characteristics of traditional and modern transmission and distribution networks. Explain the impact of the electricity sector on the environment and apply solutions to reduce greenhouse gas emissions in the electricity sector.		
1.4. Course content		
Forms, sources and classification of energy. Energy sources and energy conversion. Thermal power plants, hydroelectric power plants, renewable energy sources. Electricity production and consumption in the world. Transformers and rotating machines. Power system. Structure and operation of transmission and distribution networks. Elements of electric power networks and plants. Low voltage installations and lighting. Electric shock protection. External and internal lightning and surge protection. Basic analysis in power engineering. Impact of the electricity sector on the environment - environmental protection. Greenhouse effect and greenhouse gasses. Solutions for reducing greenhouse gas emissions in the electricity sector. Emission reduction strategies through examples and international actions.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education	☐ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship

	☐ fieldwork	☐ other _____

1.6. Student's obligations

Course attendance, activity, homework, studying.

1.7. Evaluation of student's work

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

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

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

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

Title	*Number of copies*	*Number of students*
H. Požar, Osnove energetike 1, 2 i 3, Školska knjiga, Zagreb, 1992.		40
B. Udovičić, Elektroenergetski sustav, Kigen, Zagreb, 2005.		40
P. Hasse, J. Wiesinger, W. Zischank, Priručnik za zaštitu od munje i uzemljenje, Kigen d.o.o., Zagreb, 2009.		40
G. Piani, A.Višković, B.Saftić, Protokol iz Kyota; Ostvarenje i budući razvoj, zakonodavstvo, strategije i tehnologije, Kigen d.o.o., Zagreb, 2011.		40
Lecture notes (e-book).		

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

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

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

Through the Institution's quality assurance system.

GENERAL INFORMATION		
Teacher	Prof. Dr. Sc. Zoran Jurković	
Course title	**Production Machines, Tools, Jigs and Fixtures**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	2nd/3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	30+30+0

COURSE DESCRIPTION		
1.1. Course objectives		
Introduction to the basic concepts and characteristics of processing machines. Ability to solve problems related to simulating machine operation and designing tools and devices for specific applications. Developing the ability to work in small groups.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Defining the basic structural elements and classifying processing machines. Analyzing control systems on processing machines. Analyzing the technical and technological characteristics of processing machines. Explaining the basics of tool and device design. Analyzing examples of tool design for particle separation processing. Analyzing examples of fixture and device design. Defining modular processing systems and flexible manufacturing cells. Describing machining centers, special machine tools. Outlining the basics of high-dynamic processing machines. Describing tool and workpiece clamping, storage, and transport systems. Applying computer packages in simulating machine operation.		
1.4. Course content		
Basic concepts, classifications, and development of machine tools. Overview and characteristics of fundamental structural elements of machine tools. Static and dynamic rigidity of the machine. Drives for main and auxiliary motions. Position measurement systems on the machine. Overview of control systems on machine tools. Basics of NC machine programming. Technical and technological characteristics of the following types of machines: lathes, milling machines, drilling machines, planing machines, grinding machines, cutting, threading, and gear cutting machines. Machining centers. Flexible manufacturing cells and production systems. Modular machining systems and transfer lines. Trends in the development of machine tools and accompanying equipment. Basics of cutting tool geometry. Materials for cutting tools and devices. Basic principles of tool and workpiece clamping. Classification and construction of fixtures.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises	☑ individual assignments ☐ multimedia and network ☑ laboratories

	☐ long distance education ☑ fieldwork	☐ mentorship ☐ other _____

1.6. Student's obligations

Class attendance and activity, homework and independent learning.

1.7. Evaluation of student's work

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

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

Class attendance and activity, homework, continuous knowledge assessment, and written and/or oral examination.

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

Title	*Number of copies*	*Number of students*
Hriešik, A., Jurković, Z.: Proizvodna oprema – I dio, ISBN: 953-6326-19-1, Rijeka, 2003.	1	40
Tadić, B., Vukelić, Đ., Jurković, Z.: Alati i pribori, ISBN: 978-86-6335-000-7, Fakultet inženjerskih nauka u Kragujevcu, Kragujevac, 2013.	12	40
Grizelj, B.: Alati i naprave, ISBN: 953-6048-26-4, Strojarski fakultet u Sl. Brodu, 2004.	2	40
Cebalo, R.: Alatni strojevi, ISBN: 953-96501-0-0, Zagreb, 2000.	1	40

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

Cebalo, R.: Obradni sustavi, ISBN: 953-96501-4-3, Zagreb, 2000.
Pahole, I., Balič, J.: Obdelovalni stroji, ISBN: 86-453-0522-6, Fakulteta za strojništvo, Maribor, 2003.
Kopač, J.: Obdelovalni stroji- 1.zvezek, ISBN: 961-6238-32-9, Fakulteta za strojništvo, Ljubljana, 2001.

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

Through the Institution's quality assurance system.

GENERAL INFORMATION		
Teacher	Assist. Prof. Dr. Sc. Ivan Volarić	
Course title	**Signals and Systems**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	2nd/3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	45+15+0

COURSE DESCRIPTION		
1.1. Course objectives		
Understanding time and frequency analysis and processing methods of continuous and discrete-time signals, as well as basic input-output relationships of linear time-invariant (LTI) systems. Development of analysis, synthesis, and problem solving skills.		
1.2. Course enrolment requirements		
Mathematics 3		
1.3. Expected course learning outcomes		
Define both elementary signals and basic system properties. Define the response of LTI systems, convolution integral and sum. Use the convolution for the time-domain analysis of LTI systems. Define Fourier series and Fourier transform. Use different Fourier representations in spectral analysis of signals. Define the frequency response of LTI systems. Study LTI systems in the frequency domain. Describe signal sampling and reconstruction procedures.		
1.4. Course content		
Signals and systems; classification, elementary signals, signal models, operations on signals, system properties. Continuous and discrete LTI systems; zero-input response, zero-state response, convolution of signals, properties of LTI systems. Fourier series; line spectrum, systems with periodic inputs. Fourier transform; signal energy, system frequency response, ideal filters. Signal sampling; aliasing, reconstruction filter. Discrete Fourier Transform (DFT); signal spectral analysis		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education ☐ fieldwork	☐ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other _____

1.6. Student's obligations

Course attendance, project work, individual studying.

1.7. Evaluation of student's work

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

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

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

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

Title	*Number of copies*	*Number of students*
B. P. Lathi: Linear Systems and Signals, 2/E, Oxford University Press, 2004.	3	40

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

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

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

Through the Institution's quality assurance system.

GENERAL INFORMATION		
Teacher	Assoc. Prof. Dr. Sc. Goran Mauša	
Course title	**Introduction to Object-Oriented Programming**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	2nd/3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

COURSE DESCRIPTION		
1.1. Course objectives		
Basic knowledge and skills for object oriented programming.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Explain the basic principles of the object-oriented paradigm. Correctly interpret the concepts of class, object and interface. Apply exception handling mechanism. Correctly apply the concepts of abstraction, data encapsulation, inheritance and polymorphism for software development. Use object-oriented programming language and associated libraries for program development. Document the implemented software solution. Test the behavior of the built program and remove the observed errors. Apply the object-oriented design principles for the software solution. Demonstrate the use of an integrated development framework for the development of an object-oriented software solution.		
1.4. Course content		
Object oriented programming using Java. Basic principles of object oriented programming, class and object, access control, inheritance and polymorphism, abstraction and interfaces, exceptions, input-output data streams, testing, memory, documentation.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education ☐ fieldwork	☑ individual assignments ☐ multimedia and network ☑ laboratories ☐ mentorship ☐ other _____
1.6. Student's obligations		

Course attendance, activity, studying, exercising.							
1.7. Evaluation of student's work							
Course attendance	2	Activity/Participation		Seminar paper		Experimental work	
Written exam	1,5	Oral exam		Essay		Research	
Project		Sustained knowledge check	2,5	Report		Practice	
Portfolio		Homework		Final exam			
1.8. Procedure and examples of learning outcome assessment in class and at the final exam							
Course attendance, continuous knowledge testing, written exam.							
1.9. Assigned reading (at the time of the submission of study programme proposal)							

Title	*Number of copies*	*Number of students*
Java Tutorial, dostupno na http://docs.oracle.com/javase/tutorial/index.html	web (free)	40
Java dokumentacija, dostupno na https://docs.oracle.com/javase/8/	web (free)	40

1.10. Optional / additional reading (at the time of proposing study programme)
Marko Čupić, Programiranje u Javi, FER, 2015 G. Booch, J. Rumbaugh, I. Jacobson, The Unified Modeling Language User Guide, Addison -Wesley, 1998.
1.11. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences
Through the Institution's quality assurance system.

Elective course - group B-W (winter semester)

LIST OF COURSES						
Year of study: 3rd year of the University Undergraduate Study in Mechatronics and Robotics						
Semester: 5th (winter)						
COURSE	INSTRUCTOR	L	E	S	ECTS	STATUS
Database Systems	Assoc. Prof. Dr. Sc. Sandi Ljubić	30	30	0	6	E
Designing and Product Shaping	Prof. Dr. Sc. Robert Basan / Assoc. Prof. Dr. Sc. Tea Marohnić	30	30	0	4	E
Machine Elements Design 2	Assoc. Prof. Dr. Sc. Željko Vrcan / Prof. Dr. Sc. Marina Franulović	45	45	0	7	E
Fluid Mechanics	Prof. Dr. Sc. Lado Kranjčević	45	30	0	5	E
Measurement and Quality Control	Prof. Dr. Sc. Duško Pavletić	30	15	0	5	E
Ship Equipment	Prof. Dr. Sc. Tin Matulja	45	15	0	6	E
Computer-Aided Measurements	Prof. Dr. Sc. Saša Vlahinić	30	30	0	6	E
Web Application Development	Assist. Prof. Dr. Sc. Marko Gulić	30	30	0	6	E
Technological Processes	Prof. Dr. Sc. Mladen Perinić	30	30	0	4	E
Thermodynamics	Prof. Dr. Sc. Anica Trp	45	30	0	7	E
Introduction to Marine Vessels	Prof. Dr. Sc. Marko Hadjina	30	30	0	5	E

COURSE DESCRIPTION

GENERAL INFORMATION		
Teacher	Assoc. Prof. Dr. Sc. Sandi Ljubić	
Course title	**Database Systems**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

COURSE DESCRIPTION		
1.1. Course objectives		
Understanding database management systems. Database design. Defining relational databases and handling data. Enforcing data integrity and data protection. Using software tools for designing and building databases, and for data management.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Describe the basic concepts of data and information. Describe the database management system. Describe the concept of relational, network and hierarchical databases. Design an entity-relationship model. Design a relational model. Determine functional dependencies. Apply the normalization procedure. Apply Structured Query Language (SQL). Implement a physical and application model. Analyze the database integrity enforcement.		
1.4. Course content		
Basic concepts of database and database management systems. Data models. Relational algebra and relational model. Logical design of databases. Entity-relationship model. Transforming entity-relationship model into relations. Functional dependencies and normalization. Structured Query Language (SQL). Data integrity and security. Transactions.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education ☐ fieldwork	☑ individual assignments ☐ multimedia and network ☑ laboratories ☐ mentorship ☐ other _____

1.6. Student's obligations

Class attendance, attending tests, solving tasks independently

1.7. Evaluation of student's work

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

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

Tests, laboratory exercises, written exam

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

Title	*Number of copies*	*Number of students*
Thomas M. Connolly, Carolyn E. Begg: Database Systems – A Practical Approach to Design, Implementation and Management (6th Edition), Pearson Education, 2015.	1	40
Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom: Database Systems – The Complete Book (2nd Edition), Pearson Education, 2009.	1	40

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

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

Through the Institution's quality assurance system.

GENERAL INFORMATION		
Teacher	Prof. Dr. Sc. Robert Basan / Assoc. Prof. Dr. Sc. Tea Marohnić	
Course title	**Designing and Product Shaping**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	4
	Number of hours (L+E+S)	30+30+0

COURSE DESCRIPTION		
1.1. Course objectives		
Training for the correct design and shaping of technical products considering manufacturing and processing technology, maintenance, environmental protection, ergonomics, safety, maintenance, and costs.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Define functional and technologically correct design. List and explain groups of guidelines for proper design of technical products. Identify and explain technological correctness or incorrectness of products using examples. Compare different manufacturing technologies regarding their advantages and disadvantages. Solve a design task using appropriate methods and computer software.		
1.4. Course content		
Correct design considering standards and tolerances. Material selection. Proper design considering manufacturing and processing technology. Correct design of castings, forgings, and welded constructions. Correct design of parts processed by particle separation. Correct design of sheet metal parts. Correct design of polymer parts. Proper design for 3D printing technology. Correct design for assembly. Correct design for transportation and storage. Ergonomically correct design. Correct design considering recycling and environmental protection, corrosion, safety, noise protection, and maintenance. Correct design considering costs.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education ☑ fieldwork	☑ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other _____

1.6. Student's obligations
Course attendance, activity, solving of program assignments, studying.
1.7. Evaluation of student's work

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

1.8. Procedure and examples of learning outcome assessment in class and at the final exam
Course attendance, mid-term exams, program assignments, final written exam.
1.9. Assigned reading (at the time of the submission of study programme proposal)

Title	*Number of copies*	*Number of students*
Lecture notes.		40
Križan, B.: Osnove proračuna i oblikovanja konstrukcijskih elemenata, Školska knjiga, Zagreb, 2008.	10	40

1.10. Optional / additional reading (at the time of proposing study programme)
Bode, E.: Konstruktionsatlas, Vieweg, Braunschweig/Wiesbaden, 1996.
1.11. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences
Through the Institution's quality assurance system.

GENERAL INFORMATION		
Teacher	Assoc. Prof. Dr. Sc. Željko Vrcan / Prof. Dr. Sc. Marina Franulović	
Course title	**Machine Elements Design 2**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	7
	Number of hours (L+E+S)	45+45+0

COURSE DESCRIPTION		
1.1. Course objectives		
To develop a capability to calculate, design and apply basic machine elements by means of traditional and computer aided techniques.		
1.2. Course enrolment requirements		
Attended course: Machine Elements Design 1		
1.3. Expected course learning outcomes		
Describe couplings. Analyze the operation of a friction clutch. Compare couplings. Describe lubricants. Describe rolling and sliding bearings. Apply rolling bearings. Describe hydrostatic and hydrodynamic lubrication. Apply HS and HD lubrication calculations. Design a sliding bearing with HD lubrication. Compare bearings. Apply knowledge to actual engineering problems.		
1.4. Course content		
Basics of friction and belt drives, their operation and components. Couplings: types, design, dimensioning, application and selection. Compensation couplings. Elastic couplings. Safety couplings. Friction clutches and brakes. Hydrodynamic couplings. Basics of lubrication. Introduction to lubricants. Basics of gear transmission applications. Rolling bearings: types and durability calculation. Sliding bearings: types and load capacity. Design, dimensioning and optimisation of radial sliding bearing with hydrodynamic lubrication. Introduction to piping systems. Seals and sealing.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education ☐ fieldwork	☐ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other _____
1.6. Student's obligations		

Course attendance, activity during class, oral examinations, mid-term examinations, coursework, individual study.

1.7. Evaluation of student's work

Course attendance	3	Activity/Participation		Seminar paper		Experimental work	
Written exam	1	Oral exam		Essay		Research	
Project	2,5	Sustained knowledge check	0,5	Report		Practice	
Portfolio		Program assignments		Final exam			

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

Course attendance. Verification of individual study by mid-term examinations. Continuous monitoring of accuracy, precision, completeness and creativity of coursework assignments. Oral and/or written final examination.

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

Title	*Number of copies*	*Number of students*
Obsieger, B.: Spojke, Tehnički fakultet Rijeka, 2012	75	40
Obsieger, B.: Valjni ležajevi, Tehnički fakultet Rijeka, 2012.	75	40
Krautov strojarski priručnik, Sajema, Zagreb, 2009.	15 (ed. 2009); 9 (ed. 1997)	40
Obsieger, B., Remenski prijenos, Rijeka, 2012.	75	40
Obsieger, B., Prijenosi sa zupčanicima, Tehnički fakultet Rijeka, 2012.	75	40

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

Obsieger, B.: Proračun radijalnog kliznog ležaja, e-skripta
Flender Technical Handbook, Flender, pdf (internet)
Decker, K.-H., Elementi strojeva, Golden marketing-Tehnička knjiga, Zagreb, 2006.

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

Through the Institution's quality assurance system.

GENERAL INFORMATION		
Teacher	Prof. Dr. Sc. Lado Kranjčević	
Course title	**Fluid Mechanics**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	45+30+0

COURSE DESCRIPTION		
1.1. Course objectives		
Understanding the physical meaning of laws and equations of fluid mechanics and developing students' abilities to solve problems related to the field of fluid mechanics and the development of independent work and projects related to various problems involving fluid mechanics.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Define and describe fluid properties. Define and describe fluid statics: Euler equation of fluid statics, relative fluid movement, stability, fluid pressure on flat and curved surfaces, buoyancy. Define and describe the basic laws of fluid dynamics: Conservation of Mass - The Continuity Equation, The Linear Momentum and Moment of Momentum Equations with the Bernoulli equation, The Energy Equation with the modified Bernoulli equation. Define and describe laminar and turbulent viscous fluid flow. Apply the basic laws of fluid mechanics to calculate the physical values of the fluid flow, orifice flow, flow through the wide openings, Venturi meter and Pitot-Prandtl tube. Calculate fluid flow losses through a complex pipeline system.		
1.4. Course content		
Introduction to Fluid Mechanics. Basic physical values. Fluid properties. Fluid statics. Euler equation of fluid statics with solutions. Pressure measurement devices. Relative fluid motion. Stability. Fluid forces on flat and curved surfaces. Buoyancy. Fluid kinematics. Velocity and acceleration. Circular motion and discharge. Fluid dynamics. Basic laws of fluid dynamics. Conservation of Mass - The Continuity Equation, The Linear Momentum and Moment of Momentum Equations with the Bernoulli equation, The Energy Equation with the modified Bernoulli equation. Euler equation of motion. Application of the Bernoulli equation: orifices, weirs, Pitot tube, Venturi meter. Viscosity and viscosity measurement. Relation between the laminar and turbulent flow. Dimensional analysis. Real fluid flow. Pipe flow losses. Cavitation. Flow around bodies. Introduction to free surface flow. Introduction to compressible flow.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises	☑ individual assignments ☐ multimedia and network

	☐ long distance education ☐ fieldwork	☐ laboratories ☐ mentorship ☐ other _____

1.6. Student's obligations

Course attendance, activity, homework, studying.

1.7. 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		Program assignments		Final exam			

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

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

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

Title	*Number of copies*	*Number of students*
L. Sopta, L. Kranjčević, Mehanika fluida, skripta. Tehnički fakultet Rijeka, 2004.	web	40
Bruce R. Munson, D. F. Young, T. H. Okiishi, Fundamentals of Fluid Mechanics, 4th Updated Edition, John Wiley and Sons, 2003.	1	40
Streeter, V.L, Wylie E.B., Fluid mechanics, 8th edition, McGraw Hill, 1985.	1	40

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

Kakac, S., Liu, H.: Heat exchangers, CRC Press, Florida, 2002.
Kays, W.M., London, A.L.: Compact heat exchangers, McGraw-Hill Book Co., NY,1984.

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

Through the Institution's quality assurance system.

GENERAL INFORMATION		
Teacher	Prof. Dr. Sc. Duško Pavletić	
Course title	**Measurement and Quality Control**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	30+15+0

COURSE DESCRIPTION		
1.1. Course objectives		
Understanding the basis of measurements and quality control. The acquisition of specific skills in methods and techniques of metrology and control. Understanding trends in the development of measurement in production and science.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Interpret basic metrological concepts. Conduct basic measurements in the field of industrial metrology. Error sources in dimensional measurements and calculation uncertainty of measurement results. Analyze, compare and validate the test results. Explain the basic principles of optical measurement techniques and 3D measurement systems. Explain the basic concepts of quality control.		
1.4. Course content		
Development and application of measurement. International System of Units. Base, derived and Non-SI units accepted for use with SI. Anglo-Saxon system of units. Fundamentals of metrology, measuring procedures, measurement error and uncertainty. Measurements and measurement equipment: length, shape, position, displacement, pressure, temperature, force, hardness, roughness, flow, speed, sound and basic electromagnetic quantities. Sensors in process/product control. Optical and opto-electronic measuring devices. 3D contact and non-contact coordinate measuring machines and devices. Testing, verification and calibration of measuring means. Quality control. Planning and documenting measurement. Evaluating measurement results. Quality assessments of products and processes.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education ☐ fieldwork	☑ individual assignments ☐ multimedia and network ☑ laboratories ☐ mentorship ☐ other _____

1.6. Student's obligations

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

1.7. 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	3	Report		Practice	
Portfolio		Program assignments		Final exam			

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

Laboratory exercises, sustained knowledge check and final written exam.

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

Title	*Number of copies*	*Number of students*

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

Zaimović Uzunović, N. Mjerna tehnika, Mašinski fakultet u Zenici, Zenica, 2006.
Jay L. Bucher: The Metrology Handbook, ASQ Quality Press, 2004.
Graham T. Smith: Industrial Metrology, Springer, 2002.
Bašić, H.: Mjerenja u mašinstvu, Mašinski fakultet, Sarajevo, 2008.

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

Through the Institution's quality assurance system.

GENERAL INFORMATION		
Teacher	Prof. Dr. Sc. Tin Matulja	
Course title	**Ship Equipment**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	3rd	
ECTS credits and teaching	ECTS student ‘s workload coefficient	6
	Number of hours (L+E+S)	45+15+0

COURSE DESCRIPTION		
1.1. Course objectives		
In this course students receive a basic knowledge of the ship's equipment , elements and outfitting systems related to defined learning outcomes.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Apply technical requirements, conventions, regulations and standards. Define and describe the equipment for anchoring, mooring and towing. Describe and distinguish between the rudder and steering gear. Describe and specify equipment for safety. Describe and specify the equipment to move, place and protect cargo. Describe and differentiate the hatches, hatches, covers, skylights, doors, windows and panes. Describe the equipment to move the crew and passengers. Distinguish gear wheel, navigation and communication, navigation lights and signaling devices. Deploy troops and equipment to describe the systems to protect troops. Describe and display elements and the performance of heating, ventilation and air conditioning. Describe and display elements and the performance of heating, ventilation and air conditioning. Describe and show ways of insulation and covering floors, walls and ceilings.		
1.4. Course content		
Technical requirements, conventions, regulations, standards. Equipment troops. Restraints troops. Equipment for cargo. Hatches and lids. Cargo doors. Equipment and devices for moving cargo. Special equipment to move the cargo. Equipment for stitching and protecting cargo. Containers for cargo. Ventilation, insulation and cladding warehouses. Rescue equipment and safety. Funding for rescue. Equipment for fire protection. Equipment accommodation and special rooms. Isolation quarters. Partitions, doors, windows, windows and skylights. Deck coverings, walls and ceilings. Railings, bridges, ladders. Staircases, platforms, flooring, elevators. Furniture and other equipment. Tools and equipment for maintenance of working conditions on board. Arrangements for the stability of the ship. Equipment for steering, navigation and communication. Lights and signaling devices. Equipment for anchoring, mooring and towing. Equipment for the operation of the machines. Special equipment.		
1.5. Teaching methods	☑ lectures	☑ individual assignments

	☐ seminars and workshops ☑ exercises ☐ long distance education ☑ fieldwork	☐ multimedia and network ☑ laboratories ☐ mentorship ☐ other _____

1.6. Student's obligations

Course attendance, activity, homework, studying

1.7. 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	2	Report		Practice	
Portfolio		Program assignments		Final exam			

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

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

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

Title	*Number of copies*	*Number of students*
Matulja, T.: Nastavni materijal objavljen na e-kolegiju Oprema broda, 2017.	2	40
Buxton, I. L.: Cargo Access Equipment for Merchant Ships, MacGregor Publications Ltd., 2014.	2	40
House, D.J.: Cargo Work, Elsevier Butterworth-Heinemann, Oxford, 2005.	2	40
House, D.J.: Seamanship Techniques, Elsevier, 2005.	2	40

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

Bosnić, A., Vukičević, M., Oprema broda, Fakultet strojarstva i brodogradnje, Zagreb, 1983.
Ozretić V., Brodski pomoćni strojevi i uređaji, Liburnija, Rijeka, 1996.
Cowley, J., Fire Safety at Sea, MEP Series, Volume 1, Part 5. IMAREST, London, 2004.
Boisson, P., Safety at Sea, BV Paris, 1999.

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

Through the Institution's quality assurance system.

GENERAL INFORMATION		
Teacher	Assist. Prof. Dr. Sc. Marko Gulić	
Course title	**Web Application Development**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

COURSE DESCRIPTION		
1.1. Course objectives		
This course prepares students to work in the area of web application development by teaching them basics of web systems design and implementation. It is expected to provide practical skills for development of dynamic and interactive web applications by introducing contemporary technologies, platforms, programming languages, and related development tools.		
1.2. Course enrolment requirements		
There are no formal prerequisites for course enrollment, but basic programming skills are expected.		
1.3. Expected course learning outcomes		
Upon a completion of the course, students will be able to: describe the basic principles of distributed systems and web-based protocols; explain the characteristics of the application models based on client-server paradigm; analyze the possibilities of different approaches to web application development; apply contemporary technologies for developing web system frontend and backend; develop dynamic web applications based on data resources.		
1.4. Course content		
The basic principles for building distributed, dynamic, and interactive information services for content management. Main concepts of web programming. Design and implementation of web application frontend (HTML, CSS, JavaScript) and backend. Practical examples of dynamic web application development with the use of contemporary technologies. Web services (REST).		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education ☐ fieldwork	☑ individual assignments ☐ multimedia and network ☑ laboratories ☐ mentorship ☐ other _____

1.6. Student's obligations							
Class attendance, participation in the student project team (group project assignment).							
1.7. Evaluation of student's work							
Course attendance	1	Activity/Participation		Seminar paper		Experimental work	
Written exam	2	Oral exam		Essay		Research	
Project	2	Sustained knowledge check	2	Report		Practice	
Portfolio		Program assignments		Final exam			

1.8. Procedure and examples of learning outcome assessment in class and at the final exam		
Class attendance, midterm exams (continuous knowledge examination)		
1.9. Assigned reading (at the time of the submission of study programme proposal)		
Title	*Number of copies*	*Number of students*
John Dean (2018.), Web Programming with HTML5, CSS, and JavaScript, Jones & Bartlett Learning		40
Daniel Correa, Paola Vallejo (2022.), Practical Laravel: Develop clean MVC web applications, Independently		40
Michael Mikowski, Josh Powell (2013.), Single Page Web Applications, Manning Publications		40
1.10. Optional / additional reading (at the time of proposing study programme)		
David Flanagan (2020.), JavaScript: The Definitive Guide, O'Reilly Media		
1.11. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences		
Through the Institution's quality assurance system.		

GENERAL INFORMATION		
Teacher	Prof. Dr. Sc. Saša Vlahinić	
Course title	**Computer-Aided Measurements**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

COURSE DESCRIPTION		
1.1. Course objectives		
Computer Aided Measurements enable students to understand advantages and possibilities of electronic measurement instruments, to independently analyze measurement problems and to realize virtual instrumentation.		
1.2. Course enrolment requirements		
Electrical Engineering		
1.3. Expected course learning outcomes		
After passing the exam, student is able to do following: 1. Interpret and explain measurement uncertainty 2. Apply the model of measurement uncertainty at simple examples 3. Describe the working principles of measurement amplifiers 4. Describe how noise and interference influence measurement results and methods how to reduce them 5. Describe transfer function of A/D and D/A converters 6. Describe working principles of different types of A/D converters 7. Select the appropriate type of A/D converter for different measurement problems 8. Describe the working principles of user interfaces 9. Implement virtual instrument 10. Analyze characteristics of automated instrumentation		
1.4. Course content		
Introduction to measurement science. The international system of units. Measurement errors. Measurement uncertainty. Noise and interference. Measurement amplifiers. Analog-digital converters. Digital-analog converters. Oscilloscopes. Automated measurements. Microprocessors and microcontrollers in computerized instrumentation. Examples of computer aided measurements: 3D multisensor coordinate measuring machines and systems for 3D scanning-digitization-measurements. Communication with measurement equipment. Basic configurations of computerized measurement systems. Virtual instrumentation. Software for development of measurement applications.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops	☑ individual assignments

	☑ exercises ☐ long distance education ☐ fieldwork	☐ multimedia and network ☑ laboratories ☐ mentorship ☐ other _____

1.6. Student's obligations

Course and laboratory practice attendance, seminar paper, activity during course lectures, studying.

1.7. Evaluation of student's work

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

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

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

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

Title	*Number of copies*	*Number of students*
Vujević, D., Ferković, B.: Osnove elektrotehničkih mjerenja, 1. i 2. dio, Školska knjiga, Zagreb, 1996.	8	40

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

Šantić, A.: Elektronička instrumentacija, 3. izdanje, Školska knjiga, Zagreb, 1993.
Coombs, C.F.Jr.: Electronic Instrument Handbook, McGraw-Hill, 2nd Edition, 1999.

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

Through the Institution's quality assurance system.

GENERAL INFORMATION		
Teacher	Prof. Dr. Sc. Mladen Perinić	
Course title	**Technological Processes**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	4
	Number of hours (L+E+S)	30+30+0

COURSE DESCRIPTION		
1.1. Course objectives		
Introduction to fundamental concepts in the production area. Knowing the features of the process and the impact on the setting process. Positive effects of simultaneous engineering. Introduction to the elements defining and managing processes and procedures rationalization and optimization processes.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Define the basic concepts in the area of production (manufacturing process, technological process, technology, technology legality, technological discipline, machining system, production system, machining cycle, production cycle). Define the features of process and interpret their impact on the settings of process. Define the types of production and interpret the influence of the type and mode of the technological process and its settings. Explain the impact of the performance of the product in the process - techno logicality. Analysis of product parts techno logicality's elements.		
1.4. Course content		
Introduction. The manufacturing process and technological process, technological chains. Machining cycle and production cycle. Machining system. Production system - the basic models. Other basic concepts. Optimal technological process. Reliability processes. Definition of technological process. Influence of production type and ways of keeping production in the setting process. Impact performance in the process - techno logicality. Technological analysis of products and parts. Simultaneous engineering. Operation. The impact on the structure of the process. Preparation and clearing job. Stages of development processes, technological documentation. The parameters of the process. Optimisation of process parameters - the impact of job characteristics. Categories of time in defining operation. The choice of input materials - variant processes. Technological bases. Production equipment. Operating funds. Roles of special tools - economic justification for the application. Group technology - the impact of the rationalization of production and preparatory activities.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises	☑ individual assignments ☐ multimedia and network

	☐ long distance education ☐ fieldwork	☐ laboratories ☐ mentorship ☐ other _____

1.6. Student's obligations

Course attendance, class participation, homework, self-learning.

1.7. Evaluation of student's work

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

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

Attendance and activity on teaching, homework, continuous knowledge check and written and/or oral exam.

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

Title	*Number of copies*	*Number of students*
Gačnik, V., Vodenik, F.: Projektiranje tehnoloških procesa. Zagreb 1990	4	40
Curis, M.A.: Process planning. New York, 1988.	1	40
Jurković, M., Tufekčić, D.: Tehnološki procesi, projektiranje i modeliranje, 2000.	3	40

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

Mueller, G.: Gleichungen für Technologen. Veb Verlag Technik. 1988.

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

Through the Institution's quality assurance system.

GENERAL INFORMATION		
Teacher	Prof. Dr. Sc. Anica Trp	
Course title	**Thermodynamics**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	7
	Number of hours (L+E+S)	45+30+0

COURSE DESCRIPTION
1.1. Course objectives
Obtaining theoretical knowledge and developing skills to solve practical problems in the field of thermodynamics. Acquiring the knowledge required for attending lectures in the field of thermal and energy engineering.
1.2. Course enrolment requirements
Attended courses Mathematics 1 and Mathematics 2
1.3. Expected course learning outcomes
Define and describe the first and second laws of thermodynamics as well as the concept of thermal conditions. Define and describe the equation of state of an ideal gas and gas mixtures and describe the ideal gas state changes. Describe and compare the thermal cycles, compare and analyze the reversible and irreversible processes and define work losses due to the irreversibility. Describe and compare the processes of internal combustion engines. Describe state changes during evaporation and condensation and describe, compare and analyze processes of steam plants. Describe and analyze the thermal behavior during combustion. Describe and analyze the exchange of energy in the flow through the nozzle. Define, describe and compare basic types of heat transfer and describe the heat transfer within the heat exchanger. Describe and analyze the humid air changes of state. Apply acquired knowledge to solve thermodynamic tasks (practical problems).
1.4. Course content
Thermal state and thermal equilibrium postulates. The first law of thermodynamics. Ideal gas equation of state. Work and pV-diagram. Specific heat capacity. Gas mixtures. Ideal gas state changes. Thermodynamic cycles. Carnot cycle. Reversible and irreversible processes. Irreversibility and work. Entropy and irreversibility. The second law of thermodynamics. Technical work. Maximum work. Damping. Enthalpy. Mixing of gasses. Mixing of gasses irreversibility. Losses due to irreversibility. Processes of internal combustion engines. Evaporation and condensation. The heat exchange during evaporation. State changes of saturated steam. Superheated steam. Processes of steam plants. Mollier hs-diagram. Exergy. Combustion. Thermal phenomena during combustion. Energy exchange in the flow. De Laval nozzle. Fundamentals of heat transfer. Heat conduction. Heat transfer by convection. Heat transfer by radiation. Overall heat transfer coefficient. Heat exchangers. Humid air. Mollier hx-diagram. Humid air changes of state.

1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education ☐ fieldwork	☑ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other _____

1.6. Student's obligations

Course attendance, activity, homework, studying.

1.7. Evaluation of student's work

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

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

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

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

Title	*Number of copies*	*Number of students*
Bošnjaković, F.: Nauka o toplini, svezak 1., 2. i 3. (pretisak izdanja iz 1978., 1976. i 1986.), Graphis d.o.o., Zagreb, 2012.	38	40
Halasz, B, Galović, A., Tadić, M.: Zbirke zadataka iz Nauke o toplini, 1 dio, 2 dio, Sveučilišna tiskara, Zagreb, 1993. i 1996.	19	40

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

Galović, A.: Termodinamika I, (knjiga), Fakultet strojarstva i brodogradnje, Zagreb, 2007.
Galović, A.: Termodinamika 2, (knjiga), Fakultet strojarstva i brodogradnje, Zagreb, 2007.

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

Through the Institution's quality assurance system.

GENERAL INFORMATION		
Teacher	Prof. Dr. Sc. Marko Hadjina	
Course title	**Introduction to Marine Vessels**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	30+30+0

COURSE DESCRIPTION		
1.1. Course objectives		
Within this course students learn a basic knowledge about characteristics and systematization of vessels in accordance with course defined learning outcomes.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Use basic terminology and professional terms regarding vessels. Explain and interpret the basic characteristics and specifications of vessels. Describe and present parts of the ship hull, superstructure and ship equipment. Define basic types, dimensions and characteristics of the hip hull form. Distinguish and present the main elements of the ship hull structure. Explain and interpret the fundamentals of statics and dynamics of vessels. Explain and distinguish elements and configurations of ship main engine and propulsion. Systematize and classify vessels according to their purpose, type of cargo, type of main engine, type of propulsion, hull construction method, size, area of navigation and materials for the construction of the hull. Use IMO conventions, classification rules, guidelines, regulations and standards. Basic use of shipbuilding software.		
1.4. Course content		
Marine vessels development. Vessels, definitions. Basic characteristics of vessels. Selection and specification of the ship. Vessel types regarding its structural characteristics. Hull, superstructure, equipment. General plan of the ship. Hull form and dimensions. Ship structure. Characteristics, terms and professional terminology. Ship basic stability and dynamics. Exploitation functionality of vessels. Ship main engine and propulsion. Systematization of vessels according to: purpose, main engine type, method of hull construction, size, area of navigation, hull construction material, type of operation, type of propulsion. Basics of ship design and construction procedure. Classification. Conventions, rules, guidelines and recommendations. Regulations and standards. Software.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises	☐ individual assignments ☐ multimedia and network ☑ laboratories

	☐ long distance education ☐ fieldwork	☐ mentorship ☐ other _____

1.6. Student's obligations

Course attendance, activity, sustained knowledge check, studying.

1.7. Evaluation of student's work

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

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

Course attendance, activity, sustained knowledge check (two mid-term exams), written and oral exam or their combination.

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

Title	*Number of copies*	*Number of students*
Nastavni materijal nastavnika: „Uvod u plovne objekte“		40
Furlan, Z. i dr.: Osnove brodogradnje, Školska knjiga, Zagreb, 1989.	3	40
Klaas van Dokkum : Ship Knowledge: Ship Design, Construction, DOKMAR, Netherland, 2011	10	40

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

Rhinoceros 4 Nurbs modeling for Windows, Manual Level 1, Robert McNee
Tupper, E.: Introduction to Naval Architecture, Butterworth-Heinemenn, Oxford, 2013
Reeds Vol 5:Ship Construction for Marine Engineers 2016
D.J.Eyres: Ship Construction, 2012.

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

Through the Institution's quality assurance system.

Elective courses A-S (summer semester)

LIST OF COURSES						
Year of study: 2nd and 3rd year of the University Undergraduate Study in Mechatronics and Robotics						
Semester: 4th and 6th (summer)						
COURSE	INSTRUCTOR	L	E	S	ECTS	STATUS
Automatic Control	Prof. Dr. Sc. Dario Matika	45	30	0	7	I
Electrical Drives	Prof. Dr. Sc. Neven Bulić	30	30	0	5	I
Energy Systems	Assoc. Prof. Dr. Sc. Vladimir Glažar / Assoc. Prof. Dr. Sc. Igor Bonefačić	30	30	0	4	I
Engineering Statistics	Assoc. Prof. Dr. Sc. Loredana Simčić / Assoc. Prof. Dr. Sc. Ivan Dražić	30	30	0	5	I
Programming 2	Prof. Dr. Sc. Ivo Ipšić	45	30	0	7	I
Computer Simulations in Engineering	Prof. Dr. Sc. Siniša Družeta	15	30	0	6	I
Embedded Systems	Assist. Prof. Dr. Sc. Ivan Volarić	45	30	0	7	I
Introduction to Artificial Intelligence	Prof. Dr. Sc. Ivan Štajduhar	30	30	0	5	I

COURSE DESCRIPTION

GENERAL INFORMATION		
Teacher	Prof. Dr. Sc. Dario Matika	
Course title	**Automatic Control**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	2nd/3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	7
	Number of hours (L+E+S)	45+30+0

COURSE DESCRIPTION		
1.1. Course objectives		
The aim of the subject is adopting theoretical and simulation knowledge from the automation field. Training students to simulate individually in Matlab with application of different control methods. Developing skills of individual and group work and results presentation.		
1.2. Course enrolment requirements		
Fundamentals of Automatic Control.		
1.3. Expected course learning outcomes		
Define basic terms and definitions in the automation control field. Describe basic control structures and characteristics. Analyze linear control systems in time and frequency domain. Analyze stability of linear control systems. Apply PID regulator and other regulators developed from the PID regulator. Compare time and frequency domain graph-analytical and analytical control system design methods. Apply cascade control. Synthesize linear control systems in state space. Analyze controllability and observability of linear control systems.		
1.4. Course content		
Basic terms and definitions. Basic control structures and characteristics. Analysis of linear control systems in time and frequency domain. Stability of linear control systems. PID regulator and other regulators developed from the PID regulator. Time and frequency domain conventional and modern control system design: graph analytical and analytical methods, cascade control - technical and symmetrical optimum, state space synthesis of linear control systems. Controllability and observability of linear control systems.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education ☐ fieldwork	☑ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other _____

1.6. Student's obligations

Course attendance, activity, simulation exercises, studying.

1.7. 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	
Portfolio		Simulation exercises	1,5	Final exam			

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

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

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

Title	*Number of copies*	*Number of students*
N. Perić: Automatsko upravljanje, Fakultet elektrotehnike i računarstva, Zagreb, 2001.	0 (internet)	40

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

D. Matika, D. Brnobić: Osnove regulacijske tehnike, Tehnički fakultet Rijeka, 2004.
Z. Vukić, Lj. Kuljača: Automatsko upravljanje - analiza linearnih sustava, Kingen, d.o.o., Zagreb, 2005.
J. D'Azzo, C. Houpis, S. Sheldon: Linear Control System Analysis and Design with Matlab: Fifth Edition, Marcel Dekker, Inc., New York, 2003.

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

Through the Institution's quality assurance system.

GENERAL INFORMATION		
Teacher	Prof. Dr. Sc. Neven Bulić	
Course title	**Electrical Drives**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	2nd/3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	30+30+0

COURSE DESCRIPTION		
1.1. Course objectives		
Understanding the principles of operation and requirements placed on electric motor drives. Specificities of individual types of machines within electric motor drives. Knowledge of components of electric motor drives. Overall criteria for selecting suitability: price, procurement, and maintenance, usability and motor control complexity, and associated components.		
1.2. Course enrolment requirements		
Fundamentals of Automatic Control.		
1.3. Expected course learning outcomes		
Describe the physical image of the electric motor drive, Define the general characteristics of individual types of electric machines and working mechanisms, Define the static characteristics of standard electric motor drives, Compare the features of different electric machines in specific electric motor drives, Compare the advantages and disadvantages of different control methods in specific types of electric motor drives. Justify the choice of a specific electric machine in accordance with the client's requirements.		
1.4. Course content		
Basic concepts. Fundamentals of mechanics of rotating machines. Torque characteristics of working mechanisms. Direct current machines with series and separately excited as parts of electric motor drives. Methods of speed control of electric motor drives with separately and series excited DC machines. Dynamic states of separately excited DC machines. Asynchronous machines: structure, static characteristics, classical control methods. Scalar control of asynchronous machines using V/f method. Frequency converters and methods of generating variable frequency and voltage. Synchronous machines as motors and generators: characteristics, applications, and related issues. Converters for synchronous machines. Special types of electric machines. Energy losses in dynamic states of electric motor drives.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education	☑ individual assignments ☐ multimedia and network ☑ laboratories ☐ mentorship

	☐ fieldwork	☐ other _____

1.6. Student's obligations

Course attendance, activities in class, writing laboratory reports, studying

1.7. Evaluation of student's work

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

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

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

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

Title	*Number of copies*	*Number of students*
B. Jurković: Elektromotorni pogoni, Školska knjiga, Zagreb, 1986.	8	40
Ion Boldea, Syed A. Nasar Electric Drives Prentice Hall, 2006.	0	40

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

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

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

Through the Institution's quality assurance system.

GENERAL INFORMATION		
Teacher	Assoc. Prof. Dr. Sc. Vladimir Glažar / Assoc. Prof. Dr. Sc. Igor Bonefačić	
Course title	**Energy Systems**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	2nd/3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	4
	Number of hours (L+E+S)	30+30+0

COURSE DESCRIPTION		
1.1. Course objectives		
Acquisition of theoretical knowledge and develop the skills needed to solve technical problems in the design phase, construction and management of energy systems. Developing competencies for project management in the energy sector.		
1.2. Course enrolment requirements		
None		
1.3. Expected course learning outcomes		
1. Calculate energy and exergy losses in energy systems. 2. Analyze diagrams of state changes in energy processes. 3. Compare the energy losses and efficiency of energy systems. 4. Evaluate energy systems with a particular focus on sustainable energy systems. 5. Calculate the operating costs of energy systems. 6. Classify basic operating parameters and variables of energy systems. 7. Analyze the sources of pollution in energy systems.		
1.4. Course content		
Thermodynamic fundamental of energy systems. Main characteristics of heat energy. Main characteristics of electrical energy. Efficiency of energy processes. Energy conversion efficiency. Energy systems with the steam process (Clausius – Rankine). Influencing factors on efficiency of steam energy systems. Processes in nuclear power plants. Main parts of nuclear power plant. Types of nuclear power plants. Comparison of nuclear and conventional power plant. Energy systems with gas-turbine process (Joule - Brayton). Efficiency of Joule-Brayton's process. Efficiency improving of gas-turbine process. Combined energy systems. Gasturbine systems for aero-jet driving. Cogeneration energy plants. Energy system with MHD generator. Energy systems with fuel cells. Techno-economical analysis and comparison of cogeneration systems. Economical analysis of energy plants. Auxiliary systems of energy plants. Environment protection in energy plants. Economic production and rational use of energy.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises	☑ individual assignments ☐ multimedia and network

	☐ long distance education ☐ fieldwork	☐ laboratories ☐ mentorship ☐ other _____

1.6. Student's obligations

Course attendance, activity, homework, studying.

1.7. Evaluation of student's work

Course attendance	2	Activity/Participation		Seminar paper		Experimental work	
Written exam	0,75	Oral exam		Essay		Research	
Project		Sustained knowledge check	1	Report		Practice	
Portfolio		Homework	0,25	Final exam			

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

Course attendance, activity, continuous knowledge testing (2 mid-term exams), written or oral exam

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

Title	*Number of copies*	*Number of students*
Prelec, Z.: Energetika u procesnoj industriji, Školska knjiga, Zagreb, 1994.	10	40

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

El-Vakil, M.: Power Plant Technology, McGraw Hill Book Company, 2002.
Reay, D., Wright, A,: Innovation for Energy Efficiency, Pergamon Press, 2013.
Nag, P.K.: Power Plant Engineering 4e, Mcgraw Hill Education, 2014.
Amidpour, M., Manesh, M.H.K.: Cogeneration and Polygeneration Systems, Academic Press, 2021.

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

Through the Institution's quality assurance system.

GENERAL INFORMATION		
Teacher	Assoc. Prof. Dr. Sc. Loredana Simčić / Assoc. Prof. Dr. Sc. Ivan Dražić	
Course title	**Engineering Statistics**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	2nd/3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	30+30+0

COURSE DESCRIPTION		
1.1. Course objectives		
Acquiring basic knowledge and skills in probability and statistics needed for solving problems in engineering practice.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Define and interpret correctly random events and probabilities of events. Apply rules for evaluating the probability of intersection and union of events, conditional distributions, total probability and Bayes theorem. Define and interpret correctly random variables and random vectors and their numerical indicators and use some basic probability distributions in typical experiments. Define basic terms in descriptive statistics and perform statistical data analysis. Estimate some parameters of a population or a probability distribution from samples (confidence intervals). Express and perform basic statistical hypothesis tests. Determine the linear regression functions for two-dimensional statistical data sets and interpret the results correctly.		
1.4. Course content		
Descriptive statistics. Basics of probability theory: events, probability and probability space. Conditional probability. Random variable: probability distribution function, cumulative distribution function, numerical parameters. Standard probability distributions. Central limit theorem. Random vectors. Basics of statistical inference: Estimating parameters. Testing of hypotheses. Goodness of fit test.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education ☐ fieldwork	☐ individual assignments ☐ multimedia and network ☑ laboratories ☐ mentorship ☐ other _____

1.6. Student's obligations

Course attendance, activity/participation, studying

1.7. 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		Sustained knowledge check	2	Report		Practice	
Portfolio		Homework		Final exam			

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

Course attendance, activity, tests on computer, mid-term exams, tests on computer, written and oral exam

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

Title	*Number of copies*	*Number of students*
Črnjarić-Žic N., Interna skripta i zbirka zadataka iz Inženjerske statistike, Rijeka 2010.	110	40
Elezović, N., Diskretna vjerojatnost; Slučajne varijable; Statistika i procesi, Biblioteka Bolonja, Element, Zagreb 2007.	3	40

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

J.L.Devore, Probability and statistics for engineering and the sciences, Cengage Learning, 2016
Pauše, Ž.: Uvod u matematičku statistiku, Školska knjiga Zagreb, 1993

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

Through the Institution's quality assurance system.

GENERAL INFORMATION		
Teacher	Prof. Dr. Sc. Ivo Ipšić	
Course title	**Programming 2**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	2nd/3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	7
	Number of hours (L+E+S)	45+30+0

COURSE DESCRIPTION		
1.1. Course objectives		
Software development in programming language C.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Understand the principles of software development and utilize the C programming language. Adopt the syntax of the C programming language. Be familiar with program branching commands. Differentiate between basic and complex data types. Compare basic and complex data structures. Adopt the working principle of functions. Understand pointers and dynamic memory allocation. Evaluate the operation of I/O functions.		
1.4. Course content		
Program structure. Memory classes. Functions and the method of argument passing. Recursive functions. Function libraries. Pointers. Pointer arithmetic. The relationship between pointers and arrays. Pointers as function arguments. Dynamic memory allocation. Command line arguments. Structures. Arrays of structures. Pointers and structures. Self-referential structures. File operations. Standard functions for reading and writing. Formatted and binary files. Preprocessor. Program compilation. Configure and make tools. Makefile.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☑ long distance education ☐ fieldwork	☑ individual assignments ☐ multimedia and network ☑ laboratories ☐ mentorship ☐ other _____
1.6. Student's obligations		

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

1.7. Evaluation of student's work

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

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

Lecturing with knowledge checking based on quizzes, partial exams and homeworks. Exercises with problem solving and preparing for the final project.

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

Title	*Number of copies*	*Number of students*
Rajko Vulin: Od sada programiramo u C-u, Turbo C, Školska knjiga, Zagreb 1991.	1	40
Kernighan B. W., Ritchie D. M., The C Programming Language, Prentice Hall, Inc., 1988.	1	40

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

Rajko Vulin: "Zbirka riješenih zadataka iz C-a", Školska knjiga, Zagreb 1995.

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

Through the Institution's quality assurance system.

GENERAL INFORMATION		
Teacher	Prof. Dr. Sc. Siniša Družeta	
Course title	**Computer Simulations in Engineering**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	2nd/3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	7
	Number of hours (L+E+S)	15+30+0

COURSE DESCRIPTION		
1.1. Course objectives		
General knowledge of computer simulation technology. Understanding the basics of mathematical modeling. Knowledge of the capabilities and limitations of computer simulations. Recognizing the method of solving engineering problems using computer simulations.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Correctly interpret the methodology of mathematical modeling. Classify mathematical models typical for modeling technical systems. Recognize the basic types of numerical grids. Classify commercial software for numerical modeling. Explain the entire process of applying computer simulations to solve engineering problems. Explain the advantages and disadvantages of numerical modeling.		
1.4. Course content		
The process of numerical modeling. Building and using models, from mathematical description to software implementation of simulations. Discretization methods and numerical schemes. Structured and unstructured numerical grids. Defining initial and boundary conditions. Case studies of the application of computer simulations in engineering practice. Introduction to commercial software for conducting computer simulations such as ANSYS, CATIA, and similar. Implementation of the entire process of applying computer simulations to solve engineering problems on a specific example		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education ☐ fieldwork	☑ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other _____

1.6. Student's obligations							
Attendance, class participation, individual assignment.							
1.7. Evaluation of student's work							
Course attendance	1,5	Activity/Participation		Seminar paper	2	Experimental work	
Written exam		Oral exam		Essay		Research	
Project		Sustained knowledge check	0,5	Report		Practice	
Portfolio		Homework		Final exam			

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

Course attendance, activity, continuous knowledge testing, seminar paper.

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

Title	*Number of copies*	*Number of students*
Commercial software manuals: ANSYS, CATIA, ...		40

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

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

Through the Institution's quality assurance system.

GENERAL INFORMATION		
Teacher	Assist. Prof. Dr. Sc. Ivan Volarić	
Course title	**Embedded Systems**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	2nd/3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	7
	Number of hours (L+E+S)	45+30+0

COURSE DESCRIPTION
1.1. Course objectives
Introduction to embedded computer systems, their basic architecture, and integration within digital/analog electrical systems. Master working with a development environment (IDE) for programming embedded computer systems and acquiring basic knowledge for creating systems based on embedded computer systems.
1.2. Course enrolment requirements
None.
1.3. Expected course learning outcomes
After completing the course, the student should be able to: ● Describe the standard architecture of embedded computer systems ● Describe the structure of the control unit, bus, memory, clock generation, power supply voltage, and system reset conductance ● Use development environments/tools for programming, analysis, and validation of embedded computer systems (simulators, emulators, debuggers) ● Determine key parameters and registers of an embedded computer system ● Apply and manage interrupts (interrupt) ● Describe and apply peripheral units of an embedded computer system: analog-digital I/O, AD and DA conversion, Timers, counters, PWM, EEPROM, serial communication protocols: UART, SPI, I2C ● Implement and verify the operation of algorithms for solving specific problems in embedded system applications
1.4. Course content
Introduction to embedded computer systems. Basic architecture of microcontrollers, power supply, and diagnostics, clock generation, and reset. Control unit: registers, ALU, instruction cycle. Bus, memory, data types, and storage. Machine language. Serial-USB interface, ICSP, Emulators, Simulators. Development environment and introduction to programming for embedded computer systems. Debugging. Application of interrupts (interrupt) in the program structure. Peripheral functions: Analog-digital I/O, analog-digital and digital-analog conversion. Peripheral functions: Timers, counters, PWM, CCP. Peripheral functions: EEPROM and Flash memory. Serial communication protocols: UART, SPI, I2C.

1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education ☐ fieldwork	☑ individual assignments ☐ multimedia and network ☑ laboratories ☐ mentorship ☐ other _____

1.6. Student's obligations

Course attendance, activity, homework, studying, team project

1.7. Evaluation of student's work

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

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

Lab quizzes, mid-term exams, final project

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

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

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

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

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

Through the Institution's quality assurance system.

GENERAL INFORMATION		
Teacher	Prof. Dr. Sc. Ivan Štajduhar	
Course title	**Introduction to Artificial Intelligence**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	2nd/3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

COURSE DESCRIPTION		
1.1. Course objectives		
Introduction and application of problem-solving and decision-making techniques in intelligent agents and independent application of these methods to real problems.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Adopt artificial intelligence techniques. Apply artificial intelligence techniques to problems. Understand methods of state space search, decision-making under (un)certainty, and graphical models.		
1.4. Course content		
Introduction to artificial intelligence and application examples. State space search, directed search, and search with adversaries. Markov decision process. Reinforcement learning. Probability and reasoning. Bayesian network. Markov model and hidden Markov model.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education ☐ fieldwork	☑ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other _____
1.6. Student's obligations		
Course attendance, activity in class, studying.		
1.7. Evaluation of student's work		

Course attendance	2	Activity/Participation		Seminar paper		Experimental work	

Written exam	2,5	Oral exam		Essay		Research	
Project		Sustained knowledge check	1,5	Report		Practice	
Portfolio		Homework		Final exam			

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

Course attendance, midterm exams, exam

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

Title	*Number of copies*	*Number of students*
Russell, S.J., Norvig P., Artificial Intelligence: A Modern Approach, 3rd ed., Pearson Education Limited, 2016.	3	40

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

Sutton, Richard S., and Andrew G. Barto. Reinforcement learning: An introduction. MIT press, 2018.
Poole, David L., and Alan K. Mackworth. Artificial Intelligence: foundations of computational agents. Cambridge University Press, 2010.

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

Through the Institution's quality assurance system.

Elective courses B-S (summer semester)

LIST OF COURSES						
Year of study: 2nd and 3rd year of the University Undergraduate Study in Mechatronics and Robotics						
Semester: 4th and 6th (summer)						
COURSE	INSTRUCTOR	L	E	S	ECTS	STATUS
English in Engineering	mr. sc. Elisa Velčić Janjetić, Sen. Lec./ Anita Badurina Filipin, Lec.	15	30	0	4	E
Communication Networks	Assist. Prof. Dr. Sc. Ivan Volarić	30	30	0	6	E
Machine Elements Design 1	Prof. Dr. Sc. Marina Franulović	45	30	0	7	E
Modelling of Process Information Systems	Prof. Dr. Sc. Alfredo Višković / mr. sc. Branka Dobraš, Sen. Lec.	30	30	0	6	E
Operating Systems	Prof. Dr. Sc. Kristijan Lenac	30	30	0	6	E
Organization of Business Systems	Assoc. Prof. Dr. Sc. Samir Žic	30	30	0	6	E
Basics of Ship Production	Prof. Dr. Sc. Marko Hadjina / Prof. Dr. Sc. Tin Matulja	30	15	0	5	E
Introduction into Finite Element Method	Prof. Dr. Sc. Marko Čanađija	15	30	0	4	E
Production Technologies	Prof. Dr. Sc. Goran Cukor / Assist. Prof. Dr. Sc. Graciela Šterpin Valić	45	15	0	5	E
Computational Engineering	Prof. Dr. Sc. Siniša Družeta / Assoc. Prof. Dr. Sc. Stefan Ivić	30	30	0	4	E
Computational Modelling in Shipbuilding	Prof. Dr. Sc. Albert Zamarin / Prof. Dr. Sc. Marko Hadjina	15	45	0	4	E
Environment Protection	Prof. Dr. Sc. Roko Dejhalla	45	0	0	4	E

COURSE DESCRIPTION

GENERAL INFORMATION		
Teacher	mr. sc. Elisa Velčić Janjetić, Sen. Lec../ Anita Badurina Filipin, Lec.	
Course title	**English in Engineering**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	2nd/3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	4
	Number of hours (L+E+S)	1+2+0

COURSE DESCRIPTION		
1.1. Course objectives		
The aim of the course is to enable students to acquire knowledge and skills related to the basic communication needs of engineers and to use the language of the engineering profession at an elementary level, considering all four language skills: reading, listening, speaking, and writing, all according to the Common European Framework of Reference for Languages.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Compare and explain general language and the language of the profession (engineering) based on selected texts and thematic units. Implement grammatical structures and aspects in written and oral communication. Identify terminology, key words, and/or information in selected texts and distinguish and analyze relevant and irrelevant elements in the same. Present the advantages and disadvantages of certain thematic units. Verbally and in writing, argue their positions and criticize and evaluate certain solutions to a given problem. Students will acquire basic knowledge necessary for obtaining international certificates of English language proficiency.		
1.4. Course content		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education ☐ fieldwork	☑ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other _____

1.6. Student's obligations

Attendance at lectures, active participation in the teaching process, independent study.
Monitoring of Student Work (add X next to the appropriate form of monitoring)

1.7. Evaluation of student's work

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

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

Class attendance and active participation, continuous assessment, seminar paper, written exam.

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

Title	*Number of copies*	*Number of students*
Velčić Janjetić, E. & Badurina Filipin, A.:Radni materijal za Engleski jezik u inženjerstvu	20	40

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

Dunn, M. et al.: English for Mechanical Engineering in Higher Education Studies. Garnet Publishing Ltd 2010.

Glendinning, E. H. & Glendinning, N.: Oxford English for Electrical and Mechanical Engineering. Oxford University Press 2001.

Ibbotson, M.: Professional English in Use. Engineering. Cambridge University Press 2009.

Ibbotson, M.: Cambridge English for Engineering. Cambridge University Press 2015.

Smith, R. H. C.: English for Electrical Engineering in Higher Education Studies. Garnet Publishing Ltd 2014.

Swan, M. & Walter, C.: Oxford English Grammar Course. Intermediate. Oxford University Press 2017.

Vince, M.: Intermediate Language Practice. Heinemann ELT. Oxford 1998. Paterson, K. & Wedge, R.: Oxford Grammar for EAP. Oxford University Press 2013.

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

Through the established quality assurance system of the Faculty.

GENERAL INFORMATION		
Teacher	doc.dr.sc. Ivan Volarić	
Course title	**Communication Networks**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	2nd/3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

COURSE DESCRIPTION		
1.1. Course objectives		
The course aims to define the principles of network operations and communication among devices. It describes the structure and architecture of networks and basic communication protocols. It aims to develop the ability to use basic tools for analysis and configuration of networks based on the TCP/IP and OSI models.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
After successfully completing the course, the student will be able to do the following: Define basic measures of communication channels. Define the OSI reference model of computer system architecture. Describe the purpose of all layers of the OSI reference model. Compare the OSI and TCP/IP models. Describe the most commonly used protocols and represent them with finite state machines. Apply basic tools for analysis and configuration of networks and network protocols. Implement simple simulations of networks and communication protocols. Describe types and examples of security threats in the context of network systems. Make basic configurations of network devices.		
1.4. Course content		
Organization of communication networks. Basic measures of communication channels - channel capacity, bandwidth, signal-to-noise ratio, throughput. TCP/IP model. OSI reference model. Physical layer in OSI model: theoretical foundations, media, construction of the physical layer. Data link layer. Error detection and correction. Finite state machines. Examples of network protocols. Device addressing in networks. IEEE standard 802. Network layer. Traffic routing algorithms. Elements and services of the transport layer. Application layer. Internet applications and application protocols. Security. Discrete simulation of communication networks. Basic tools for working and setting up communication networks, OpenWrt. Application of communication networks in electrical engineering.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises	☐ individual assignments ☐ multimedia and network

	☐ long distance education ☐ fieldwork	☑ laboratories ☐ mentorship ☐ other _____

1.6. Student's obligations

Attendance at lectures, completion of homework, completion of laboratory exercises, written exam.

1.7. 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		Homework		Final exam			

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

Attendance at lectures, homework, laboratory exercises, quizzes, and written exams.

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

Title	*Number of copies*	*Number of students*
Radovan, M.: Računalne mreže (1), Rijeka, Digital point tiskara, 2010.	1	40
Radovan, M.: Računalne mreže (2), Rijeka, Digital point tiskara, 2011.	1	40

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

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

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

Through the established quality assurance system of the Faculty.

GENERAL INFORMATION		
Teacher	**Machine Elements Design 1**	
Course title	Prof. Dr. Sc. Marina Franulović	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	2nd/3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	7
	Number of hours (L+E+S)	45+30+0

COURSE DESCRIPTION		
1.1. Course objectives		
Acquiring theoretical knowledge and developing skills for understanding loads, stresses, types, functions, shapes, and materials of machine elements, as well as for their calculation according to standards.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Selecting criteria for dimensioning and shaping simple machine elements. Applying standardized procedures for the verification calculation of the load-bearing capacity of machine elements. Solving given structural problems. Interpreting achieved results through information sharing, presentation, and technical documentation.		
1.4. Course content		
Basics of design. Design process. Types of loads. Stresses and deformations of structural elements. Static loading. Dynamic loading. Material characteristics. Allowable stresses. Wöhler diagram. Smith diagram. Stress concentration. Joining elements. Fasteners. Bolted connections. Moving bolted connections. Pins, dowels. Shaft and hub connections. Keyed joints. Springs. Welded, soldered, glued, and riveted joints.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education ☐ fieldwork	☑ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other _____
1.6. Student's obligations		
Attending classes, participating in class activities, solving tasks during classes and at home, self-study.		

1.7. Evaluation of student's work

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

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

Attendance of classes. Written or oral quizzes. Continuous assessment of accuracy, precision, completeness, and creativity in solving construction tasks. Written and/or oral examination to assess acquired knowledge in the final exam.

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

Title	*Number of copies*	*Number of students*
Križan, B.: Osnove proračuna i oblikovanja konstrukcijskih elemenata, Školska knjiga, Zagreb, 2008.	18	40
Križan, B.; Franulović, M., Zelenika, S.: Konstrukcijski elementi - Zbirka zadataka: Osnove, elementi za spajanje, osovine i vratila Rijeka: Tehnički fakultet Sveučilišta u Rijeci, 2012	35	40
Krautov strojarski priručnik, Sajema, Zagreb, 2009	6	40

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

Decker, K.-H.: Elementi strojeva, Golden marketing-Tehnička knjiga, Zagreb, 2006.
Križan, B.; Basan, R.: Polimerni konstrukcijski elementi, Zigo, Rijeka, 2009.

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

Through the established quality assurance system of the Faculty.

GENERAL INFORMATION		
Teacher	Prof. Dr. Sc. Alfredo Višković / mr. sc. Branka Dobraš, Sen. Lec..	
Course title	**Modelling of Process Information Systems**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	2nd/3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

COURSE DESCRIPTION		
1.1. Course objectives		
The aim of the course is to acquire theoretical knowledge and develop skills in modeling process information for complex technical systems and plants.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Describe and explain the modular structure of technical systems. Analyze the structure of parameters for drive identification. Define and distinguish real-time process information models in the electric power system. Explain and interpret the sources of process information of technical systems. Describe and correctly interpret the structure of process information in remote communication. Design and create UML diagrams for different systems. Distinguish standard communication methods and the connection of open systems. Correctly interpret the importance and application of standardization in modeling process information systems. Define and describe the application of SCL language. Explain and justify the equipment and software support in electric power system control centers.		
1.4. Course content		
Modular structure of technical systems. Structure of variables for drive identification. Representation of process variables in multidimensional vector space. Application of an object-oriented approach in modeling. Technological functional model of process information. Device design of process information. Structure of process information in remote communication between plants and control centers. Application of the Common Information Model (CIM). Abstract model of real devices in the plant. Interface for electric power system control applications (EMS-API). Standardization of communications and plant automation process information. Process information models in the environment of new technologies and associated standards. Connecting open systems (OSI). Application of UML diagrams in modeling process information. Application of SCL language (based on XML) for configuring and parameterizing intelligent electronic devices (IED). Application of multi-agent systems.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops	☑ individual assignments

	☑ exercises ☐ long distance education ☑ fieldwork	☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other _____

1.6. Student's obligations

Attendance at lectures, activity in class, completion of a seminar paper, independent study.

1.7. Evaluation of student's work

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

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

Attendance at lectures, activity in class, seminar paper, written and oral exams.

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

Title	*Number of copies*	*Number of students*
Šimunić, J.: Predavanja, 2012.	1	40
Shahidehpour M., Wang Y., Communication and Control in Electric Power Systems, Wiley & Sons, 2003.	1	40

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

Strauss C., Practical Electrical Network Automation and Communication Systems, Elsevier, 2003.
Brand K.P., Lohmann V., Wimmer W., Substation Automation Handbook, UAC, 2003.
Rehtanz, C., Autonomous systems and intelligent agents in power system control and operation, Springer; 1 ed, 2003.

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

Through the established quality assurance system of the Faculty.

GENERAL INFORMATION		
Teacher	Prof. Dr. Sc. Kristijan Lenac	
Course title	**Operating Systems**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	2nd/3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

COURSE DESCRIPTION		
1.1. Course objectives		
To familiarize with the basics of modern operating systems.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Understand basic concepts, components and services of operating systems. Understand the relation between the hardware, software support and functions of the operating system. Use command-line interface to manage the operating system. Manage computer processes. Analyze and implement multi-threaded and multi-process programs. Manage synchronization mechanisms. Understand scheduling algorithms. Manage memory resources.		
1.4. Course content		
Introduction to operating systems: history of operating systems, operating system structure, interaction between operating system and hardware. Process management: processes and threads, concurrent execution, scheduling, deadlocks, synchronization. Memory management. Shells for working with operating systems and shell programming. Operating system security.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education ☐ fieldwork	☑ individual assignments ☐ multimedia and network ☑ laboratories ☑ mentorship ☐ other _____
1.6. Student's obligations		
Attendance at lectures, activity in class, quizzes, independent study, solving tasks independently.		

1.7. *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		Homework		Final exam			

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

Quizzes and continuous assessment, written exam.

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

Title	*Number of copies*	*Number of students*

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

Silberschatz, Galvin, Gagne: Operating System Concepts, Wiley, 8th Ed.
Budin, Golub, Jakobović, Jelenković: Operacijski sustavi, 1. izdanje
Tanenbaum: Modern Operating Systems, Prentice Hall, 2008.
Stallings: Operating Systems: Internals and Design Principles, Prentice Hall, 6th Ed.

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

Through the established quality assurance system of the Faculty.

GENERAL INFORMATION		
Teacher	Assoc. Prof. Dr. Sc. Samir Žic	
Course title	**Organization of Business Systems**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	2nd/3rd	
ECTS credits and teaching	ECTS student ‘s workload coefficient	6
	Number of hours (L+E+S)	30+30+0

COURSE DESCRIPTION		
1.1. Course objectives		
To acquire knowledge in the field of organization and economics of business systems.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Explain the concept of a business system and setting up a business system. Differentiate between the organizational forms of business systems and specificities. Explain the organization's resources and the functioning of competitive markets. Identify risks associated with investments and market participation. Recognize key factors when making business decisions in the company. Explain the types and importance of intellectual property. Distinguish between ownership, management and leadership. Define job evaluation and teamwork. Explain the influence of supply chains on the success of the business system. Know the effects of operations and basic financial statements.		
1.4. Course content		
Definition and evolution of business system organization. Organizational forms of business systems. Setting up a business system. Basic principles of organization. Manageability of the system. Formal and informal organization. Information in the business system. The behavioral approach in organizational theory. Business decision-making. Types of organizational structures. Designing the organization of the business system. Forms of commercial companies. Supply chains. Organizational changes. Intellectual Property. Job evaluation. Ownership. Management. Leadership. Teamwork. Business policy. Planning. Long-term and short-term business system plans. Economic aspects of business systems. Business effects. Organizational resources and competitiveness. Case studies: Study of cases from business practice.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education	☐ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship

	☐ fieldwork	☐ other _____

1.6. Student's obligations

Attendance at lectures, activity in class, independent study.

1.7. Evaluation of student's work

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

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

Attendance at lectures, activity in class, continuous assessment, written exam.

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

Title	*Number of copies*	*Number of students*
T. Mikac, M. Ikonić.: Organizacija poslovnih sustava, Tehnički fakultet Sveučilišta u Rijeci, online skripta, Rijeka, 2011.		40

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

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

Through the established quality assurance system of the Faculty.

GENERAL INFORMATION		
Teacher	Prof. Dr. Sc. Marko Hadjina / Prof. Dr. Sc. Tin Matulja	
Course title	**Basics of Ship Production**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	2nd/3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	30+15+0

COURSE DESCRIPTION		
1.1. Course objectives		
Within this course, students acquire knowledge about shipbuilding according to defined learning outcomes.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Differentiate materials for shipbuilding and marine technology objects. Describe the technology for protecting hull elements. Interpret the reproduction of dimensions and shapes of ship structure. Analyze and explain production line configurations. Define the flows of ship structure elements, assemblies, and sections. Describe devices and machines for the pre-processing and processing of sheets and profiles. Describe the making of elements and assemblies of ship equipment. Analyze pre-assembly of the hull and equipment. Interpret the breakdown of hull and equipment. Describe and classify horizontal and vertical transportation.		
1.4. Course content		
Materials for shipbuilding and marine technology objects. Anti-corrosion technology. Reproduction of dimensions and shapes of ship structure. Production lines. Flows of sheets, profiles, ship structure elements, assemblies, and sections. Pre-processing of sheets and profiles, manufacturing of ship structure elements, assembling of assemblies and sections of ship structure. Devices and machines for pre-processing and processing of sheets and profiles. Manufacturing of ship equipment. Pre-assembly of hull and equipment. Basics of welding ship structure. Disassembly of hull and equipment. Equipping sections. Painting sections. Horizontal and vertical transport. Basics of specialized shipbuilding software for modeling structure and shipbuilding technology.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education	☑ individual assignments ☐ multimedia and network ☑ laboratories ☐ mentorship

	☑ fieldwork	☐ other _____

1.6. Student's obligations

Attendance at lectures, activities in class, project work, independent study.

1.7. 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	1	Sustained knowledge check	1	Report		Practice	
Portfolio		Homework		Final exam			

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

Attendance at lectures, activity in class, continuous assessment (two midterms), seminar paper, written exam, oral exam, or any combination of these forms.

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

Title	*Number of copies*	*Number of students*
Nastavni materijal nastavnika: „Osnove gradnje broda"		40
Furlan, Z., Lučin, N., Pavelić, A.: Tehnologija gradnje brodskog trupa, Školska knjiga, Zagreb, 1986.	10	40

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

D.J.Eyres: Ship Construction, 2012.
Klaas van Dokkum : Ship Knowledge: Ship Design, Construction, DOKMAR, Netherland, 2011.

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

Through the established quality assurance system of the Faculty.

GENERAL INFORMATION		
Teacher	Prof. Dr. Sc. Marko Čanađija	
Course title	**Introduction into Finite Element Method**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	2nd/3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	4
	Number of hours (L+E+S)	15+30+0

COURSE DESCRIPTION		
1.1. Course objectives		
To acquire theoretical knowledge and develop skills for solving practical problems using the finite element method in solid mechanics.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Define the stiffness matrix, load vector, and the basic equation of the finite element for basic types of finite elements. Formulate the structure equation, displacement vectors, and load vectors of the structure, and apply boundary conditions to the structure equation. Carry out the discretization of structures with finite elements in specific problems. Calculate the distribution of stresses and displacements for line and surface structures, and bodies using the finite element method.		
1.4. Course content		
Introduction. Application areas of FEM in solid mechanics. Overview of forming the stiffness matrix of a finite element, load vector, and finite element equation. Local and global coordinate systems. Boundary conditions. Structure equation. Basics of application in line and surface structures, and bodies. Model verification methods. Common errors in using the finite element method.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☑ exercises ☐ long distance education ☐ fieldwork	☑ individual assignments ☐ multimedia and network ☑ laboratories ☐ mentorship ☐ other _____
1.6. Student's obligations		

Attendance at lectures, activity in class, completion of homework assignments, completion of a seminar paper, independent study.

1.7. Evaluation of student's work

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

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

Attendance at lectures, activity in class, homework assignments, project task, written exam.

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

Title	*Number of copies*	*Number of students*
Brnić, J., Čanađija, M.: "Analiza deformabilnih tijela metodom konačnih elemenata", Fintrade, Rijeka, 2009.	10	40
Brnić, J.: "Elastomehanika i plastomehanika", Školska knjiga, Zagreb, 1996.	13	40

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

Bathe, K. J.: "Finite Element Procedures", Prentice Hall, Englewood Cliffs, 1996.
Zienkiewicz, O. C., Taylor, R. L.: "The Finite Element Method", Vol. 1, Butterworth-Heinemann, 2000.
Cook, R. D., Malkus, D. S., Plesha, M. E., Witt, R. J.: "Concepts and Applications of Finite Element Analysis", John Wiley & Sons, 2001.

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

Through the established quality assurance system of the Faculty.

GENERAL INFORMATION		
Teacher	Prof. Dr. Sc. Goran Cukor / Assist. Prof. Dr. Sc. Graciela Šterpin Valić	
Course title	**Production Technologies**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	2nd/3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	45+15+0

COURSE DESCRIPTION		
1.1. Course objectives		
To familiarize with the basics of analyzed manufacturing technologies/processes and their applications and to equip students with the ability to select the most suitable manufacturing process considering economic aspects and the quality of the finished product, performing calculations, and specifying technological parameters.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Identify and describe manufacturing technologies/processes and their application. Interpret the physical basis of analyzed manufacturing processes. Interpret the criteria for selecting manufacturing processes. Apply basic calculations of technological parameters. Analyze the characteristics of different manufacturing processes. Evaluate the advantages and limitations of different manufacturing processes with respect to their application area. Select the most suitable process considering economic aspects and the quality of the finished product.		
1.4. Course content		
Significance, development, and classification of manufacturing technologies. Casting processes: single-use mold processes and permanent mold processes. Forming processes: deformation processes of massive parts, sheet forming processes, and special and unconventional processes. Material removal processes: conventional and unconventional processes. Joining processes. Powder metallurgy processes. Ceramic and glass forming processes. Polymer processing. Additive processes. Competitive aspects of manufacturing.		
1.5. Teaching methods	☑ lectures ☑ seminars and workshops ☑ exercises ☐ long distance education ☐ fieldwork	☑ individual assignments ☑ multimedia and network ☑ laboratories ☐ mentorship

		☐ other _____

1.6. Student's obligations

Attendance at lectures, classroom activities, completion of homework assignments, quizzes, preparation and presentation of seminars, independent study.

1.7. 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	
Portfolio		Homework		Final exam			

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

Attendance at lectures, homework, continuous assessment, seminar, written and/or oral exam.

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

Title	*Number of copies*	*Number of students*
Katavić, I.: Ljevarstvo, Tehnički fakultet Sveučilišta u Rijeci, 2001.	5	40
Duplančić, I.: Obrada deformiranjem, Fakultet elektrotehnike, strojarstva i brodogradnje Sveučilišta u Splitu, 2007.	2	40
Cukor, G.: Proračuni u obradi metala rezanjem, interna skripta, Tehnički fakultet Sveučilišta u Rijeci, 2014.	100	40
Cukor, G.: Obrada metala rezanjem, interna skripta, Tehnički fakultet Sveučilišta u Rijeci, 2021.	100	40

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

Kalpakjian, S., Schmid, S.R.: Manufacturing Processes for Engineering Materials, 4th ed., Prentice Hall, 2003.

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

Through the established quality assurance system of the Faculty.

GENERAL INFORMATION		
Teacher	Prof. Dr. Sc. Siniša Družeta / Assoc. Prof. Dr. Sc. Stefan Ivić	
Course title	**Computational Engineering**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	2nd/3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	4
	Number of hours (L+E+S)	30+30+0

COURSE DESCRIPTION		
1.1. Course objectives		
Understanding the possibilities for automating engineering tasks using programming and connecting computer programs. Recognizing opportunities for implementing such systems. Knowledge of computer tools for creating software-technical solutions for preprocessing, visualization, and data processing.		
1.2. Course enrolment requirements		
Computational methods.		
1.3. Expected course learning outcomes		
Identify opportunities for implementing automation of engineering tasks using high-level programming languages. Connect multiple software by adjusting input-output data. Create advanced data visualizations and results from other software. Automate the execution of repetitive engineering tasks and establish systems for simple optimizations of the same.		
1.4. Course content		
Basic programming skills in a high-level programming language for the needs of software work automation, visualization, preprocessing, and data processing. Programmatic communication between different software. Reading and writing from files. Programmable data visualization. Application of acquired knowledge on a specific engineering task (project).		
1.5. Teaching methods	☑ lectures ☑ seminars and workshops ☑ exercises ☐ long distance education ☐ fieldwork	☑ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other _____
1.6. Student's obligations		

Lectures, exercises, consultations, project tasks, presentation of results.							
1.7. Evaluation of student's work							
Course attendance	2	Activity/Participation		Seminar paper		Experimental work	
Written exam		Oral exam		Essay		Research	0,5
Project	1,5	Sustained knowledge check		Report		Practice	
Portfolio		Homework		Final exam			
1.8. Procedure and examples of learning outcome assessment in class and at the final exam							
Attendance at lectures, homework, seminar.							
1.9. Assigned reading (at the time of the submission of study programme proposal)							

Title	*Number of copies*	*Number of students*
Priručnici i vodiči za softvera za izradu računalnih simulacija		40

1.10. Optional / additional reading (at the time of proposing study programme)
Sweigart, A.: Automate the Boring Stuff with Python: Practical Programming for Total Beginners, No Starch Press, 2015.
1.11. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences
Through the established quality assurance system of the Faculty.

GENERAL INFORMATION		
Teacher	Prof. Dr. Sc. Albert Zamarin / Prof. Dr. Sc. Marko Hadjina	
Course title	**Computational Modelling in Shipbuilding**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	2nd/3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	4
	Number of hours (L+E+S)	15+45+0

COURSE DESCRIPTION		
1.1. Course objectives		
Within this course, students will be using advanced shipbuilding CAE/CIM systems and tools in the design and analysis of shipbuilding products and processes.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Get acquainted with the specifics of contemporary shipbuilding CAE/CIM systems. Differentiate integration tools for connecting shipbuilding products and processes. Interpret the interaction of complex CAE/CIM tools with other specific tools. Analysis of the basic properties of the modern integrated software package 3D EXPERIENCE within the concept of a digital shipyard, for product design and design and management of production processes. Define and create a computer model of the construction and related technological information. Apply relevant input documentation, as well as the rules and regulations of classification societies in the process of creating shipbuilding classification documentation, as well as shipyard standards for creating a detailed computer model with accompanying technical and technological documentation.		
1.4. Course content		
Familiarization with the specifics of contemporary shipbuilding CAE/CIM systems. 3D product database model. Integration tools for connecting shipbuilding products and processes. Data transfer for the production of documentation. Interaction of complex CAE/CIM tools with other specific tools. Data transfer between integrated and specific software packages. Presentation of modern PLM specific tools for product design and design and management of production processes; 3D EXPERIENCE. Based on relevant input documentation and information, create a computer model of ship construction and related technological information and produce relevant documentation. Overview of the process of creating shipbuilding classification and technological documentation for the design, construction, and outfitting of shipbuilding products in accordance with shipbuilding standards.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops	☑ individual assignments

	☑ exercises ☐ long distance education ☐ fieldwork	☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other _____

1.6. Student's obligations

Attendance at lectures, classroom activities, part of the project task, independent study.

1.7. Evaluation of student's work

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

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

Attendance at lectures, classroom activity, project task completion, oral exam.

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

Title	*Number of copies*	*Number of students*
Nastavni materijali „Računarsko modeliranje u brodogradnji“		40
Korisnička dokumentacija i upute za korištenje integriranog programskog paketa 3D EXPERIENCE	20	40
Pravila i propisi klasifikacijskih društava; IACS-CSR, LR, DNV-GL, ABS, BV, HRB.	20	40
ISSC Specialist Committee Reports V.3. Materials and Fabrications Technology	2	40

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

Fei Tao , Meng Zhang et al, Digital Twin Driven Smart Manufacturing, 2019
Book of proceedings of International Conference on Computer and IT Applications in the Maritime Industries, Pontignano, 17-19 August 2020, Hamburg, Technische Universität Hamburg-Harburg, 2020, ISBN 978-3-89220-717-7
Lamb, T., et al., Ship Design & Construction, Vol. 1, 2, SNAME, 2003.

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

Through the established quality assurance system of the Faculty.

GENERAL INFORMATION		
Teacher	Prof. Dr. Sc. Roko Dejhalla	
Course title	**Environment protection**	
Study programme	University Undergraduate Study in Mechatronics and Robotics	
Course status	elective	
Year	2nd/3rd	
ECTS credits and teaching	ECTS student 's workload coefficient	4
	Number of hours (L+E+S)	45+0+0

COURSE DESCRIPTION		
1.1. Course objectives		
To define the basic concepts of ecology and environmental protection. Analyze the aspects of the technosphere's impact on the environment. Describe processes that contribute to pollution. Compare technologies and their impact. Differentiate between development and sustainable development. Argue the necessity of sustainable development. Describe current problems of global pollution. Distinguish basic concepts of ecology and environmental protection. Understand the impact of technology on the environment.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Analyze the impact of individual engineering activities on the environment based on independent research. Develop the ability to work in an interdisciplinary team and communicate with experts in other areas. Develop the ability to design and manage environmental protection projects.		
1.4. Course content		
Introduction to the environment, subject of ecology. Soil, atmosphere, waters, and seas. Interaction with the environment. Environmental monitoring, especially in the marine environment. Sampling from the environment. Measurement methods of analytical chemistry. Physical measurement methods. Fluorescence methods. Basics of environmental process modeling. Environmental protection. Environmental improvement. Marine technology engineering. Marine technology facilities and interaction with the environment. International conventions and standards.		
1.5. Teaching methods	☑ lectures ☐ seminars and workshops ☐ exercises ☐ long distance education ☑ fieldwork	☑ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other _____

1.6. Student's obligations

Attendance at lectures, classroom activities, research and literature review, independent work preparation, consultations, independent study, presentation of work.

1.7. Evaluation of student's work

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

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

Attendance at lectures, classroom activity, continuous assessment, written and oral exams.

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

Title	*Number of copies*	*Number of students*
Briški, F.: Zaštita okoliša, Fakultet kemijskog inženjerstva i tehnologije, Zagreb, 2016	1	40
Črnjar, M.: Ekonomika i politika zaštite okoliša, Ekonomski fakultet, Rijeka, 2002.	1	40

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

Dobrinić, J., Bonato, J.: Fizika, Pomorski fakultet, Rijeka, 2009.
Reible, D. D.: Fundamentals of Environmental Engineering, Springer, London, 1999.
Matas, M., Simonić, V., Šobot, S.: Zaštita okoline danas za sutra, Školska knjiga, Zagreb, 1989.
Pandey, G. N., Carney, G. C.: Environmental Engineering, Tata McGraw-Hill, New Delhi, 1989

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

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