Semester 1		
Undergraduate professional study in mechatronics obligatory courses		
P:prof.vis.šk. Ivica Levanat P: Alemka Knapp A:prof.vis.šk. Ivica Levanat A: Alemka Knapp L:prof.dr. Dubravko Horvat L: Diana Šaponja-Milutinović dipl.ing.fizike, pred.	Physics	ECTS:6.0
A:pred. Valter Perinović mag. kineziologije	Physical Education	ECTS:1.0
P:dr.sc. Vlatko Mićković prof. A:dr.sc. Vlatko Mićković prof.	Mathematics	ECTS:7.0
P: Vesna Alić-Kostešić dipl.ing.stroj. P:Doc. dr. sc. Ana Pilipović P: Željko Alar P:izv.prof. dr. sc. Darko Landek P: Mladen Šercer L: Mladen Šercer L:izv.prof. dr. sc. Darko Landek L:Doc. dr. sc. Ana Pilipović L: Željko Alar	Materials and Manufacturing Processes	ECTS:5.0
P: Vesna Alić-Kostešić dipl.ing.stroj. L: Miroslav Radaković	Methodology of professional and scientific research	ECTS:2.0
P: Mia Čarapina dipl. ing., pred. L: Goran Sirovatka	Osnove programiranja	ECTS:5.0
P: Vesna Alić-Kostešić dipl.ing.stroj. P: Hrvoje Galijan dipl.ing.stroj. K: Hrvoje Galijan dipl.ing.stroj. K: Antonio Antunović dipl. ing. brodogradnje K: Saša Radić	Technical Documentation	ECTS:4.0

Semester 2		
Undergraduate professional study in mechatronics obligatory courses		
A:pred. Valter Perinović mag. kineziologije	Physical Education	ECTS:1.0
P: Hrvoje Rakić , dipl.ing.stroj., pred. L: Hrvoje Rakić , dipl.ing.stroj., pred.	Matlab	ECTS:2.0
P: Vesna Alić-Kostešić dipl.ing.stroj. P: Branimir Markulin Grgić A: Miroslav Radaković	Mechanics	ECTS:6.0
P: Vesna Alić-Kostešić dipl.ing.stroj. P: Hrvoje Galijan dipl.ing.stroj. P:dr. sc. Emil Barić mag. ing. mech. A: Hrvoje Galijan dipl.ing.stroj. K: Hrvoje Galijan dipl.ing.stroj. K: Goran Lukić A:dr. sc. Emil Barić mag. ing. mech. K:dr. sc. Emil Barić mag. ing. mech. K:mr.sc. Ante Zaninović dipl.ing.brod. K: Antonio Antunović dipl. ing. brodogradnje	Machine Elements	ECTS:5.0
P:izv. prof. dr. sc. Edouard Ivanjko L: Dino Čakija L: Josip Ćurković mag. ing. el. techn. inf. A: Milivoj Mandić	Electrical Engineering	ECTS:6.0
P:dr.sc. Vlatko Mićković prof. A:dr.sc. Vlatko Mićković prof.	Applied Mathematics	ECTS:5.0
P:pred. Ivan Lujo , dipl.ing. A:pred. Ivan Lujo , dipl.ing. L:pred. Ivan Lujo , dipl.ing. A: Dean Fraj struč. spec. ing. el. L: Dean Fraj struč. spec. ing. el.	Sensors	ECTS:5.0

Semester 3		
Undergraduate professional study in mechatronics obligatory courses		
P: Dino Čakija P:izv. prof. dr. sc. Edouard Ivanjko A: Josip Ćurković mag. ing. el. techn. inf. L: Josip Ćurković mag. ing. el. techn. inf. L: Želimir Ivanović	Electronics and Sensors	ECTS:5.0
P:dr. sc. Toni Bjažić prof. v. š. L: Josip Ćurković mag. ing. el. techn. inf. A: Antonia Penđer mag. ing. stroj. L: Antonia Penđer mag. ing. stroj.	Elements of Automation	ECTS:5.0
P:mr.sc. Milivoj Puzak v. pred A:mr.sc. Milivoj Puzak v. pred L:mr.sc. Milivoj Puzak v. pred	Electrical Engineering Energy	ECTS:6.0
A:pred. Valter Perinović mag. kineziologije	Physical Education	ECTS:1.0
P: Branimir Markulin Grgić P: Vesna Alić-Kostešić dipl.ing.stroj. K: Zvonimir Petković mag. ing. mech. K: Antonio Antunović dipl. ing. brodogradnje	Computer Aided Design	ECTS:5.0
P: Branimir Markulin Grgić P: Vesna Alić-Kostešić dipl.ing.stroj. A: Branimir Markulin Grgić A: Miroslav Radaković	Essentials of Mechanisms	ECTS:5.0
Undergraduate professional study in mechatronics elective courses		
P:dr.sc. Biljana Stojaković ,prof.v.š. u trajnom zvanju A:dr.sc. Ivana Špiranec prof. visoke škole	English Language in Mechatronics	ECTS:3.0
P: Marija Krstinić A: Marija Krstinić	German Language in Mechatronics	ECTS:3.0

Semester 4		
Undergraduate professional study in mechatronics obligatory courses		
A:pred. Valter Perinović mag. kineziologije	Physical Education	ECTS:1.0
P:dr. sc. Toni Bjažić prof. v. š. A: Josip Ćurković mag. ing. el. techn. inf. L: Josip Ćurković mag. ing. el. techn. inf. L: Tin Mohor L: Antonia Penđer mag. ing. stroj.	Process modeling and simulation	ECTS:5.0
P: Filip Mateša mag. ing. mech. P: Vesna Alić-Kostešić dipl.ing.stroj. A: Filip Mateša mag. ing. mech. L: Filip Mateša mag. ing. mech.	Pneumatics and Hydraulics	ECTS:6.0
P:mr.sc. Goran Malčić v.pred. L: Ivica Vlašić	Processing Computers	ECTS:6.0
P:dr. sc. Toni Bjažić prof. v. š. L: Josip Ćurković mag. ing. el. techn. inf. A: Antonia Penđer mag. ing. stroj. L: Antonia Penđer mag. ing. stroj.	Automatic control	ECTS:5.0
Undergraduate professional study in mechatronics elective courses		
P:prof. dr. sc. Dario Matika A:prof. dr. sc. Dario Matika L: Antonia Penđer mag. ing. stroj.	Robots and Manipulators	ECTS:4.0
P: Zvonimir Petković mag. ing. mech. P: Vesna Alić-Kostešić dipl.ing.stroj. L: Zvonimir Petković mag. ing. mech.	Numerically Controlled Machine Tools	ECTS:4.0
P: Mario Panjičko L: Mario Panjičko	Technologies and plants for waste treatment and recycling	ECTS:6.0
Undergraduate professional study in mechatronics elective courses		
P:dr.sc. Biljana Stojaković ,prof.v.š. u trajnom zvanju A:dr.sc. Ivana Špiranec prof. visoke škole A: Zoran Vulelija	Business English Language in Mechatronics	ECTS:3.0
P: Marija Krstinić A: Marija Krstinić	Business German Language in Mechatronics	ECTS:3.0

Semester 5		
Undergraduate professional study in mechatronics obligatory courses		
P:prof. dr. sc. Dario Matika A:prof. dr. sc. Dario Matika L:prof. dr. sc. Dario Matika A: Antonia Penđer mag. ing. stroj.	Electrical Servo Drives	ECTS:5.0
P:dr. sc. Tomislav Pavlović L:dr. sc. Tomislav Pavlović L: Dean Fraj struč. spec. ing. el.	Communication Techniques in Mechatronics	ECTS:4.0
P:mr.sc. Ante Zaninović dipl.ing.brod. P: Vesna Alić-Kostešić dipl.ing.stroj. A:mr.sc. Ante Zaninović dipl.ing.brod. L:mr.sc. Ante Zaninović dipl.ing.brod.	Metrology and Quality Control	ECTS:4.0
P:mr.sc. Branimir Preprotić dipl. inž. stroj. P: Vesna Alić-Kostešić dipl.ing.stroj. A:mr.sc. Branimir Preprotić dipl. inž. stroj. L:mr.sc. Branimir Preprotić dipl. inž. stroj. A: Darko Mitrović	Maintenance of Technical Systems in Mechatronics	ECTS:4.0
P: Boris Matjačić P:dr. sc. Toni Bjažić prof. v. š. L: Boris Matjačić	Printed Circuit Board Design	ECTS:4.0
P:dr. sc. Toni Bjažić prof. v. š. L:dr. sc. Toni Bjažić prof. v. š. L: Dean Fraj struč. spec. ing. el. L: Tin Mohor	Designing Embedded Computer Systems	ECTS:5.0
Undergraduate professional study in mechatronics elective courses		
P:Dr.sc. Vlasta Zanki dipl.ing.stroj. P: Vesna Alić-Kostešić dipl.ing.stroj. A:Dr.sc. Vlasta Zanki dipl.ing.stroj. L:Dr.sc. Vlasta Zanki dipl.ing.stroj.	Energy Management	ECTS:4.0
P: Vesna Alić-Kostešić dipl.ing.stroj. P:dr. sc. Emil Barić mag. ing. mech. A:dr. sc. Emil Barić mag. ing. mech. L:dr. sc. Emil Barić mag. ing. mech.	Transportation Systems	ECTS:4.0

Semester 6		
Undergraduate professional study in mechatronics obligatory courses		
P:dr. sc. Toni Bjažić prof. v. š. S: Antonia Penđer mag. ing. stroj.	Semestral paper	ECTS:5.0
K: Antonia Penđer mag. ing. stroj. K: Hrvoje Rakić , dipl.ing.stroj., pred.	Practical Work	ECTS:7.0
P:mr.sc. Sergej Lugović MBA A: Dinko Horvat struč.spec.ing.techn.inf. S: Dinko Horvat struč.spec.ing.techn.inf.	Technology Entrepreneurship	ECTS:6.0
S:dr. sc. Toni Bjažić prof. v. š.	Final Thesis	ECTS:12.0
Undergraduate professional study in mechatronics elective courses		
P: Vesna Alić-Kostešić dipl.ing.stroj. S: Vesna Alić-Kostešić dipl.ing.stroj.	Methodology of professional and scientific research	ECTS:2.0

Code WEB/ISVU	23251/143205	**ECTS**	5.0	**Academic year**	2018/2019
Name	Applied Mathematics				
Status	2nd semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (30+0+0+0) 90
Teachers	Lectures:1. dr.sc. Vlatko Mićković prof. Auditory exercises:dr.sc. Vlatko Mićković prof.				
Course objectives	To enable students to solve mathematical problems related to engineering practice.				
Learning outcomes:	1.ability to calculate primitive functions - indefinite integrals. Level:6 2.ability to calculate definite integrals. Level:6 3.ability to calculate improper integrals. Level:6 4.ability to calculate integrals by using numerical methods. Level:6 5.ability to solve basic types of differential equations. Level:6 6.ability to solve differential equations by using Laplace transformation. Level:6 7.ability to solve differential equations by using numerical methods. Level:6				
Involvement of learning outcomes of the course in study programme:	1.1.OPĆI Služiti se stranim jezikom u literaturi i svakodnevnoj stručnoj komunikaciji. : 10h in 150h 1.2.OPĆI Primijeniti znanje matematike i fizike na inženjerske probleme.: 100h in 150h 1.3.OPĆI Koristiti tehnike, vještine i suvremene alate neophodne za inženjersku praksu.: 5h in 150h 1.5.OPĆI Identificirati, modelirati i rješavati inženjerske probleme.: 10h in 150h 2.2.OSOBNE Odgovornost, dosljednost, točnost, ažurnost.: 10h in 150h 2.3.OSOBNE Etički i moralni pristup radu.: 5h in 150h 2.4.OSOBNE Kritička evaluacija argumenata, pretpostavki i podataka u cilju stvaranja mišljenja i pridonošenja rješenju problema.: 10h in 150h				
Methods of carrying out lectures	Ex cathedra teaching Case studies Discussion Questions and answers Other The chalkboard lectures include theory and many examples clearly analyzed step by step, in cooperation with students.				
Methods of carrying out auditory exercises	Group problem solving Discussion, brainstorming Other Exercises are solved on the blackboard in cooperation with students.				
Course content lectures	1.Indefinite integrals, primitive function, basic integrals, 2h, Learning outcomes:1 2.Solving indefinite integrals by substitution and using partial fractions, 2h, Learning outcomes:1 3.Solving indefinite integrals by integration by parts, by completing the square of second degree trinomial, 2h, Learning outcomes:1 4.Definite integrals, Newton-Leibnizs formula, Mid value theorem for integrals, 2h, Learning outcomes:1,2 5.Improper integrals, trigonometry and hyperbolic supstitutions, 2h, Learning outcomes:1,2 6.Application of definite integrals: areas of plane figures, the arc length of a curve, volumes of solids and areas of surfaces of revolution, 2h, Learning outcomes:1,2,3 7.Numerical methods of calculating definite integrals, 2h, Learning outcomes:1,2,3,4 8.1. exam, 2h, Learning outcomes:1,2,3,4 9.Ordinary differential equations - introduction, 2h, Learning outcomes:5 10.First order ODE with separable variables, homogenous ODEs, 2h, Learning outcomes:5 11.Solving ODEs by variable substitution (homogeneous diff. eqs., ode of form y=f(ax+by+c)), 2h, Learning outcomes:5 12.Linear ODEs, homogenous and nonhomogenous, variation of constant method, integrating factor method, 2h, Learning outcomes:5 13.Linear ODEs of second order with constant coefficients, homogenous and nonhomogenous, 2h, Learning outcomes:5 14.Solving ODEs by Laplaces transformation; Numerical methods of solving ODEs, 2h, Learning outcomes:5,6,7 15.2. exam, 2h, Learning outcomes:5,6,7				
Course content auditory	1.Indefinite integrals, primitive function, basic integrals, 2h, Learning outcomes:1 2.Solving indefinite integrals by substitution, and using partial fractions, 2h, Learning outcomes:1 3.Solving indefinite integrals by integration by parts, by completing the square of second degree trinomial, 2h, Learning outcomes:1 4.Definite integrals, Newton-Leibnizs formula, 2h, Learning outcomes:1,2 5.Improper integrals, trigonometry and hyperbolic supstitutions, 2h, Learning outcomes:1,2 6.Application of definite integrals: the areas of plane figures, the arc length of a curve, volumes of solids and areas of surfaces of revolution, 2h, Learning outcomes:1,2,3 7.Numerical methods of calculating definite integrals, 2h, Learning outcomes:1,2,3,4 8.1. exam, 2h, Learning outcomes:1,2,3,4 9.Ordinary differential equations - introduction, 2h, Learning outcomes:5 10.First order ODE with separable variables, 2h, Learning outcomes:5 11.Solving ODEs by variable substitution (homogeneous diff. eqs., ode of form y=f(ax+by+c)), 2h, Learning outcomes:5 12.Linear ODEs, homogenous and nonhomogenous, variation of constant method, integrating factor method, 2h, Learning outcomes:5 13.Linear ODEs of second order with constant coefficients, homogenous and nonhomogenous, 2h, Learning outcomes:5 14.Solving ODEs by Laplaces transformation; Numerical methods of solving ODEs, 2h, Learning outcomes:6,7 15.2. exam, 2h, Learning outcomes:5,6,7				
Required materials	Basic: classroom, blackboard, chalk... Whiteboard with markers Special equipment Some of the problems are solved using the appropriate software Mathematica.				

Exam literature	Basic literature: 1. P. Javor: Uvod u matematičku analizu, Školska knjiga, Zagreb, 1983. 2. S. Suljagić: Matematika II, skripta, Zagreb, 2006. 3. I. Slapničar: Matematika 2, skripta, Split, 2008. 4. B. P. Deminovič: Zadaci i rješeni primjeri iz više matematike, Danjar, Zagreb, 1995. Additional literature: 1. L. Krnić, Z. Šikić: Račun diferencijalni i integralni, I dio, Školska knjiga, Zagreb, 1992. 2. I. Ivanšić: Fourierov red i integral, diferencijalne jednadžbe, skripta, FER, Zagreb, 1997. 3. T. Bradić, R. Roki, J. Pečarić, M. Strunje: Matematika za tehničke fakultete, Multigraf, Zagreb, 1994.
Students obligations	No special requirements.
Knowledge evaluation during semester	Two exams during semester Ratings by the outcome: maximum 100 points 50-62 sufficient (2) 63-75 good (3) 76-88 very good (4) 89-100 excellent (5)
Knowledge evaluation after semester	Written exam 60% of mark Ratings of written part of the exam: maximum 100 points 50-62 sufficient (2) 63-75 good (3) 76-88 very good (4) 89-100 excellent (5) Oral exam 40% of mark
Student activities:	Aktivnost — ECTS (Written exam) — 4 (Oral exam) — 1
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
Proposal made by	dipl.ing.mat Tihana Strmečki., 19.05.2016.

Code WEB/ISVU	23544/156312	**ECTS**	5.0	**Academic year**	2018/2019
Name	Automatic control				
Status	4th semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (15+15+0+0) 90
Teachers	Lectures:1. dr. sc. Toni Bjažić prof. v. š. Auditory exercises: Antonia Penđer mag. ing. stroj. Laboratory exercises: Josip Ćurković mag. ing. el. techn. inf. Laboratory exercises: Antonia Penđer mag. ing. stroj.				
Course objectives	To introduce students to the structure of automatic control systems, methods of description of their characteristics and modelling, methods of stability analysis and synthesis of linear continuous and digital control systems				
Learning outcomes:	1.ability to draw a block schematics of tipical control system, to differentiate the rolls of individual blocks and make basic transformations between blocks. Level:6 2.ability to draw the Bode plot of the frequency characteristics of typical automation elements. Level:6 3.ability to draw the Bode plot of the frequency characteristics of the open loop with a controller. Level:6 4.ability to calculate the gain margin and phase margin of a control system. Level:6 5.ability to calculate the static, kinetic and dynamic error of a control system. Level:6 6.ability to assess the response overshoot and peak response time from the phase margin and crossing frequency. Level:6,7 7.ability to calculate the controller parameters from the given control quality indicators. Level:6				
Methods of carrying out lectures	Ex cathedra teaching Case studies Simulations Questions and answers				
Methods of carrying out auditory exercises	Group problem solving Discussion, brainstorming Computer simulations Solving the typical problem tasks.				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Laboratory exercises, computer simulations Computer simulations				
Course content lectures	1.Introductory lecture; Basic terms and classification of control systems, 2h, Learning outcomes:1 2.Static and dynamic characteristics of control system elements, 2h, Learning outcomes:1 3.Modeling of control system elements, 2h, Learning outcomes:1 4.Transfer functions and frequency characteristics of elements - part 1, 2h, Learning outcomes:2 5.Transfer functions and frequency characteristics of elements - part 2, 2h, Learning outcomes:2 6.Transfer functions and frequency characteristics of elements - part 3, 2h, Learning outcomes:2 7.First control exam, 2h, Learning outcomes:1,2 8.Stabilty of automatic control systems - part 1, 2h, Learning outcomes:3,4 9.Stabilty of automatic control systems - part 2, 2h, Learning outcomes:3,4 10.Determination of control quality indicators of continuous systems - part 1, 2h, Learning outcomes:5,6 11.Determination of control quality indicators of continuous systems - part 2, 2h, Learning outcomes:5,6 12.Synthesis of continuous control systems using frequency methods - part 1, 2h, Learning outcomes:7 13.Synthesis of continuous control systems using frequency methods - part 2, 2h, Learning outcomes:7 14.Introduction to digital control systems, 2h, Learning outcomes:7 15.Second control exam, 2h, Learning outcomes:3,4,5,6,7				
Course content auditory	1.Using inverse Laplace transform for calculation of responses of typical control system elements - part 1, 1h, Learning outcomes:1 2.Using inverse Laplace transform for calculation of responses of typical control system elements - part 2, 1h, Learning outcomes:1 3.Complex analysis as introduction to frequency characteristics of elements, 1h, Learning outcomes:2 4.Frequency characteristics of typical control system elements - numeric examples 1, 1h, Learning outcomes:2 5.Frequency characteristics of typical control system elements - numeric examples 2, 1h, Learning outcomes:2 6.Frequency characteristics of typical control system elements - numeric examples 3, 1h, Learning outcomes:2 7.First control exam, 1h, Learning outcomes:1,2 8.Stability and control quality assesment - technical optimum - second order process, 1h, Learning outcomes:3,4,6 9.Stability and control quality assesment - technical optimum - third order process, 1h, Learning outcomes:3,4,6 10.Stability and control quality assesment - symmetrical optimum - second order process, 1h, Learning outcomes:3,4,6 11.Stability and control quality assesment - symmetrical optimum - third order process, 1h, Learning outcomes:3,4,6 12.Calculation of continuous PI controller parameters from given response overshoot - example 1, 1h, Learning outcomes:3,4,5,6,7 13.Calculation of continuous PI controller parameters from given response overshoot - example 2, 1h, Learning outcomes:3,4,5,6,7 14.Calculation of digital PI controller parameters from given response overshoot, 1h, Learning outcomes:3,4,5,6,7 15.Second control exam, 1h, Learning outcomes:3,4,5,6,7				
Course content laboratory	1.Block schematics of typical control system in Simulink, 1h, Learning outcomes:1 2.Using embedded Matlab functions for calculation of responses and frequency characteristics of elements, 1h, Learning outcomes:2 3.Responses of typical automation element on a harmonic excitation - introduction to the frequency characteristics, 1h, Learning outcomes:2 4.Bode plot of the frequency characteristics of typical first order elements - part 1, 1h, Learning outcomes:2 5.Bode plot of the frequency characteristics of typical first order elements - part 2, 1h, Learning outcomes:2				

	6.Bode plot of the frequency characteristics of the second order elements, 1h, Learning outcomes:2 7.First control exam, 1h, Learning outcomes:1,2 8.Control quality assesment using Bode plots of frequency characteristics - technical optimum - part 1, 1h, Learning outcomes:1,3,4 9.Control quality assesment using Bode plots of frequency characteristics - technical optimum - part 2, 1h, Learning outcomes:1,3,4 10.Control quality assesment using Bode plots of frequency characteristics - symmetric optimum - part 1, 1h, Learning outcomes:1,3,4 11.Control quality assesment using Bode plots of frequency characteristics - symmetric optimum - part 2, 1h, Learning outcomes:1,3,4 12.Calculation of continuous PI controller parameters from given response overshoot - part 1, 1h, Learning outcomes:1,3,4,5,6,7 13.Calculation of continuous PI controller parameters from given response overshoot - part 2, 1h, Learning outcomes:1,3,4,5,6,7 14.Calculation of digital PI controller parameters from given response overshoot, 1h, Learning outcomes:1,3,4,5,6,7 15.Second control exam, 1h, Learning outcomes:3,4,5,6,7
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory General purpose computer laboratory Whiteboard with markers Overhead projector
Exam literature	Basic literature: 1. P. Crnošija, T. Bjažić: Osnove automatike, I. Dio: Analiza i sinteza kontinuiranih sustava - teorija i primjena, Element, Zagreb, 2011. 2. N.S. Nise: Control Systems Engineering, 6th edition, John Wiley Sons, New Jersey, 2011. ISBN13: 978-0470-54756-4 3. J. Petrić: Automatska regulacija: Uvod u analizu i sintezu, Fakultet strojarstva i brodogradnje, Sveučilište u Zagrebu, 2012. 4. D. Matika: Sustavi digitalnog upravljanja, skripta, Tehnički fakultet, Sveučilšte u Rijeci, 2005. Additional literature: 1. K. Ogata, Modern Control Engineering, Pearson Education Inc., Upper Saddle River, New Jersey, 2010. 2. Li Qui, Kemin Zhou, Introduction to Feedback Control, Pearson Education Inc., Upper Saddle River, New Jersey, 2010.
Students obligations	Student must achieve minimum 30 points during semester.
Knowledge evaluation during semester	A maximum of 60 points can be earned during the semester through the following activities: 1. presence on lectures, auditory and laboratory exercises maximum 7.5 points, minimum 5 points to pass, 2. short exams on lectures and auditory exercises maximum 12.5 points, minimum 0 points to pass, 3. preparation tests on laboratory exercises (entrance tests) maximum 10 points, minimum 0 points to pass, 4. two main exams maximum 30 points (2 x 15), minimum 0 points to pass. A prerequisite to take the final exam is earning at least 30 points during the semester. Students which earn less than 15 points are graded F (unsuccesfull) and they have to enroll the course again in the next academic year. Students which earn between 15 and 30 points are graded FX (insufficient), but they can approach an additional exam. The additional exam is carried out on the first exam term, and it contains tasks from 2, 3 and 4 enumeration above with a total of 30 points. If the student earns 15 or more points on the additional exam, the total points earned during the semester will be set to 30 and student can approach the final exam.
Knowledge evaluation after semester	A maximum of 40 points can be earned on the final exam, so the total number of points on the course is equal to 100. The grading is carried out according to the following scales (ISVU and ECTS scales): [50, 60) grade 2 (pass) or ECTS grade E [60, 65) grade 2 (pass) or ECTS grade D [65, 80) grade 3 (good) or ECTS grade C [80, 90) grade 4 (very good) or ECTS grade B [90, 100] grade 5 (excellent) or ECTS grade A
Student activities:	Aktivnost — ECTS (Classes attendance) — 2 (Constantly tested knowledge) — 3
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
Proposal made by	Toni Bjažić, Ph.D., senior lecturer

Code WEB/ISVU	23545/156314	**ECTS**	3.0	**Academic year**	2018/2019
Name	Business English Language in Mechatronics				
Status	4th semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - elective course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (30+0+0+0) 30
Teachers	Lectures:1. dr.sc. Biljana Stojaković ,prof.v.š. u trajnom zvanju Auditory exercises:dr.sc. Ivana Špiranec prof. visoke škole Auditory exercises: Zoran Vulelija				
Course objectives	To develop basic language skills, taking into consideration the field of expertise; to enable students to carry out both written and oral communication, to write a cv and a job application letter, to prepare students for a job interview				
Learning outcomes:	1.to write a job application letter. Level:6,7 2.to wirte a cv. Level:6,7 3.to relate academic degrees in engineering education in various countries. Level:6,7 4.to relate levels of engineering education in the English speaking countries and in Croatia. Level:6,7 5.to analyse elements of a job interview. Level:6 6.to present a company. Level:6,7 7.ability to present specific subjects related to the field of expertise. Level:6,7 8.ability to give comments on subjects related to the field of expertise. Level:6 9.ability to write a summary of a specific text related to the field of expertise. Level:6,7 10.ability to combine the expressions used in business communication (both oral and written). Level:6,7 11.to generate dialogues. Level:6,7 12.to analyse phraseology in making phone calls. Level:6 13.to analyse acronyms and abbreviations in business communication. Level:6 14.to analyse word formation in English. Level:6				
Methods of carrying out lectures	Ex cathedra teaching Case studies Demonstration Discussion Questions and answers Seminar, students presentation and discussion Homework presentation				
Methods of carrying out auditory exercises	Group problem solving Traditional literature analysis Data mining and knowledge discovery on the Web Essay writing Discussion, brainstorming Interactive problem solving Workshop Students practice the skills of listening, reading, speaking and writing and adopt technical terminology and devolop and practice grammatical structures characteristic for the English language.				
Course content lectures	1.Forms and levels of engineering education in English speaking countries, 2h, Learning outcomes:1 2.Academic degrees in engineering education in various countries, 2h, Learning outcomes:1,2 3.Jobs in Mechatronics, 2h, Learning outcomes:4 4.Jobs in IT , 2h, Learning outcomes:4 5.Acronyms and abbreviations in business communication, 2h, Learning outcomes:13 6.Phraseology used in making phone calls, 2h, Learning outcomes:12 7.Preliminary exam, 2h, Learning outcomes:1,2,4,12,13 8.CV, 2h, Learning outcomes:2 9.Job application letter, 2h, Learning outcomes:1 10.Job interview , 2h, Learning outcomes:5 11.Job interview Dress Code, 2h, Learning outcomes:5 12.Job interview Body Language, 2h, Learning outcomes:5 13.Presenting a company, 2h, Learning outcomes:6 14.Presenting a company, 2h, Learning outcomes:6 15.Preliminary exam, 2h, Learning outcomes:1,2,5,6				
Course content auditory	1.Research and development; vocabulary exercises, 2h, Learning outcomes:7,8,11 2.Research and development;grammar patterns , 2h, Learning outcomes:7,8 3.Actuators in motion control systems; grammar patterns, vocabulary exercises, 2h, Learning outcomes:7,8 4.Optimising operation through advanced process control; making dialogues, 2h, Learning outcomes:11,13 5. Technical development; grammar patterns, 2h, Learning outcomes:7,8,10,11,13 6.Preliminary exam, 2h, Learning outcomes:7,8,9,10,11,12,13 7.Describing improvements and redesigns; word formation in English, 2h, Learning outcomes:11,14 8.Writing a CV, 2h, Learning outcomes:2 9.Pisanje zamolbe za posao, 2h, Learning outcomes:1 10.Job interview, 2h, Learning outcomes:5,11 11.Job interview, 2h, Learning outcomes:5,11 12.Job interview, 2h, Learning outcomes:5,11 13.Presenting a company, 2h, Learning outcomes:6,8,10,11 14.Presenting a company, 2h, Learning outcomes:6,8,10,11 15.Preliminary exam, 2h, Learning outcomes:6,8,10,11				
Required materials	Basic: classroom, blackboard, chalk... Whiteboard with markers Overhead projector				

	Video equipment Operating supplies	
Exam literature	Osnovna: Hercezi-Skalicki, M. Reading Technical English for Academic Purposes, Školska knjiga, Zagreb, 1993. Tekstovi preuzeti s interneta i iz časopisa The Engineer koji su obrađeni na predavanjima. Tekstovi preuzeti s internet (Design News, etc.9 Additional literature: Bartolić, Lj. Tehnički rječnik brodogradnje, strojarstva i nuklearne tehnike, Školska knjiga, Zagreb, 1991. Ashley, A.A. Handbook of Commercial Correspondence. OUP, 2000 On-line dvojezični i jednojezični rječnici.	
Students obligations	maximum of 3 absences from exercises	
Knowledge evaluation during semester	Regular attendance, mini-tests, homework, seminars, written tests	
Knowledge evaluation after semester	Both written and oral exam	
Student activities:	Aktivnost (Classes attendance) (Activity in class) (Activity in class)	ECTS 1 1 1
Remark	This course can be used for final thesis theme	
Prerequisites:	No prerequisites.	
Proposal made by	Professor Biljana Stojakovic, PhD	

Code WEB/ISVU	23546/156317	**ECTS**	3.0	**Academic year**	2018/2019
Name	Business German Language in Mechatronics				
Status	4th semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - elective course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (30+0+0+0) 30
Teachers	Lectures:1. Marija Krstinić Auditory exercises: Marija Krstinić				
Course objectives	To qualify students to translate English texts related to the field of expertise. To enable students to to reach the A2 level (and certain elements of B1/B2 level) according to the Common European framework of reference for language learning				
Learning outcomes:	1.ability to make a presentation of a chosen/given text related to the field of expertise. Level:6,7 2.ability to communicate and discuss professional topics. Level:6 3.ability to write a summary on a chosen professional topic. Level:6,7 4.ability to understand lectures on professional subjects in German . Level:6,7 5.ability to combine expressions typical for business communication . Level:6,7 6.ability to write a business letter using the standard letter style. Level:6 7.ability to write translation of professional text from German into Croatian by means of a dictionary. Level:6,7 8.ability to analyse language rules and to integrate them into a new context). Level:6				
Methods of carrying out lectures	Ex cathedra teaching Case studies Questions and answers Homework presentation The lectures are only to a lesser extent, when necessary, conceived as a frontal presentation of the lecturer. The students by their questions, which are the indicators of the intensity of the material adopted, may influence to the course of the lectures and according to their preferences to the selection of texts. The lectures are conceived in intercultural and interdisciplinary terms.				
Methods of carrying out auditory exercises	Group problem solving Interactive problem solving During the auditory exercises the students solve various types of assignments continuously being pointed to cognitive, metacognitive and socioaffective strategies of learning which makes independent learning easier. They are trained to use dictionaries and text-books on their own (traditional as well as mediated by electronic media), as well as various reading techniques and to summary writings and basic business and everyday communication.				
Course content lectures	1.Aktueller Text: CeBIT (Filme: Geschichte, Aktuelles); Ausstellungen und Fachmessen, 2h, Learning outcomes:4,7 2.Andere Laender andere Sitten (geschaeftliche Kommunikation schriftlich/muendlich), Briefvorlagen, 1h, Learning outcomes:5,6,8 Anweisungen: Recherchieren, Referate schreiben, referieren, 1h, Learning outcomes:2,3 3.Gutes Benehmen ist auch fuer Berufsanfaenger wichtig, 1h, Learning outcomes:2,4,5,7 Konjunktiv Praeteritum / Konditional, 1h, Learning outcomes:8 4.Sieben Dinge, die Sie nie zu Ihrem Chef sagen sollten, 1h, Learning outcomes:4,5,7,8 Konjunktiv Plusquamperfekt, 1h, Learning outcomes:4,8 5.Prozessautomatisierung und Robotik, 1h, Learning outcomes:4,7 Adjektiv als Attribut und als Teil des Praedikats, Partizipien (Praesens, Perfekt), 1h, Learning outcomes:4,8 6.Partizipialuasdruecke, Umformung: Partizipialausdruck - Relativsatz, 2h, Learning outcomes:4,8 7.Automatisationsanlagen, 1h, Learning outcomes:7,8 Umformung: Relativsatz - Partizipialausdruck, 1h, Learning outcomes:4,8 8.Verfahrenstechniken; Rektion der Verben, 2h, Learning outcomes:1,3,8 9.Werkstoffe fuer den Maschinenbau , 1h, Learning outcomes:7,8 Pronominal- und Frageadverbien, 1h, Learning outcomes:4,8 10.Metallographie oder Werkstoffanalyse, 1h, Learning outcomes:4,7 Komparation; Negationen, 1h, Learning outcomes:8 11.Umweltschutz; Alternative Energiequellen, 2h, Learning outcomes:4,8 12.Computergeschichte (Film), 2h, Learning outcomes:4,8 13.Internet, 1h, Learning outcomes:8 Gekuerzte Saetze (Wiederholung), 1h, Learning outcomes:8 14.Vieltelefonieren mit dem Handy gehirnschaedigend, 1h, Learning outcomes:4,7,8 Relativsaetze (Wiederholung), 1h, Learning outcomes:8 15.Aktueller Text (Anlass), 2h, Learning outcomes:4,7,8				
Course content auditory	1.Arbeit mit dem Vokabelliste, 1h, Learning outcomes:4,7 Kurzgespraeche: Auf Geschaeftsreise (am Bahnhof, am Flughafen, im Hotel), 1h, Learning outcomes:5,8 2.Briefe schreiben (geschaeftlich/privat), 2h, Learning outcomes:7,8 3.Konjunktiv Praeteritum / Konditional (schriftliche Uebungen); Referieren zum gewaehlten Thema, 2h, Learning outcomes:1,2,3,8 4.1. Kolloquium (Fachtext zum Uebersetzen), 2h, Learning outcomes:7 5.Arbeit mit dem Woerterbuch; Konjunktiv Plusquamperfekt (schriftliche Uebungen), 2h, Learning outcomes:1,2,3,8 6.Umformungen (schriftliche Uebungen); Gezielte (grammatische Uebersetzung; Referieren zum gewaehlten Thema, 2h, Learning outcomes:7,8 7.Arbeit mit dem Woerterbuch; Umformungen (schriftliche Uebungen) , 2h, Learning outcomes:7,8 8.2. Kolloquium (Konjunktiv Praeteritum / Konditional; Konjunktiv Plusquamperfekt) , 2h, Learning outcomes:8 9.Arbeit mit der Vokabelliste; Pronominal- und Frageadverbien (schriftliche Uebungen), 2h, Learning outcomes:4,8 10.Komparation; Negationen (schriftliche Uebungen); Referieren zum gewaehlten Thema, 2h, Learning outcomes:1,2,8 11.Arbeit mit dem Woerterbuch; Referieren zum gewaehlten Thema, 2h, Learning outcomes:1,2,3,8 12.Umformungen: Partizipialausdruck - Relativsatz (schriftliche Uebungen); Arbeit mit der Vokabelliste, 2h, Learning outcomes:1,2,3,8 13.3. Kolloquium (Pronominal- und Frageadverbien; Fachtext zum Uebersetzen), 2h, Learning outcomes:7,8 14.Referieren zum gewaehlten Thema, 2h, Learning outcomes:1,2,3,7				

	15.1., 2., 3. Kolloquium (Wiederholung), 2h, Learning outcomes:7,8
Required materials	Basic: classroom, blackboard, chalk... Whiteboard with markers Overhead projector Video equipment During the auditory exercises the students solve various types of assignments continuously being pointed to cognitive, metacognitive and socioaffective strategies of learning which makes independent learning easier. They are trained to use dictionaries and text-books on their own (traditional as well as mediated by electronic media), as well as various reading techniques and to summary writings and basic business and everyday communication.
Exam literature	Osnovna (basic): Stručni časopisi iz svih područja strojarstva. Tekstovi dostupni na stranicama Interneta Dopunska (additional): Rječnici (J. Kljajić, Njemačko-hrvatski praktični rječnik, Školska knjiga, Zagreb, 1998.; M. Uroić, A. Hurm, Hrvatsko-njemački rječnik, Školska knjiga, Zagreb, 1994.; V. Dabac, Tehnički rječnik njemačko-hrvatski, Školska knjiga, Zagreb, 1969.; V. Muljević: Elektrotehnički rječnik njemačko-hrvatski, Školska knjiga, Zagreb, 1996. Gramatike (I. Medić, Deutsche Grammatik fuer jedermann, Školska knjiga, Zagreb, 2002.; T. Marčetić, Pregled gramatike njemačkog jezika, Školska knjiga, Zagreb, 2000.; Dreyer Schmitt: Lehr- und Uebungsbuch der deutschen Grammatik, Verlag fuer Deutsch 2002) M. Čičin-Šain Buljan, J. Kosanović, A. Štampalija, Poslovni njemački 1, Ekonomski fakultet, Zagreb, 1998.
Students obligations	Maximum of 3 absences from exercises - 80%; Homework - 100%.
Knowledge evaluation during semester	Attendance: 15 checkups during semester, value 0%, for passage 80%; Mini-exam: 3 checkups during semester, value 10%, for passage 55%; Homework: 2 checkups, value 10%; for passage 100% Written exam: 3 checkups, value 85%, for passage 55%
Knowledge evaluation after semester	Written exam: value 40%, for passage 55%. The preliminary exam includes various types of assignments for testing knowledge of language patterns and a written translation of technical text on their own. Oral exam: value 60%, for passage 55%. Oral exam includes 1. basic conversation on the assigned topic, 2. retelling the short texts analyzed during the semester, 3. translation of technical texts.
Student activities:	Aktivnost — ECTS (Classes attendance) — 1 (Written exam) — 1 (Activity in class) — 1
Remark	This course can not be used for final thesis theme
Prerequisites:	No prerequisites.
Proposal made by	Angelina Puovic

Code WEB/ISVU	23993/185488	**ECTS**	4.0	**Academic year**	2018/2019
Name	Communication Techniques in Mechatronics				
Status	5th semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+15 (0+15+0+0) 75
Teachers	Lectures:dr. sc. Tomislav Pavlović Laboratory exercises: Dean Fraj struč. spec. ing. el. Laboratory exercises:dr. sc. Tomislav Pavlović				
Course objectives	To introduce students to communication technologies used in Mechatronics systems.				
Learning outcomes:	1.ability to analyze and classify information and massages in control systems. Level:6 2.ability to analyze industrial communication and information systems. Level:6 3.ability to write clear and efficient code. Level:6,7 4.ability to choose proper laboratory equipment in analysis of communication systems. Level:7 5.ability to implement communication protocols in mechatronic systems. Level:6,7 6.ability to propose a mechatronic system with appropriate communication subsystem. Level:7				
Methods of carrying out lectures	Ex cathedra teaching Case studies Demonstration Simulations Discussion Questions and answers Seminar, students presentation and discussion				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Laboratory exercises, computer simulations Computer simulations Workshop				
Course content lectures	1.Introduction: Description of a mechatronic system with a communication subsystem, 2h, Learning outcomes:1 2.Design and general characteristics of communication systems, 2h, Learning outcomes:1,6 3.AD, DA conversion, analog communication, 2h, Learning outcomes:1,2,5 4.Analog communication, signal conditioning and filtering, 2h, Learning outcomes:1,2,5 5.Digital communication, parallel data transfer, 2h, Learning outcomes:1,2,5 6.Serial communication protocols - synchronous communication protocols, 2h, Learning outcomes:1,2,5 7.Synchronous serial communication protocols, 2h, Learning outcomes:1,2,5 8.Midterm exam, 2h, Learning outcomes:1,2,3,5,6 9.Asynchronous serial communication protocols, 2h, Learning outcomes:1,2,5 10.Asynchronous serial communication protocols, 2h, Learning outcomes:1,2,5 11.Industrial communication protocols, 2h, Learning outcomes:1,2,5 12.Industrial communication protocols, 2h, Learning outcomes:1,2,5 13.Wirelless communication protocols, 2h, Learning outcomes:1,2,5 14.Wirelless communication protocols and Internet, 2h, Learning outcomes:1,2,5 15.Final exam, 2h, Learning outcomes:1,2,3,5,6				
Course content laboratory	1.No exercises 2.No exercises 3.Introduction to a chosen microcontroller platform and laboratory equipment, 2h, Learning outcomes:3,4 4.No exercises 5.AD and DA conversion, Nyquist sampling theorem, analog communication, 3h, Learning outcomes:1,3,4 6.No exercises 7.Paralell communication, 3h, Learning outcomes:3,4,5 8.No exercises 9.SPI serial protocol, 3h, Learning outcomes:3,4,5 10.No exercises 11.I2C serial protocol, 3h, Learning outcomes:3,4,5 12.Asynchronous serial communication (UART) and CAN protocol, 3h, Learning outcomes:3,4,5 13.No exercises 14.Exam, 1h, Learning outcomes:1,2,3,4,5,6 15.No exercises				
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory Special purpose computer laboratory Overhead projector Special equipment mbed LPC 1768, signal generator, digital voltmeter, oscilloscope				
Exam literature	Osnovna literatura: 1. Rob Toulson, Tim Wilmshurst: Fast and Effective Embedded Systems Design - Applying the ARM mbed, Second Edition, Newnes, 2017. 2. J. Šribar, B. Motik: Demistificirani C++, 3. prošireno izdanje, Element, Zagreb, 2010. 3. Bilješke s predavanja 4. Bilješke s laboratorijskih vježbi				
Students obligations	Attendance at all exercises, passed laboratory exercise exam				
Knowledge evaluation during	numerical assignments quiz				

semester	theoretical questions code writing practical problem solving on a chosen microcontroller platform
Knowledge evaluation after semester	Written exam (numerical assignments, quiz, theoretical questions, code writing, practical problem solving on a chosen microcontroller platform) Optional oral exam
Student activities:	Aktivnost — ECTS (Classes attendance) — 2 (Constantly tested knowledge) — 2
Remark	This course can be used for final thesis theme
Prerequisites:	Students cannot enroll in this course unless they have passed Elektronički elementi i sklopovi Students cannot enroll in this course unless they have completed Procesna računala
ISVU equivalents:	170036;
Proposal made by	Tomislav Pavlović

Code WEB/ISVU	23538/156302	**ECTS**	5.0	**Academic year**	2018/2019
Name	Computer Aided Design				
Status	3rd semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+45 (0+0+0+45) 75
Teachers	Lectures:1. Vesna Alić-Kostešić dipl.ing.stroj. Lectures: Branimir Markulin Grgić Construction exercises: Antonio Antunović dipl. ing. brodogradnje Construction exercises: Zvonimir Petković mag. ing. mech.				
Course objectives	To qualify students to design components, circuits, complex tin surfaces and write technical documentation.				
Learning outcomes:	1.ability to shape the process and a product. Level:6 2.ability to design mechanical parts and assemblies. Level:6,7 3.ability to devise the design process as a subsystem of the manufacturing system. Level:6 4.ability to analyse the impact of the tools, loads, materials, cost, method of production and processing. Level:6 5.ability to identify the importance and impact of standardisation, ergonomics and maintenance related to proper design of machine parts. Level:6 6.Design - a two-piece straight box and curved box with a countersunk engraved. Level:6 7.Build a connecting rod and the nozzle. Level:6,7 8.Sketch shaft and hollow nut. Level:6 9.Solve the carrier and the cam. Level:6 10.Create thin-walled housing and ball bearing. Level:6,7 11.Combine different radii of curvature of the cap and draw a flange. Level:6,7 12.Shape exhaust manifold and a candlestick. Level:6 13.Edit flange and cutter. Level:6,7 14.Devise extension spring and heat exchanger. Level:6,7 15.Construct gears. Level:6,7 16.Draw a roller and roller workshop draft. Level:6 17.Compile machine mechanism and simulate the working principle. Level:6,7 18.Create a sheet metal housing. Level:6,7 19.Put together curved surface of the phone and vases. Level:6,7 20.Connect truss. Level:6,7				
Methods of carrying out lectures	Ex cathedra teaching Demonstration Material is delivered frontally, oral presentations, interviews and method.				
How construction exercises are held	Laboratory exercises, computer simulations Group problem solving Computer simulations Workshop Exercises are performed in groups, using the talks and demonstrations, as well as individual work.				
Course content lectures	1.Design basics, 2h, Learning outcomes:1 2.Settings, 2h, Learning outcomes:1 3.Design technologies , 2h, Learning outcomes:1 4.Product and process modelling , 2h, Learning outcomes:2 5.Design process , 2h, Learning outcomes:2 6.Design process phases , 2h, Learning outcomes:2 7.Design process as a production subsystem, 2h, Learning outcomes:3 8.Design process organisation, 2h, Learning outcomes:3 9.Information flows, 2h, Learning outcomes:3 10.Production types - traditional (individual, serial, mass) and contemporary , 2h, Learning outcomes:4 11.Module design, 2h, Learning outcomes:4 12.Design classification, 2h, Learning outcomes:4 13.Design principles, 2h, Learning outcomes:5 14.Importance of a material function, cost-effectiveness, processing type, 2h, Learning outcomes:5 15.Importance of standardisation, ergonomics, maintenance and serving and their influence on proper design of machine parts, 2h, Learning outcomes:5				
Course content constructures	1.Designing a 3D model of the box - Sketch 2D drawing, Extrude in 3D, Shell, 2h, Learning outcomes:6 2.Making the connecting rod and the nozzle - symmetric extrude in 3D, draft, mirror, 2h, Learning outcomes:7 3.Sketching and shaft and hollow nut - revolving profile, cut revolving, 2h, Learning outcomes:8 4.Solution of carrier extruded by default path and making eccentric flywheel by mirroring, 2h, Learning outcomes:9 5.Creating a thin-walled housing - swept with guided curves and manufacture of ball bearing - circular pattern, 2h, Learning outcomes:10 6.Combining different radii of curvature of the cap and drawing flanges - drilling with , 2h, Learning outcomes:11 7.Formatting exhaust manifold - 3D-sketch and making the candlestick - revolving and swept, 2h, Learning outcomes:12 8.Editing flanges and cutter -loft, 2h, Learning outcomes:13 9.Devise extension spring and a heat exchanger - apply the equation, add names, 2h, Learning outcomes:14 10.Construction gear, 2h, Learning outcomes:15 11.Drawing roller and making workshop drawings of roller, 2h, Learning outcomes:16 12.Assembling the mechanisms of the elements and simulation of principles of motion, 2h, Learning outcomes:17 13.Creating a sheet metal casing, 2h, Learning outcomes:18 14.Stacking curved surface - the phone and vase - transparency, 2h, Learning outcomes:19 15.Connecting trusses - 3D sketching, 2h, Learning outcomes:20				
Required materials	Basic: classroom, blackboard, chalk... General purpose computer laboratory				

	Whiteboard with markers Overhead projector classrooms, a projector, a computer lab	
Exam literature	Osnovna: 1. Kostelić A., Marjanović D., Znanost o konstruiranju, EGE Zagreb, 1997. 2. Hubka V Eder. W.E. Marjanović D: Osnove konstruiranja 3. Hubka V Eder. W.E. Principles of Engineering Design, Heurista, Zrich, 1987. Dodatna: 1. Lee, K: Principles of CAD/CAM Systems, Addison Wesley Longman, Mexico city 1999 2. Student Guide Solid Edge Fundamentals MTO1413-SG-180 3. Slade Ivo - Vježbe iz konstruiranja računalom - Solid Works	
Students obligations	maximum of 3 absences from exercises	
Knowledge evaluation during semester	Regular attendance, Colloquium - theoretical issues, Colloquium - graphical tasks	
Knowledge evaluation after semester	Written exam Verbally exam	
Student activities:	Aktivnost (Constantly tested knowledge) (Practical work) (Written exam)	ECTS 1 2 2
Remark	This course can not be used for final thesis theme	
Prerequisites:	No prerequisites.	

Code WEB/ISVU	23763/170039	**ECTS**	5.0	**Academic year**	2018/2019
Name	Designing Embedded Computer Systems				
Status	5th semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (0+30+0+0) 90
Teachers	Lectures:1. dr. sc. Toni Bjažić prof. v. š. Laboratory exercises:dr. sc. Toni Bjažić prof. v. š. Laboratory exercises: Dean Fraj struč. spec. ing. el. Laboratory exercises: Tin Mohor				
Course objectives	To teach students how to use and design microcontroller based systems in mechatronics				
Learning outcomes:	1.ability to choose proper microcontroller system for given application in mechatronics. Level:7 2.ability to write simple functions, classes and programs in C++ language. Level:6,7 3.ability to write simple programs in C++ language for chosen microcontroller system. Level:6,7 4.ability to combine your own written classes with predefined classes for work with periferal units of chosen microcontroller system. Level:6,7 5.ability to prepare documentation for production of simple printed circuit boards (PCB). Level:6,7				
Methods of carrying out lectures	Ex cathedra teaching Case studies Demonstration Simulations Discussion Questions and answers				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Laboratory exercises, computer simulations Design of hardware and software support for peripheral units				
Course content lectures	1.Introductory lecture; Basics of embedded computer systems, 2h, Learning outcomes:1 2.Program language C++; Object oriented programming approach; Writing simple programs, 2h, Learning outcomes:2 3.Using functions and classes in C++ language, 2h, Learning outcomes:2 4.Processors in embedded systems; Memory architectures in embedded control systems, 2h, Learning outcomes:1 5.Input-output hardware units (A/D, D/A, PWM, GPIO, serial and parallel interfaces, buses), 2h, Learning outcomes:1 6.Input-output hardware units as objects in C++ language; Configuring and examples of read/write operations, 2h, Learning outcomes:3,4 7.Interrupts, exceptions, timers, counters, interrupt controllers; Software support in C++ language for chosen microcontroller - part 1, 2h, Learning outcomes:3,4 8.Interrupts, exceptions, timers, counters, interrupt controllers; Software support in C++ language for chosen microcontroller - part 2, 2h, Learning outcomes:3,4 9.First control exam, 2h, Learning outcomes:1,2,3,4 10.Case study: Temperature control, 2h, Learning outcomes:1,2,3,4 11.Case study: Measuring quantity of produced electricity from photovoltaic source, 2h, Learning outcomes:1,2,3,4 12.Case study: Rotation speed control of DC drive, 2h, Learning outcomes:1,2,3,4 13.Case study: Implementation of recursive equations, 2h, Learning outcomes:1,2,3,4 14.Design of printed circuit boards using specialized software tools, 2h, Learning outcomes:5 15.Second control exam, 2h, Learning outcomes:1,2,3,4				
Course content laboratory	1.Getting acquainted with development platform of C++ programming language, 2h, Learning outcomes:2 2.Writing simple programs in C++; Using branching and loops, 2h, Learning outcomes:2 3.Using functions in C++, 2h, Learning outcomes:2 4.Using classes in C++ language - part 1, 2h, Learning outcomes:2 5.Using classes in C++ language - part 2, 2h, Learning outcomes:2 6.Getting acquainted with properties of chosen microcontroller and its development environment; Building the first program, 2h, Learning outcomes:1,2,3 7.Working with digital inputs and outputs of chosen microcontroller, 2h, Learning outcomes:1,2,3,4 8.Working with analog inputs and outputs of chosen microcontroller; PWM outputs, 2h, Learning outcomes:1,2,3,4 9.Communication with personal computer using serial interface, 2h, Learning outcomes:1,2,3,4 10.Communication with user using LCD display and serial interface, 2h, Learning outcomes:1,2,3,4 11.Using interrupt routine for event counting; Using timers, 2h, Learning outcomes:1,2,3,4 12.Using interrupt routine for precise timing control; Implementation of recursive equations, 2h, Learning outcomes:1,2,3,4 13.Using specialized software for design of simple printed circuit board (PCB) - part 1, 2h, Learning outcomes:5 14.Using specialized software for design of simple printed circuit board (PCB) - part 2, 2h, Learning outcomes:5 15.Term for compensation of missed exercises and acquiring additional points from laboratory exercises, 2h				
Required materials	Basic: classroom, blackboard, chalk... Special purpose computer laboratory Whiteboard with markers				
Exam literature	Osnovna: 1. Lj. Cvitaš: Brzi razvoj prototipova na bazi mikroupravljača, Tehničko veleučilište u Zagrebu, 2015. 2. J. Šribar, B- Motik: Demistificirani C++, 3. prošireno izdanje, Element, Zagreb, 2010. 3. Bilješke i prezentacije s predavanja te informacije s interneta na osnovu poveznica navedenih na predavanjima i prezentacijama Dodatna: 1. BUDIN, LEO: Mikroračunala i mikroupravljači. Element, Zagreb, ISBN 953-6098-69-5, 2001., 328 str. 2. GRUNDLER, DARKO: Primijenjeno računalstvo. Graphis, Zagreb, ISBN 953-6647-03-6, 2000., 524 str. 3. VUČIĆ, MLADEN: Upotreba mikrokontrolera u ugrađenim računalnim sustavima. Skripta FER - Fakultet elektrotehnike				

	i računarstva, Zagreb, 2007., 124 str. 4. VUČIĆ, MLADEN, PETRINOVIĆ, DAVORKA: Projektiranje ugrađenih računalnih sustava - laboratorijske vježbe. Skripta FER - Fakultet elektrotehnike i računarstva, Zagreb, 2007., 193 str. 5. E. A. Lee, S. A. Seshia: Introduction to Embedded Systems - A Cyber-Physical Systems Approach, ISBN 978-0-557-70857-4, 2011. 6. J. Farrel: Object-Oriented Programming Using C++, Fourth Edition, ISBN 978-1-4239-0257-7, Course Technology, 2009.
Students obligations	Student must achieve minimum 30 points during semester.
Knowledge evaluation during semester	A maximum of 60 points can be earned during the semester through the following activities: 1. presence on lectures and laboratory exercises maximum 7.5 points, minimum 5 points to pass, 2. short exams on lectures maximum 12.5 points, minimum 0 points to pass, 3. preparation tests on laboratory exercises (entrance tests) maximum 10 points, minimum 0 points to pass, 4. two main exams maximum 30 points (2 x 15), minimum 0 points to pass. A prerequisite to take the final exam is earning at least 30 points during the semester. Students which earn less than 15 points are graded F (unsuccesfull) and they have to enroll the course again in the next academic year. Students which earn between 15 and 30 points are graded FX (insufficient), but they can approach an additional exam. The additional exam is carried out on the first exam term, and it contains tasks from 2, 3 and 4 enumeration above with a total of 30 points. If the student earns 15 or more points on the additional exam, the total points earned during the semester will be set to 30 and student can approach the final exam.
Knowledge evaluation after semester	A maximum of 40 points can be earned on the final exam, so the total number of points on the course is equal to 100. The grading is carried out according to the following scales (ISVU and ECTS scales): [50, 60) grade 2 (pass) or ECTS grade E [60, 65) grade 2 (pass) or ECTS grade D [65, 80) grade 3 (good) or ECTS grade C [80, 90) grade 4 (very good) or ECTS grade B [90, 100] grade 5 (excellent) or ECTS grade A
Student activities:	Aktivnost — ECTS (Classes attendance) — 2 (Constantly tested knowledge) — 3
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
Proposal made by	Toni Bjažić, Ph.D., Senior Lecturer

Code WEB/ISVU	23250/143204	**ECTS**	6.0	**Academic year**	2018/2019
Name	Electrical Engineering				
Status	2nd semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+45 (30+15+0+0) 105
Teachers	Lectures:1. izv. prof. dr. sc. Edouard Ivanjko Lectures:dr.sc. Žarko Nožica Auditory exercises: Milivoj Mandić Laboratory exercises: Dino Čakija Laboratory exercises: Josip Ćurković mag. ing. el. techn. inf.				
Course objectives	Acquiring basic knowledge in electrical engineering.				
Learning outcomes:	1.ability to solve simple problems related to electromagnetism. Level:6 2.ability to solve simple problems related to electrical engineering. Level:6 3.ability to calculate parameters of electrical networks. Level:6 4.ability to test experimentally the basic laws of physics relevant for electrical engineering. Level:6 5.ability to analyse specific problems, calculate values and estimate the physical relevance of the values calculated . Level:6,7 6.Analyze voltages and currents in RLC circuits with AC source. Level:6 7.analizy transition state for circuits with R,C, L elements and with a DC source. Level:6 8.Calculate effective and average voltage and current values. Level:6 9.DC circuit analysis using basic law's and methods.. Level:6 10.Measure electrical parameters in DC circuits. Level:7 11.identify basic parameters in electrostatics. Level:6 12.Analyse circuits with capacitors. Level:6 13.analyse simple magnetic circuits. Level:6				
Involvement of learning outcomes of the course in study programme:	1.1.OPĆI Služiti se stranim jezikom u literaturi i svakodnevnoj stručnoj komunikaciji. : 10h in 180h 1.5.OPĆI Identificirati, modelirati i rješavati inženjerske probleme.: 10h in 180h 2.2.OSOBNE Odgovornost, dosljednost, točnost, ažurnost.: 10h in 180h 2.5.OSOBNE Spremnost za rad na terenu i u nestandardnim uvjetima.: 10h in 180h 2.12.OSOBNE Fleksibilnost i prilagodljivost u iznalaženju tehničkih rješenja uz neupitno poštivanje temeljnih etičkih načela, pravnih normi i pravila struke.: 10h in 180h 3.4.MEH Predložiti senzore, aktuatore, energetske i upravljačke jedinice, komunikacijske protokole i popratnu opremu za automatizaciju različitih tehničkih procesa u mehatronici (elektromotorni pogoni, alatni strojevi, procesi skladištenja fluida, toplinski i tra: 50h in 180h 3.6.MEH Projektirati elektroničke sklopove s mikroupravljačima pomoću EDA alata: 80h in 180h				
Methods of carrying out lectures	Ex cathedra teaching Discussion Questions and answers Emphasis on physical explanations and graphical illustrations/characteristics of electrical circuits, components and machines. Mathematical formalism is used to a minimal extent. Giving a series of examples of the use of electrical devices and machines.				
Methods of carrying out auditory exercises	Group problem solving Discussion, brainstorming Numerical examples of solving/calculating simple electrical and magnetic circuits. Simple numerical examples related to the characteristics of electrical machines. Initiating discussions with students and stressing the examples from practical use.				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Group problem solving Independent exercises in groups on specially prepared experimental setups for fundamentals of electrical engineering. Demonstration exercises in the field of electrical machines with intensive participation/questioning of students. The students make reports from the exercises				
Course content lectures	1.Elektrostatics, basic electrical properties, 2h, Learning outcomes:11 2.Electrical field, electrical induction, electrical potential, 2h, Learning outcomes:11 3.Capacitor, energy, basic connections, 2h, Learning outcomes:12 4.Magnetism: magnetic field, 2h, Learning outcomes:1 5.Magnetic parameters, magnetic field, 2h, Learning outcomes:1,13 6.forces between two conductor lines, electromagnetic induction, 2h, Learning outcomes:1 7.induction, magnetic field energy, 2h, Learning outcomes:1 8.Energy transformation between electrical and magnetic field, 2h, Learning outcomes:1,7 9.Direct current, resistance, 2h, Learning outcomes:10,11,12 10.Electrical sources, 2h, Learning outcomes:10,12 11.Electrical circuit, Kirchhoff, 2h, Learning outcomes:10,11,12 12.Connecting electrical sources, kcomplex electrical circuits, measuring instruments, 2h, Learning outcomes:9,10 13.Alternating current circuits, frequency, phase, 2h, Learning outcomes:5,6 14.Reprezentations and calculations with alternating current, R,L,C circuits under alternating current condition, 2h, Learning outcomes:5,6 15.Solving AC circuits, power and power factor, , 2h, Learning outcomes:3,5				
Course content auditory	1.Elektrostatics, basic electrical properties, 2h, Learning outcomes:11 2.Electrical field, electrical induction, electrical potential, 2h, Learning outcomes:11 3.Capacitor, energy, basic connections, 2h, Learning outcomes:12 4.Magnetism: Fundamental laws, 2h, Learning outcomes:1,13 5.Magnetic parameters, magnetic field, 2h, Learning outcomes:1,13 6.forces between two conducting lines, electromagnetic induction, 2h, Learning outcomes:1,13 7.induction, magnetic field energy, 2h, Learning outcomes:1,13 8.Energy transformation between electrical and magnetic field, 2h, Learning outcomes:1,13				

	9.Direct current, resistance, 2h, Learning outcomes:10,11,12 10.Electrical sources, 2h, Learning outcomes:10,12 11.Electrical circuits, Kirchhoff, 2h, Learning outcomes:5,10,11,12 12.Connecting electrical sources, kcomplex electrical circuits, measuring instruments, 2h, Learning outcomes:9,10 13.Alternating current circuits, frequency, phase, 2h, Learning outcomes:5,6,9,10 14.Reprezentations and calculations with alternating current, R,L,C circuits under alternating current condition, 2h, Learning outcomes:5,6 15.Solving AC circuits, power and power factor, , 2h, Learning outcomes:3,5
Course content laboratory	1.Electrical charges and electrical influence, 3h, Learning outcomes:4 2.Magnetism, magnetic field, magnetic induction, 3h, Learning outcomes:1,4 3.Ohm, 3h, Learning outcomes:4,10,11,13 4.Transitions in circuits containing R, C, L elements under DC conditions, 3h, Learning outcomes:4,7,13 5.The analysis of circuits that contain R,C, L elements under AC conditions, 3h, Learning outcomes:4,6 6.no lecture, 2h 7.no lecture, 2h 8.no lecture, 2h 9.no lecture, 2h 10.no lecture, 2h 11.no lecture, 2h 12.no lecture, 2h 13.no lecture, 2h 14.no lecture, 2h 15.no lecture, 2h
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory Overhead projector
Exam literature	Osnovna: 1. V. Pinter, "Osnove elektrotehnike I i II", Tehnička knjiga , Zagreb 1994. 2. E. Stanić, "Osnove elektrotehnike", Školska knjiga, Zagreb, 2006. 3. M. Essert, Z. Valter, "Osnove elektrotehnike", Liber, Zagreb, 1990. Dodatna: 1. B.Kuzmanović: Osnove elektrotehnike I, II, Element, Zagreb 2011
Students obligations	maximum of 3 absences from classes
Knowledge evaluation during semester	Kolokvij, numeri zadaci#3#33#40$Kolokvij, teorijska pitanja#3#33#50$
Knowledge evaluation after semester	Taking the exam by two preliminary exams.
Student activities:	Aktivnost — ECTS (Classes attendance) — 3 (Constantly tested knowledge) — 3
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
Proposal made by	professor Žarko Nožica, PhD

Code WEB/ISVU	23537/156300	**ECTS**	6.0	**Academic year**	2018/2019
Name	Electrical Engineering Energy				
Status	3rd semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+45 (30+15+0+0) 105
Teachers	Lectures:1. mr.sc. Milivoj Puzak v. pred Auditory exercises:mr.sc. Milivoj Puzak v. pred Laboratory exercises:mr.sc. Milivoj Puzak v. pred				
Course objectives	To transfer to students the basic knowledge related to electricity transformations and applications				
Learning outcomes:	1.analyze the problem. Level:6 2.formulate the problem. Level:6,7 3.evaluate the solutions. Level:6,7 4.differentiate the solutions. Level:6 5.compare the solutions. Level:6,7				
Methods of carrying out lectures	Ex cathedra teaching				
Methods of carrying out auditory exercises	Group problem solving Discussion, brainstorming				
Methods of carrying out laboratory exercises	Group problem solving				
Course content lectures	1.Electric power sources. Electrical network as a power source., 2h, Learning outcomes:4 2.Three phase system. Voltage and frequency standards. Loads in three phase system. Electric power in three phase system., 2h, Learning outcomes:4 3.Energy conversion. Voltage transformations., 2h, Learning outcomes:5 4.Single phase and three phase transformers. Magnetic circuits, iron losses., 2h, Learning outcomes:1 5.Transformer model, substitute scheme., 2h, Learning outcomes:1 6.Basics of conversion of electric energy into mechanical energy and vice versa. Laws of conversion: induced voltage, force on a conductor, conversion moment., 2h, Learning outcomes:2 7.Model of a machine for DC voltages and currents., 2h, Learning outcomes:1 8.Model of a machine for AC power system; rotating magnetic field., 2h, Learning outcomes:1 9.Asynchronous machines - features and performances., 2h, Learning outcomes:4 10.Asynchronous machines - features and performances., 2h, Learning outcomes:4 11.Synchronous machines - features and performances., 2h, Learning outcomes:4 12.Synchronous machines - features and performances., 2h, Learning outcomes:4 13.Energy conversion losses., 2h, Learning outcomes:1 14.Electronic converters - basic principles and classification., 2h, Learning outcomes:5 15.no lecture, 2h				
Course content auditory	1. Symmetrical and unsymmetrical 3-phase power systems., 2h, Learning outcomes:4 2.Symmetrical and unsymmetrical 3-phase loads., 2h, Learning outcomes:4 3.Elements of substitute transformer scheme., 2h, Learning outcomes:1 4.No-load test and short-circuit test of a transformer., 2h, Learning outcomes:2,5 5.Electromechanical energy conversion - numerical examples., 2h, Learning outcomes:5 6.Calculation of the induced voltage and the developed torque., 2h, Learning outcomes:1 7.1. colloquium, 2h 8.Asynchronous machines - characteristics., 2h, Learning outcomes:4 9.Asinkroni motor - speed control., 2h, Learning outcomes:5 10.Single phase asynchronous machines - characteristics., 2h, Learning outcomes:4 11.Synchronous machines - characteristics., 2h, Learning outcomes:4 12.Synchronous machines - windings, 2h, Learning outcomes:5 13.AC machines - running start, 2h, Learning outcomes:5 14.AC machines - losses., 2h, Learning outcomes:3 15.2. colloquium, 2h				
Course content laboratory	1.No laboratory exercises , 1h, Learning outcomes:5 2.No laboratory exercises, 1h, Learning outcomes:5 3.No laboratory exercises, 1h, Learning outcomes:5 4.No laboratory exercises, 1h, Learning outcomes:5 5.No laboratory exercises, 1h, Learning outcomes:5 6.No laboratory exercises, 1h, Learning outcomes:5 7.No laboratory exercises, 1h, Learning outcomes:5 8.No laboratory exercises, 1h, Learning outcomes:5 9.No laboratory exercises, 1h, Learning outcomes:5 10.No laboratory exercises, 1h, Learning outcomes:5 11.No laboratory exercises, 1h, Learning outcomes:5 12.No laboratory exercises, 1h, Learning outcomes:5 13.No laboratory exercises, 1h, Learning outcomes:5 14.No laboratory exercises, 1h, Learning outcomes:5 15.No laboratory exercises, 1h, Learning outcomes:5				
Required materials	Basic: classroom, blackboard, chalk... Whiteboard with markers Overhead projector				

Exam literature	Obavezna: 1. V. Pinter Osnove elektrotehnike II Tehnička knjiga , Zagreb 1994 2. Inženjerski priručnik 1, Školska knjiga, 1996. 3. Wolf: Osnove električnih strojeva Školska knjiga 1991.	
Students obligations	maximum of 3 absences from exercises	
Knowledge evaluation during semester	Redovitost pohaa#10#10#0$Kolokvij, numeri zadaci#2#45#50$Kolokvij, teorijska pitanja#2#45#50$	
Knowledge evaluation after semester	Paper test#1#50#50$Verbally examination#1#50#50$	
Student activities:	Aktivnost (Classes attendance) (Constantly tested knowledge)	ECTS 3 3
Remark	This course can be used for final thesis theme	
Prerequisites:	No prerequisites.	

Code WEB/ISVU	23759/170035	**ECTS**	5.0	**Academic year**	2018/2019
Name	Electrical Servo Drives				
Status	5th semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (15+15+0+0) 90
Teachers	Lectures:1. prof. dr. sc. Dario Matika Auditory exercises:prof. dr. sc. Dario Matika Auditory exercises: Antonia Penđer mag. ing. stroj. Laboratory exercises:prof. dr. sc. Dario Matika				
Course objectives	To transfer to students the basic knowledge related to electrical drives, placing a special emphasis on servo drives.				
Learning outcomes:	1.ability to distinguish between the terms - management, control and guidance electric motor drive in Mechatronics. Level:6 2.ability to distinguish between the main elements of mechatronic systems and their functions (control, microcomputer, actuator, sensor and interface). Level:6 3.ability to calculate the parameters of AC and DC electric motor drive in Mechatronics. Level:6 4.ability to calculate the parameters of the controller, actuator and sensor. Level:6 5.ability to outline transient response and transfer function of electric motor drive in Mechatronics. Level:6 6.ability to link knowledge from the fields of electrical, pneumatic and hydraulic. Level:6,7 7.ability to calculate the control parameters in state - space representation and via root locus. Level:6 8.ability to analyze, simulate and demonstrate the work of electric motor drive in Mechatronics. Level:6				
Methods of carrying out lectures	Ex cathedra teaching Demonstration Simulations Discussion				
Methods of carrying out auditory exercises	Laboratory exercises, computer simulations Discussion, brainstorming Computer simulations Illustrations of operating regimes of electrical drives and of motor selection on simple numerical examples. Illustration of electrical drive control by computer simulation (demonstration) and discussions with the students.				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Laboratory exercises, computer simulations Discussion, brainstorming Demonstration exercises - intensive discussions with the students. The students make reports from the exercises.				
Course content lectures	1.Introduction to electrical drives in Mechatronics, 2h 2.Classification and basic characteristics of electric drives in Mechatronics, 2h, Learning outcomes:1,2 3.DC drives and inverters in Mechatronics - Part 1, 2h, Learning outcomes:1,2,3 4.DC drives and inverters in Mechatronics - Part 2, 2h, Learning outcomes:1,2,3 5.AC drives and inverters in Mechatronics - Part 1, 2h, Learning outcomes:1,2,3 6.AC drives and inverters in Mechatronics - Part 2, 2h, Learning outcomes:1,2,3 7.The first control task, 2h, Learning outcomes:1,2,3 8.Process controllers and sensors in Mechatronics - Part 1, 2h, Learning outcomes:1,2,4 9.Process controllers and sensors in Mechatronics - Part 2, 2h, Learning outcomes:1,2,4 10.Power Electronics in Mechatronics, 2h, Learning outcomes:1,2,5 11.Interfaces of electric drives in Mechatronics, 2h, Learning outcomes:1,2 12.Remote control and monitoring of electric drives in Mechatronics, 2h, Learning outcomes:1,2 13.Examples of electric drives in Mechatronics - Part 1, 2h, Learning outcomes:6,8 14.Examples of electric drives in Mechatronics - Part 2, 2h, Learning outcomes:6,8 15.The second control task, 2h, Learning outcomes:6,8				
Course content auditory	1.Calculation of the static characteristics of a DC electric drives in Mechatronics - Part 1, 1h, Learning outcomes:3,4 2.Calculation of the static characteristics of a DC electric drives in Mechatronics - Part 2, 1h, Learning outcomes:3,4 3.Calculation of the dynamic characteristics of the DC electric drives in Mechatronics - Part 1, 1h, Learning outcomes:3,4 4.Calculation of the dynamic characteristics of the DC electric drives in Mechatronics - Part 2, 1h, Learning outcomes:3,4 5.Calculation of the characteristics of inverters and routers, 1h, Learning outcomes:3,4 6.Calculation of the static characteristics of an AC electric drives in Mechatronics - Part 1, 1h, Learning outcomes:3,4 7.Calculation of the static characteristics of an AC electric drives in Mechatronics - Part 2, 1h, Learning outcomes:3,4 8.The first control task, 1h, Learning outcomes:3,4 9.Calculation of dynamic characteristics of AC electric drives in Mechatronics - Part 1, 1h, Learning outcomes:3,4 10.Calculation of dynamic characteristics of AC electric drives in Mechatronics - Part 2, 1h, Learning outcomes:3,4 11.Calculation of the characteristics of the frequency converter, 1h, Learning outcomes:3,4 12.Calculation of the parameter PID controller electric drives, 1h, Learning outcomes:3,4 13.Calculation of parameters of cascade control electric drives, 1h, Learning outcomes:3,4,5 14.The parameters of the process computer control of Electric Drives, 1h, Learning outcomes:3,4,5 15.The second control task, 1h, Learning outcomes:3,4,5				
Course content laboratory	1.Basic characteristics of Matlab, 1h, Learning outcomes:7,8 2.Introduction to simulation of electric drives in the state space, 1h, Learning outcomes:7,8 3.Introduction to simulation of electric drives using the characteristics of the root, 1h, Learning outcomes:7,8 4.Analysis and simulation of a motorized drive in the states - Part I, 1h, Learning outcomes:7,8 5.Analysis and simulation of a motorized drive in the states - Part II, 1h, Learning outcomes:7,8 6.Synthesis of electric drives - Part I, 1h, Learning outcomes:7,8 7.Synthesis of electric drives - Part II, 1h, Learning outcomes:7,8 8.A simulation using the characteristics of the root - Part I, 1h, Learning outcomes:7,8				

	9.A simulation using the characteristics of the root - Part II, 1h, Learning outcomes:7,8 10.Simulation and demonstration of DC motor -Part I, 1h, Learning outcomes:7,8 11.Simulation and demonstration of DC motor -Part II, 1h, Learning outcomes:7,8 12.Simulation and demonstration of an AC motor - Part I, 1h, Learning outcomes:7,8 13.Simulation and demonstration of an AC motor - Part II, 1h, Learning outcomes:7,8 14.Simulation and demonstration of stepper motor -Part I, 1h, Learning outcomes:7,8 15.Simulation and demonstration of stepper motor -Part II, 1h, Learning outcomes:7,8
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory Whiteboard with markers Overhead projector
Exam literature	Osnovna: 1. T. Bjažić, Bilješke predavanja (prezentacije i upute za laboratorijske vježbe) 2. Vlastite bilješke s predavanja Dodatna: 1. W. Leonhard, "Control of Electrical Drives, Third Edition", Springer, Berlin, 2001. 2. R. Krishnan, "Electric Motor Drives - Modeling, Analysis and Control, Prentice Hall, New Jersey, 2001. 3. R. Krishnan, Permanent Magnet Synchronous and Brushless DC Motor Drives, CRC Press, Taylor Francis Group, Boca Raton, 2010.
Students obligations	s Student must achieve minimum 50% of points in laboratory exercises
Knowledge evaluation during semester	Lecture activities maximum 10 points, 0 points to pass Laboratory exercises maximum 20 points, minimum 10 points to pass First exam maximum 25 points, minimum 12.5 points to pass Second exam maximum 25 points, minimum 12.5 points to pass Oral exam maximum 20 points, minimum 10 points to pass Toatal: 100 points Grades: 50 - 2 62 - 3 75 - 4 87 - 5
Knowledge evaluation after semester	Laboratory exercises maximum 10 points Written exam maximum 40 points, minimum 20 points to pass Oral exam maximum 50 points, minimum 25 points to pass Toatal: 100 points Grades: 50 - 2 62 - 3 75 - 4 87 - 5
Student activities:	Aktivnost ECTS (Classes attendance) 2 (Constantly tested knowledge) 3
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
Proposal made by	Prof. Dario Matika, Ph.D. and Toni Bjažić, Ph.D., senior lecturer

Code WEB/ISVU	23534/156294	**ECTS**	5.0	**Academic year**	2018/2019
Name	Electronics and Sensors				
Status	3rd semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (15+15+0+0) 90
Teachers	Lectures:1. izv. prof. dr. sc. Edouard Ivanjko Lectures: Dino Čakija Auditory exercises: Josip Ćurković mag. ing. el. techn. inf. Laboratory exercises: Josip Ćurković mag. ing. el. techn. inf. Laboratory exercises: Želimir Ivanović				
Course objectives	To transfer to students the basic knowledge related to semiconductor elements and electronic circuits and its applications in Mechatronics.				
Learning outcomes:	1.Analyze basic mechanism in semiconductors. Level:6 2.ability to distinguish between semiconductors, diodes, rectifiers and stabilizers. Level:6 3.ability to propose a solution including a digital logic circuit, combination and sequential logic circuit, the circuit with flip-flop, an integrated logic circuit. Level:6,7 4.ability to combine analog-digital and digital-to-analog converters. Level:6,7 5.Analyze modes of operation of basic semiconductor components. Level:6 6.Analyse characteristics basic electronic circuits. Level:6 7.Differentiate between basics building blocks of computers and their roles. Level:6 8.Integrate computer in a process. Level:6,7				
Methods of carrying out lectures	Ex cathedra teaching Discussion Questions and answers An emphasis is given on the interpretation of static characteristics of electronic components and their applications in fundamental electronic circuits. The principles of converting the measured physical quantity into an appropriate electrical signal for different types of sensors and transducers. Providing numerous examples on the use of electronic circuits and devices as well as sensors and transducers.				
Methods of carrying out auditory exercises	Simple numerical examples related to the selection of appropriate electronic components, operation of electronic circuits, sensors and transducers. Motivating discussions with students and giving an emphasis on practical applications.				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Introduction to electronic measuring instruments (voltmeter, ampermeter, oscilloscope, function generator). Independent exercises in groups utilizing prototyping boards for testing electronic circuits. Interactive demonstration exercises from the field of electrical measurements and sensorics with simultaneous testing of students				
Course content lectures	1.Semiconductors basics, 2h, Learning outcomes:1,5 2.Bsic Semiconductor komponents, 2h, Learning outcomes:2 3.Bipolar transistor, 2h, Learning outcomes:2,6 4.Unipolar transistor, 2h, Learning outcomes:2,6 5.Electronics cisrcuits, rectifiers, voltage stabilizers, 2h, Learning outcomes:2 6.Amplifiers, 2h, Learning outcomes:6 7.Diferential Amplifiers, operational amplifiers, 2h, Learning outcomes:6 8.Circuits with feedback, circuits with operational amplifier, 2h, Learning outcomes:6 9.Circuits with switching funcion, switches, 2h, Learning outcomes:6 10.Circuits accepting non-electrical variables, 2h, Learning outcomes:6 11.Integrated circuits, combitorial circuits, , 2h, Learning outcomes:3 12.Sequential digital circuits, 2h, Learning outcomes:3 13.Digital/analog/digital converters, 2h, Learning outcomes:4 14.Computers, 2h, Learning outcomes:7 15.Conecting computers with processes, 2h, Learning outcomes:8				
Course content auditory	1.Solving problems, semiconductor basics, 2h, Learning outcomes:1 2.Calculating basic circuit and components parameters, 2h, Learning outcomes:5,6 3.Calculating basic circuit and components parameters, 2h, Learning outcomes:4,6 4.Designing basic circuits, 2h, Learning outcomes:6 5.Designing basic circuits, 2h, Learning outcomes:6 6.Examples and priciples explained, follow up, 2h, Learning outcomes:6 7.Examples and priciples explained, follow up, 2h, Learning outcomes:6 8.Examples, 1h, Learning outcomes:6 9.no exercises, 2h 10.no exercises, 2h 11.no exercises, 2h 12.no exercises, 2h 13.no exercises, 2h 14.no exercises, 2h 15.no exercises, 2h				
Course content laboratory	1.Semiconductor diodes and rectifiers, 2h, Learning outcomes:5 2.I/O characteristics of Zener, 2h, Learning outcomes:5 3.Characteristics of Bipolar Transistor, 2h, Learning outcomes:5 4.Transistor as Amplifier (in CE mode), 2h, Learning outcomes:5 5.JFET characteristics, 2h, Learning outcomes:5 6.Basic circuits with integrated Operational Amplifier, 2h, Learning outcomes:5 7.Logic circuits, 2h, Learning outcomes:5 8. no labs, 2h 9. no labs, 2h				

	10. no labs, 2h 11. no labs, 2h 12. no labs, 2h 13. no labs, 2h 14. no labs, 2h 15. no labs, 2h
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory Whiteboard with markers Overhead projector
Exam literature	Osnovna: 1. J. Grilec, D. Zorc: ''Osnove elektronike'', Školska knjiga, Zagreb, 1993. Dodatna: 1. J. Božičević: ''Temelji automatike 2 mjerni pretvornici i mjerenje'', Školska knjiga, Zagreb, 1991.
Students obligations	maximum of 1 absences from exercises
Knowledge evaluation during semester	Redovitost pohaa#10#10#0$Kolokvij, numeri zadaci#2#45#50$Kolokvij, teorijska pitanja#2#45#50$
Knowledge evaluation after semester	The exam is carried out by means of two preliminary exams (colloquia) during the semester.
Student activities:	Aktivnost — ECTS (Classes attendance) — 2 (Constantly tested knowledge) — 3
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.

Code WEB/ISVU	23536/156296	**ECTS**	5.0	**Academic year**	2018/2019
Name	Elements of Automation				
Status	3rd semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (15+15+0+0) 90
Teachers	Lectures:1. dr. sc. Toni Bjažić prof. v. š. Auditory exercises: Antonia Penđer mag. ing. stroj. Laboratory exercises: Josip Ćurković mag. ing. el. techn. inf. Laboratory exercises: Antonia Penđer mag. ing. stroj.				
Course objectives	To introduce students to the elements of automation systems and their properties.				
Learning outcomes:	1.ability to distinguish between the terms of control, regulation and guidance, static and dynamic characteristics, transfer function, step response function and impulse response function. Level:6 2.ability to calculate the transfer function of an automation element from its differential equation. Level:6 3.ability to sketch the step response of the automation element from its transfer function. Level:6 4.ability to calculate the parameters and determine the form of the automation element transfer function from its step response. Level:6 5.ability to calculate static and dynamic characteristics of separately excited DC machine. Level:6 6.ability to calculate static and dynamic characteristics of controllable electric energy sources, thyristor and transistor power amplifiers. Level:6 7.ability to calculate static characteristics of induction machines and connect its dynamic characteristics with dynamic characteristics of separately excited DC machines. Level:6				
Methods of carrying out lectures	Ex cathedra teaching Case studies Demonstration Simulations				
Methods of carrying out auditory exercises	Computer simulations Solving the typical problem tasks.				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Laboratory exercises, computer simulations Computer simulations				
Course content lectures	1.Introductory lecture; Basic terms; Elements of automation as part of automatic control system; Functional elements of control system, 3h, Learning outcomes:1 2.Static and dynamic characteristics; Linearization; Transfer function; Step response function; Impulse response function, 2h, Learning outcomes:1 3.Responses of the typical automation elements of the first order: P, PT1 and DT1 elements, 2h, Learning outcomes:2,3,4 4.Responses of the typical automation elements of the first order: PDT1, I and IT1 elements, 2h, Learning outcomes:2,3,4 5.Responses of the typical automation elements of the second order, 2h, Learning outcomes:2,3,4 6.Responses of the automation elements of higher order; Responses of the elements with dead time; Responses of the standard controllers: PI, PIDT1, 2h, Learning outcomes:2,3,4 7.Static and dynamic characteristics of separately excited DC machines - part 1, 2h, Learning outcomes:5 8.Static and dynamic characteristics of separately excited DC machines - part 2, 2h, Learning outcomes:5 9.First exam, 2h, Learning outcomes:1,2,3,4 10.Static and dynamic characteristics of controllable electric energy sources, 2h, Learning outcomes:6 11.Static and dynamic characteristics of thyristor and transistor power amplifiers; Connection with controllable electric energy sources and braking regimes of DC machines, 2h, Learning outcomes:4,5 12.Static characteristics of induction machines - part 1, 2h, Learning outcomes:7 13.Static characteristics of induction machines - part 2, 2h, Learning outcomes:7 14.Equivalency of dynamic characteristics of AC and DC machines, 1h, Learning outcomes:5,6,7 15.Second exam, 2h, Learning outcomes:5,6,7				
Course content auditory	1.No auditory exercises 2.Linearization of nonlinear characteristics (calculation, graphic and table method), 1h, Learning outcomes:1 3.Numeric examples of P, PT1 and DT1 automation elements responses, 1h, Learning outcomes:2,3,4 4.Numeric examples of PDT1, I and IT1 automation elements responses, 1h, Learning outcomes:2,3,4 5.Numeric examples of second order automation elements responses, 1h, Learning outcomes:2,3,4 6.Numeric examples of standard controllers responses: PI, PIDT1 and dead time automation elements, 1h, Learning outcomes:2,3,4 7.Numeric examples of calculation of static characteristics of separately excited DC machines based on catalogue data, 1h, Learning outcomes:5 8.Numeric examples of calculation of dynamic characteristics of separately excited DC machines based on catalogue data, 1h, Learning outcomes:5 9.First exam, 1h, Learning outcomes:1,2,3,4 10.Simulation of DC/DC boost converter and calculation of its static and dynamic characteristics, 1h, Learning outcomes:6 11.Calculation of static and dynamic characteristics of thyristor power amplifier with resistive load, 1h, Learning outcomes:6 12.Calculation of static and dynamic characteristics of transistor power amplifier, 1h, Learning outcomes:6 13.Waveform sketching of armature current and rotation speed of separately excited DC machine with constant excitation, 1h, Learning outcomes:5,6 14.Numeric examples of static characteristics of induction machines based on catalogue data, 2h, Learning outcomes:7 15.Second exam, 1h, Learning outcomes:5,6,7				

Course content laboratory	1.Basic usage of program package Matlab, 1h 2.Basic usage of Simulink, 1h 3.Static and dynamic characteristics od automation elements - part 1, 1h, Learning outcomes:1 4.Static and dynamic characteristics od automation elements - part 2, 1h, Learning outcomes:1 5.Responses of typical automation elements of the first order - part 1, 1h, Learning outcomes:2,3,4 6.Responses of typical automation elements of the first order - part 2, 1h, Learning outcomes:2,3,4 7.Responses of the automation elements described by the general second order transfer function - part 1, 1h, Learning outcomes:2,3,4 8.Responses of the automation elements described by the general second order transfer function - part 2, 1h, Learning outcomes:2,3,4 9.Dynamic characteristics of separately excited DC machine with constant excitation - part 1, 1h, Learning outcomes:5 10.Dynamic characteristics of separately excited DC machine with constant excitation - part 2, 1h, Learning outcomes:5 11.Separately excited DC machine fed by transistor power amplifier - part 1, 1h, Learning outcomes:5,6 12.Separately excited DC machine with constant excitation fed by transistor power amplifier - part 2, 1h, Learning outcomes:5,6 13.Regenerative braking of separately excited DC machine with constant excitation fed by transistor power amplifier - part 1, 1h, Learning outcomes:5,6 14.Regenerative braking of separately excited DC machine with constant excitation fed by transistor power amplifier - part 2, 1h, Learning outcomes:5,6 15.Term for compensation of missed exercises and acquiring additional points from laboratory exercises, 1h
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory General purpose computer laboratory Whiteboard with markers Overhead projector
Exam literature	Obavezna: 1. P. Crnošija, T. Bjažić: Osnove automatike I. dio: Analiza i sinteza kontinuiranih sustava - teorija i primjena, Element, Zagreb, 2011. Dodatna: 1. Frohr, Ortenburger: Introduction to electronic control engineering; Siemens, Berlin 1992.
Students obligations	Student must achieve minimum 30 points during semester.
Knowledge evaluation during semester	A maximum of 60 points can be earned during the semester through the following activities: 1. presence on lectures, auditory and laboratory exercises maximum 7.5 points, minimum 5 points to pass, 2. short exams on lectures and auditory exercises maximum 12.5 points, minimum 0 points to pass, 3. preparation tests on laboratory exercises (entrance tests) maximum 10 points, minimum 0 points to pass, 4. two main exams maximum 30 points (2 x 15), minimum 0 points to pass. A prerequisite to take the final exam is earning at least 30 points during the semester. Students which earn less than 15 points are graded F (unsuccesfull) and they have to enroll the course again in the next academic year. Students which earn between 15 and 30 points are graded FX (insufficient), but they can approach an additional exam. The additional exam is carried out on the first exam term, and it contains tasks from 2, 3 and 4 enumeration above with a total of 30 points. If the student earns 15 or more points on the additional exam, the total points earned during the semester will be set to 30 and student can approach the final exam.
Knowledge evaluation after semester	A maximum of 40 points can be earned on the final exam, so the total number of points on the course is equal to 100. The grading is carried out according to the following scales (ISVU and ECTS scales): [50, 60) grade 2 (pass) or ECTS grade E [60, 65) grade 2 (pass) or ECTS grade D [65, 80) grade 3 (good) or ECTS grade C [80, 90) grade 4 (very good) or ECTS grade B [90, 100] grade 5 (excellent) or ECTS grade A
Student activities:	Aktivnost — ECTS (Classes attendance) — 2 (Constantly tested knowledge) — 3
Remark	This course can not be used for final thesis theme
Prerequisites:	No prerequisites.
Proposal made by	Toni Bjažić, Ph.D., senior lecturer

Code WEB/ISVU	23765/170041	**ECTS**	4.0	**Academic year**	2018/2019
Name	Energy Management				
Status	5th semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - elective course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (10+20+0+0) 60
Teachers	Lectures: Vesna Alić-Kostešić dipl.ing.stroj. Lectures:Dr.sc. Vlasta Zanki dipl.ing.stroj. Auditory exercises:Dr.sc. Vlasta Zanki dipl.ing.stroj. Laboratory exercises:Dr.sc. Vlasta Zanki dipl.ing.stroj.				
Course objectives	Learn the basics of energy management and energy efficiency level of buildings. The student should acquire the basic knowledge about parts of energy management systems, order of introduction, integration of energy management with building management systems, integration with system IoT and the role of the "smart" cities and are familiar with the current EU and international standards and regulations.				
Learning outcomes:	1.planning system boundaries. Level:6,7 2.differentiate the types of energy consumers. Level:6 3.identify key parameters that affect energy. Level:6 4.identify multidisciplinary power management. Level:6 5.connect buildings with information technology. Level:6,7 6.analyze energy consumption in buildings. Level:6 7.identify areas for the implementation of energy. Level:6 8.analyze international standards for energy management. Level:6 9.distinguished areas of certification and legal obligations. Level:6 10.analyze the impact of training on energy management. Level:6 11.analyze the impact of energy efficiency on competitiveness. Level:6 12.analysis of funding models. Level:6				
Methods of carrying out lectures	Ex cathedra teaching Demonstration Simulations Discussion Questions and answers Seminar, students presentation and discussion				
Methods of carrying out auditory exercises	Data mining and knowledge discovery on the Web				
Methods of carrying out laboratory exercises	Laboratory exercises, computer simulations Discussion, brainstorming Computer simulations Interactive problem solving				
Course content lectures	1.Basic terms of energy consumption, 2h, Learning outcomes:1,2 2.Consumers of energy in buildings, 2h, Learning outcomes:1,2 3.Energy audits, energy certification, 2h, Learning outcomes:2,3,6,7,9 4.The collection of data on energy consumption, 2h, Learning outcomes:3,5 5.Remote reading of energy consumption, 2h, Learning outcomes:5 6.Modeling energy consumption, 2h, Learning outcomes:5,6,7 7.The parameters that affect energy use and consumption indicators, 2h, Learning outcomes:3,4,6,7 8.Information technology in energy management, 2h, Learning outcomes:5 9.IoT, 2h, Learning outcomes:5 10.International standards in energy management, 2h, Learning outcomes:7 11.legislative environment, 2h, Learning outcomes:8 12.Training stakeholders in energy management, 2h, Learning outcomes:9 13.Funding models of energy-efficient and energy management, 2h, Learning outcomes:12 14.Energy and Competitiveness, 2h, Learning outcomes:10 15.The role of energy management in smart cities and green and smart buildings, 2h, Learning outcomes:3,4,7,10				
Course content auditory	1.no classes 2.no classes 3.no classes 4.no classes 5.no classes 6.no classes 7.no classes 8.no classes 9.no classes 10.no classes 11.no classes 12.no classes 13.no classes 14.no classes 15.no classes				
Course content laboratory	1.no clasess 2.Getting acquainted with computer programs for energy management, 2h, Learning outcomes:3,4 3.no clasess 4.The collection of data on energy consumption, 2h, Learning outcomes:2,3,5,6				

	5.no clasess 6.The collection of data on energy consumption, 2h, Learning outcomes:3,4,5,6,7 7.no clasess 8.Analysis of the parameters that affect energy, 2h, Learning outcomes:6,7 9.no clasess 10.The collection of data on energy consumption, 2h, Learning outcomes:3,4,5,6,7 11.no clasess 12.The collection of data on energy consumption, 2h 13.no clasess 14.The collection of data on energy consumption, 2h, Learning outcomes:3,4,5,6,7 15.Identification of measures to improve energy efficiency, 1h, Learning outcomes:6,7
Required materials	Basic: classroom, blackboard, chalk... Special purpose computer laboratory Overhead projector
Exam literature	1. V. Bukarica i dr, Priručnik za energetske savjetnike, UNDP, Zagreb, 2008, ISBN 978-953-7429-06-5, el. izdanje: http://www.enu.fzoeu.hr/hio/zelena-ee-knjiznica 2. Z.Morvaj, B. Sučić, V. Zanki, G. Čaćić, Priručnik za provedbu energetskih pregleda zgrada, UNDP, Zagreb, 2010, ISBN: 978-953-7429-25-6, elektr. izdanje: http://www.enu.fzoeu.hr/hio/zelena-ee-knjiznica 3. G. Čaćić, M. Bišćan i dr., Priručnik za tjednu i dnevnu analizu i interpretaciju podataka o potrošnji energije, UNDP, Zagreb, 2010, ISBN: 978-953-7429-27-0, elektr. izdanje: http://www.enu.fzoeu.hr/hio/zelena-ee-knjiznica 4. B. Pavković i dr., Priručnik za energetsko certificiranje zgrada, UNDP, Zagreb, 2010, ISBN: 978-953-7429-25-6, elektr. izdanje: http://www.enu.fzoeu.hr/hio/zelena-ee-knjiznica 5. B. Pavković, V. Zanki i dr, Priručnik za energetsko certificiranje zgrada II dio, UNDP, Zagreb, 2012, ISBN: 978-953-7429-40-9, elektr. izdanje: http://www.enu.fzoeu.hr/hio/zelena-ee-knjiznica
Students obligations	At most three absences from lectures and exercises, seminar delivered within.
Knowledge evaluation during semester	seminar
Knowledge evaluation after semester	Written examination / Oral
Student activities:	Aktivnost ECTS (Seminar Work) 2 (Written exam) 2
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.

Code WEB/ISVU	23540/156304	**ECTS**	3.0	**Academic year**	2018/2019
Name	English Language in Mechatronics				
Status	3rd semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - elective course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (30+0+0+0) 30
Teachers	Lectures:1. dr.sc. Biljana Stojaković ,prof.v.š. u trajnom zvanju Auditory exercises:dr.sc. Ivana Špiranec prof. visoke škole				
Course objectives	To transfer to students the knowledge related to the importance of English in the world and in the field of expertise, to enable students to present in English topics related to the field of expertise				
Learning outcomes:	1.To analyse the position and significance of the English language in the field of expertise. Level:6 2.To generate both oral and written communication in the English language). Level:6,7 3.To integrate the mechatronics terminology in new contexts . Level:6,7 4.to generate translation of texts related to the field of expertise. Level:6,7 5.To categorize both English and Croatian mechatronics and IT terminologies. Level:6 6.To make comments on issues related to both the English and Croatian languages used in Mechatronics. Level:6 7.To make a difference between the language used in the field of expertise and standard language. Level:6 8.To make comments on the quality of the contents in the English language posted on the Internet, especially those related to the field of expertise. Level:6 9.To analyse the Internet language translation services. Level:6 10.to present subjects related to the field of expertise. Level:6,7 11.To generate dialogues related to the field of expertise. Level:6,7 12.To analyse types of dictionary. Level:6 13.To make a difference between the free word order in Croatian and the fixed word order in English. Level:6 14.To generate sentences by applying the procedure of sequence of tenses . Level:6,7 15.To identify regular and irregular forms of plural in the English language. Level:6 16.To analyse the English language aspect categories. Level:6 17.To analyse the significance of renewable energy sources.. Level:6				
Methods of carrying out lectures	Ex cathedra teaching Guest lecturer Case studies Simulations Discussion Questions and answers Seminar, students presentation and discussion Homework presentation The teacher presents the material using a technical text which is a source for acquiring new knowledge on a particular topic. The lectures given refer to general topics which have great influence on the field of expertise. The students by their questions, which are the indicator of the intensity of the material adopted, may influence the course of the lecture..				
Methods of carrying out auditory exercises	Group problem solving Traditional literature analysis Data mining and knowledge discovery on the Web Essay writing Discussion, brainstorming Interactive problem solving Workshop Through exercises of listening, reading, speaking and writing the students adopt technical terminology and develop and practice grammatical structrues characteristic for English language.				
Course content lectures	1.English as a lingua franca, 2h, Learning outcomes:1 2.English in engineering, 2h, Learning outcomes:1 3.IT terminology in mechatronics, 2h, Learning outcomes:2,3 4.Croatian IT terminology, 2h, Learning outcomes:2,3 5.English on the Internet, 2h, Learning outcomes:2,3 6.Machine translation, 2h, Learning outcomes:1,2,3,7 7.Internet translation services, 2h, Learning outcomes:1,5,7 8.Dictionary, 2h, Learning outcomes:1,5,7 9.Learning English Online, 2h, Learning outcomes:1,5,6,7 10.Preliminary exam, 2h, Learning outcomes:1,5,7 11.Direct and Indirect Speech, 2h, Learning outcomes:8,9 12.Sequence of tenses, 2h, Learning outcomes:7,8,9 13.Plural of nouns in both English and Croatian, 2h, Learning outcomes:1,10 14.Aspect of English Verb Tenses, 2h, Learning outcomes:1,10 15.Preliminary exam, 2h, Learning outcomes:1,5,7,8,9,10				
Course content auditory	1.Materials and characterics of materials; English verb tenses, 2h, Learning outcomes:2,3,4,7,10,11 2.Smart materials; English verb tenses, 2h, Learning outcomes:2,3,4,7,10,11 3.Computers in engineering; English verb tenses, 2h, Learning outcomes:2,3,4,7,10,11 4.Computer aided manufacturing; Active voice/Passive voice, 2h, Learning outcomes:2,3,4,7,10,11 5.Fractal Roborts; Active voice/Passive voice, 2h, Learning outcomes:2,3,4,7,10,11,12 6.Friction; comparison of adjectives and adverbs, 2h, Learning outcomes:2,3,4,7,10,11 7.preliminary exam, 2h, Learning outcomes:2,3,4,7,10,11 8.Engineering and sustainability, 2h, Learning outcomes:2,3,4,7,10,11,17 9.Internal combustion engines; conditional clauses, 2h, Learning outcomes:2,3,4,7,10,11 10.Electric cars; grammar structures, 2h, Learning outcomes:2,3,4,7,10,11,17 11.Solar energy; Direct and Indirect Speech, 2h, Learning outcomes:2,3,4,7,10,11,13,17 12.Tidal energy; sequence of tenses, 2h, Learning outcomes:2,3,4,7,10,11,13,14,17				

	13.Wind turbines; plural of nouns, 2h, Learning outcomes:2,3,4,7,10,11,15,17 14.Geothermal energy; aspect of English verb tenses, 2h, Learning outcomes:2,3,4,7,11,16,17 15.Preliminary exam, 2h, Learning outcomes:2,3,7,10,11,12,13,14,15,16,17
Required materials	Basic: classroom, blackboard, chalk... Whiteboard with markers Overhead projector Video equipment Operating supplies
Exam literature	Osnovna: Tekstovi o suvremenim tehnologijama preuzeti s interneta (Design News, etc.) Additional literature: Bartolić, Lj. Tehnički rječnik brodogradnje, strojarstva i nuklearne tehnike, Školska knjiga, Zagreb, 1991. On-line dvojezični i jednojezični rječnici.
Students obligations	maximum of 3 absences from exercises
Knowledge evaluation during semester	Regular attendance, mini-tests, homework, written exams
Knowledge evaluation after semester	Both written and oral exam
Student activities:	Aktivnost — ECTS (Classes attendance) — 2 (Constantly tested knowledge) — 1
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
Proposal made by	dr. sc. Biljana Stojaković, prof.v.š..

Code WEB/ISVU	23539/156303	**ECTS**	5.0	**Academic year**	2018/2019
Name	Essentials of Mechanisms				
Status	3rd semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (30+0+0+0) 90
Teachers	Lectures:1. Branimir Markulin Grgić Lectures:2. Vesna Alić-Kostešić dipl.ing.stroj. Auditory exercises: Branimir Markulin Grgić Auditory exercises: Miroslav Radaković				
Course objectives	To qualify students to solve engineering tasks related to kinematics and dynamics of machines, vehicles, robots, manipulators, etc.				
Learning outcomes:	1.ability to analyze the structure of mechanisms and to calculate deegres of freedom. Level:6 2.ability to analyze kinematics of mechanisms using methods of instatenious velocity centres, graphical method of relative velocity and acceleration and analytical method.. Level:6 3.analyze motion of cam folower and set the criteria for selecting the optimal law of motion. Level:6 4.ability to analyze transmission ratios in planetary and differential gear systems. Level:6 5.ability to solve engineering tasks including kinematics and dynamics of mechanisms. Level:6 6.to build different methods of mechanisms synthesis. Level:6,7 7.Computer aided analysis of mechanisms. Level:6,7				
Methods of carrying out lectures	Ex cathedra teaching Case studies Discussion Questions and answers Seminar, students presentation and discussion Auditory lectures.				
Methods of carrying out auditory exercises	Auditory exercises.				
Course content lectures	1.Introduction. Position, velocity, acceleration. Straight line motion. Curvilinear motion in several coordinate systems., 1h, Learning outcomes:1 Position of a riged body in space. Translation and rotation of a rigid body. velocity and acceleration of particular body., 1h, Learning outcomes:1 Ravninsko gibanje. Trenutni pol brzina i trenutni pol ubrzanja. Plan brzina i ubrzanja. Kutna brzina i kutno ubrzanje., 1h, Learning outcomes:1 2.Impuls i kolia gibanja. Zakon kolie gibanja. Moment kolie gibanja i zakon momenta kolie gibanja. Osnovni zakoni dinamike sustava tica., 1h, Learning outcomes:1 Dinamika krutog tijela, translacija, rotacija oko nepomi osi. Kineti moment kod rotacije tijela., 1h, Learning outcomes:4 Dinami reakcije u osloncima. Dinamika ravninskog gibanje tijela, jednadbe gibanja. Sudari tica., 2h, Learning outcomes:4 3.1st preliminary exam, 2h, Learning outcomes:2 4.he aim of theory of kinematics and dynamics of mechanisms. Definitions of mechanism and machine. Short historical overview of mechanisms.Structural analysis of mechanisms. Kinematic pairs. Mobility. Linkages. Design of mechanisms. Analytical and graphical velocity and acceleration solutions. Instantaneous relative velocity centre.ntroduction in dimensional synthesis of simple planar mechanisms. Synthesis of mechanisms for coordinating input and output motion., 1h, Learning outcomes:6 5.Graphical and analytical synthesis methods. Synthesis of mechanism with two and three given position., 2h, Learning outcomes:6 6.Quick return mechanism, four bar mechanism as quick return mechanism, mechanisms generating a straight line motion., 2h, Learning outcomes:5 7.Cam mechanism. Kinematic analysis. Cam profile design. Velocity and acceleration solutions. Determination of a minimal cam radius., 2h, Learning outcomes:2 8.Fixed axis gear transmition. Epicyclic gear transmition with one and two degrees of freedom (differential gear transmition), 2h, Learning outcomes:3 9.2st preliminary exam, 2h, Learning outcomes:1,2 10.Dynamics of mechanisms. Introduction in static and dynamics of mechanism. Determination of inertial forces. Kinetostatics of mechanisms., 2h, Learning outcomes:4 11.Determination of constraint forces. Dynamics of input member. Friction influence on mechanisms motion., 1h, Learning outcomes:4 12.Principle of mass and force reduction. Equation of motion of mechanism. Forces analysis for some basic mechanisms. Balancing., 2h, Learning outcomes:4 13.Dynamics of slider-crank mechanism, design, forces and moments, equivalent masses, flywheel., 2h, Learning outcomes:4 14.Dynamics of cam mechanisms, force analysis, motion without and with damping, torque., 2h, Learning outcomes:4 15.3nd preliminary exam, 2h				
Course content auditory	1.Examples for straight line motion, curvilinear motion and rigid body rotation about stationary axis., 1h, Learning outcomes:1 Examples for equation of motion and for energy conservation law and impulse and momentum law., 1h, Learning outcomes:1 Examples for planar motion dynamics and collision of particles., 1h, Learning outcomes:1 Examples illustrating determination of mobility of 2D and 3D mechanisms., 1h, Learning outcomes:1,2 2.Graphical and analytical solutions of some simple mechanisms., 1h, Learning outcomes:1,2 3.Example in synthesis of four bar mechanism for coordinating input and output motion., 1h, Learning outcomes:6 4.Synthesis of mechanism with two and three given position., 2h, Learning outcomes:6 5.Kinematic analysis of quick return mechanism. Equation of motion of a point on connecting member of four bar mechanism., 2h, Learning outcomes:5				

	6.Examples of cam profile design. Determination of a minimal cam radius, 2h, Learning outcomes:3 7.Transmision ratio calculation for fixed axis gear transmission., 2h, Learning outcomes:4 8.Transmission ratio calculation for epicyclic (planetary) gear transmission., 2h, Learning outcomes:4 9.Example in kinetostatics of mechanisms, 2h, Learning outcomes:5 10.Determination of constraint forces example., 2h, Learning outcomes:5 11.Formulation of the equation of motion for rigid bodies mechanisms., 2h, Learning outcomes:5 12.Forces calculation in slider-crank., 2h, Learning outcomes:5 13.Forces calculation in cam mechanisms, pressure angle., 2h, Learning outcomes:3,5 14.Numerical methods in solving mechanisms., 2h, Learning outcomes:6 15.Example of solving mechanisms in Solidworks., 2h, Learning outcomes:6
Required materials	Basic: classroom, blackboard, chalk... Whiteboard with markers Overhead projector
Exam literature	Osnovna: 1. 1.Bazjanac, D.: Osnovi teorije mehanizama, Zagreb, 1966. 2. Muftić, O.,Drača,K.: Uvod u teoriju mehanizama, Sveučilišna naklada Liber, Zagreb, 1974. Dodatna: 1. Shigley, J. E., Uicker, J. J., Theory of Machines and Mechanisms, McGraw-Hill Book Co. 1995. 2. Parviz, E. N., Computer Aided Analysis of Mechanical Systems, Prentice Hall, New Jersey, 1988.
Students obligations	maximum of 3 absences from exercises
Knowledge evaluation during semester	numerical taska, theoretical questions
Knowledge evaluation after semester	The exam is to be taken through three preliminary exams or through the writen and oral exam after the semester ends.
Student activities:	Aktivnost ECTS (Classes attendance) 1 (Constantly tested knowledge) 3 (Written exam) 1
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
Proposal made by	Petra Bonačić Bartolin, mag.ing.mech.

Code WEB/ISVU	23770/170046	**ECTS**	12.0	**Academic year**	2018/2019
Name	Final Thesis				
Status	6th semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				0+320 (0+0+320+0) 40
Teachers	Seminar exercises:1. dr. sc. Toni Bjažić prof. v. š.				
Course objectives	To enable students to master a specific area in the field of expertise.				
Learning outcomes:	1.ability to write the results of a research. Level:6,7 2.ability to examine all the elements required in a task. Level:6 3.ability to analyse the obtained research results. Level:6 4.combined techniques, skills and modern tools necessary for engineering practice. Level:6,7 5.re-examine the arguments, assumptions and data in order to create opinions and contribute to solving the problem.. Level:6,7				
Methods of carrying out seminars	Traditional literature analysis Data mining and knowledge discovery on the Web Discussion, brainstorming Interactive problem solving Other consultations				
Course content seminars	1.consultations, 2h, Learning outcomes:1,2,3 2.consultations, 2h, Learning outcomes:1,2,3 3.consultations, 2h, Learning outcomes:1,2,3 4.consultations, 2h, Learning outcomes:1,2,3 5.consultations, 2h, Learning outcomes:1,2,3 6.consultations, 2h, Learning outcomes:1,2,3 7.consultations, 2h, Learning outcomes:1,2,3 8.consultations, 2h, Learning outcomes:1,2,3 9.consultations, 2h, Learning outcomes:1,2,3 10.consultations, 2h, Learning outcomes:1,2,3 11.consultations, 2h, Learning outcomes:1,2,3 12.consultations, 2h, Learning outcomes:1,2,3 13.consultations, 2h, Learning outcomes:1,2,3 14.consultations, 2h, Learning outcomes:1,2,3 15.consultations, 2h, Learning outcomes:1,2,3				
Required materials	Special equipment -				
Exam literature	Prema uputama voditelja rada i izboru pristupnika (suradnja s mentorom). Predložena literatura biti će navedena u ovisnosti o zadanoj temi.				
Students obligations	-				
Knowledge evaluation during semester	Regular consultations with mentor				
Knowledge evaluation after semester	Turning in the thesis in writing and a public oral defence.				
Student activities:	Aktivnost (Research) (Experimental work) (Practical work)		ECTS 4 4 4		
Remark	This course can not be used for final thesis theme				
Prerequisites:	No prerequisites.				
Proposal made by	Čedomir Jurčec				

Code WEB/ISVU	24058/156306	**ECTS**	3.0	**Academic year**	2018/2019
Name	German Language in Mechatronics				
Status	3rd semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - elective course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (30+0+0+0) 30
Teachers	Lectures: Marija Krstinić Auditory exercises: Marija Krstinić				
Course objectives	To qualify students to translate texts related to the field of expertise. To enable students to reach the A2 level (and certain elements of B1 level) according to the Common European framework of reference for language learning				
Learning outcomes:	1.ability to carry out standard communication related to the field of expertise . Level:6,7 2.ability to write translation of professional text from German into Croatian by means of a dictionary. Level:6,7 3.ability to define basic Mechatronics terminology . Level:6,7 4.ability to analyse similarities and differences between the structures of German and Croatian professional language. Level:6 5.ability to identify language rules in professional texts. Level:6 6.ability to integrate professional terminology into seminars and presentations. Level:6,7 7.ability to write a business letter using standard letter style. Level:6,7				
Methods of carrying out lectures	Ex cathedra teaching Case studies Questions and answers Homework presentation The lectures are only to a lesser extent, when necessary, conceived as a frontal presentation of the lecturer. The students by their questions, which are the indicators of the intensity of the material adopted, may influence to the course of the lectures and according to their preferences to the selection of texts. The lectures are conceived in intercultural and interdisciplinary terms.				
Methods of carrying out auditory exercises	Group problem solving Interactive problem solving During the auditory exercises the students solve various types of assignments continuously being pointed to cognitive, metacognitive and socioaffective strategies of learning which makes independent learning easier. They are trained for use dictionaries and text-books on their own (traditional as well as mediated by electronic media), as well as various reading techniques and to summary writings and basic business and everyday communication.				
Course content lectures	1.Mechatronik in Makro-/Mikro-/Nanotechnik, 1h, Learning outcomes:3,4 Aktueller Text (Anlass): Tag der Deutschen Einheit, 1h, Learning outcomes:1,4 2.Sprachenportfolio; Neue Rechtschreibung; Zeitformen (Aktiv), 2h, Learning outcomes:1,4 3.Aktueller Text (Anlass): Nobelpreis ...; Nobelpreistraeger usw. /A. Einstein, M. Planck, P. Higgs; M. Soljacic), 2h, Learning outcomes:1,4,5,7 4.Adaptronik, Sensorik; Zeitformen (Passiv), 2h, Learning outcomes:3,4,5 5.Kuenstliche Intelligenz; Passiversatz I, 2h, Learning outcomes:3,4,7 6.Passiversatz II; Anglizismen ohne die es nicht geht, 2h, Learning outcomes:1,3,4,7 7.Alltaegliche Phrasen; Der zerstreute Professor, 1h, Learning outcomes:1,3,4,7 Gekuerzte Nebensaetze (Infinitivgruppen), 1h, Learning outcomes:3,7 8.Laser-, Mikrofertigungstechnik, 1h, Learning outcomes:1,3,4,7 Rektion der Verben; Pronominal - und Frageadverbien, 1h, Learning outcomes:4,6,7 9.CERN (Filme: Geschichte, Aktuelles); Kroaten am CERN, 2h, Learning outcomes:1,3,4 10.Eine nette Geste; Wortbildung (Verbalsubstantive), 2h, Learning outcomes:1,4,5,7 11.Werkzeugmaschinen frueher und heute, 1h, Learning outcomes:1,2,7 Deklination der Substantive, 1h, Learning outcomes:1,3 12.Industrieroboter (Film), 2h, Learning outcomes:1,6,7 13.Mechatronik (Film), 1h, Learning outcomes:1,3,6,7 Adjektivdeklinationen, 1h, Learning outcomes:1,3 14.Im Ausland Mechatronik studieren 1 (Filme), 1h, Learning outcomes:1,3,4,5 Wortstellung im Haupt- und Nebensatz; weil/da - Saetze; als/wenn - Saetze; Relativsaetze, 1h, Learning outcomes:1,3 15.Hochschule 21; Stellenbewerbung und Vorstellungsgespraech , 2h, Learning outcomes:1,4,5,6				
Course content auditory	1.Arbeit mit dem Woerterbuch, 2h, Learning outcomes:2 2.Zeitformen - Aktiv (schriftliche Uebungen), 1h, Learning outcomes:4,5 Kurzgespraeche: Stellen Sie sich vor; Tagesablauf (Praesens), 1h, Learning outcomes:1,5 3.Arbeit mit der Vokabelliste, Referieren ueber die Resultate der Recherchen, 2h, Learning outcomes:1 4.Zeitformen (Passiv): schriftliche Uebungen, 1h, Learning outcomes:4,5 5.1. Kolloquium (Zeitformen; Fachtext zum Uebersetzen), 2h, Learning outcomes:2 6.Passiversatz (schriftliche Uebungen: Umformungen), 2h, Learning outcomes:3,4,5 7.Passiversatz (schriftliche Uebungen: Umformungen); Arbeit mit der Vokabelliste, 2h, Learning outcomes:4,5 8.2. Kolloquium (Passiversatz), 1h, Learning outcomes:4,5 Gekuerzte Nebensaetze / Infinitivgruppen (schriftliche Uebungen), 1h, Learning outcomes:5,6 9.Pronominal- und Frageadverbien (schriftliche Uebungen), 2h, Learning outcomes:1,4,5 10.1. un 2. Kolloquium (Wiederholung), 2h, Learning outcomes:2,3,6 11.Kurzgespraeche: Am telefon, im Geschaeft, 1h, Learning outcomes:1,7 Deklination der Substantive (schriftliche Uebungen, Arbeit mit dem WB), 1h, Learning outcomes:3 12.Arbeit mit dem WB, 2h, Learning outcomes:1,2,7 13.Adjektivdeklinationen (schriftliche Uebungen), 2h, Learning outcomes:3 14.3. Kolloquium Adjektivdeklinationen, Deklination der Substantive, Pronominal- und Frageadverbien, Gekuerzte Nebensaetze), 2h, Learning outcomes:2,3,6 15.Kurzgespraeche: Im Studentenheim, in der Studentenmensa; Arbeit mit dem WB, 2h, Learning outcomes:1,2,3,5				
Required materials	Basic: classroom, blackboard, chalk... Whiteboard with markers				

	Overhead projector During the auditory exercises the students solve various types of assignments continuously being pointed to cognitive, metacognitive and socioaffective strategies of learning which makes independent learning easier. They are trained for use dictionaries and text-books on their own (traditional as well as mediated by electronic media), as well as various reading techniques and to summary writings and basic business and everyday communication.
Exam literature	Osnovna: Stručni časopisi iz svih područja strojarstva. Tekstovi dostupni na stranicama Interneta Additional literature: Rječnici (J. Kljajić, Njemačko-hrvatski praktični rječnik, Školska knjiga, Zagreb, 1998.; M. Uroić, A. Hurm, Hrvatsko-njemački rječnik, Školska knjiga, Zagreb, 1994.; V. Dabac, Tehnički rječnik njemačko-hrvatski, Školska knjiga, Zagreb, 1969.; V. Muljević: Elektrotehnički rječnik njemačko-hrvatski, Školska knjiga, Zagreb, 1996. Gramatike (I. Medić, Deutsche Grammatik fuer jedermann, Školska knjiga, Zagreb, 2002.; T. Marčetić, Pregled gramatike njemačkog jezika, Školska knjiga, Zagreb, 2000.; Dreyer Schmitt: Lehr- und Uebungsbuch der deutschen Grammatik, Verlag fuer Deutsch 2002) M. Čičin-Šain Buljan, J. Kosanović, A. Štampalija, Poslovni njemački 1, Ekonomski fakultet, Zagreb, 1998.
Students obligations	Attendance 80%, Homework 100%
Knowledge evaluation during semester	Attendance: 15 checkups during semester, value 0%, for passage 80%; Mini-exam: 2 checkups during semester, value 5%, for passage 55%; Homework: 3 - 5 checkups, value 10% Written exam: 3 checkups during semester, value 85%, for passage 55%.
Knowledge evaluation after semester	Written exam: 1 checkup, value 40%, for passage 55%; Oral exam: 1 checkup, value 60%, for passage 55%. The preliminary exam includes various types of assignements for testing knowledge of language patterns and a written translation of technical text on their own.
Student activities:	Aktivnost — ECTS (Classes attendance) — 1 (Written exam) — 1 (Activity in class) — 1
Remark	This course can not be used for final thesis theme
Prerequisites:	No prerequisites.
Proposal made by	Angelina Puović

Code WEB/ISVU	23402/155778	**ECTS**	5.0	**Academic year**	2018/2019
Name	Machine Elements				
Status	2nd semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (15+0+0+15) 90
Teachers	Lectures: Vesna Alić-Kostešić dipl.ing.stroj. Lectures:dr. sc. Emil Barić mag. ing. mech. Lectures: Hrvoje Galijan dipl.ing.stroj. Auditory exercises:dr. sc. Emil Barić mag. ing. mech. Auditory exercises: Hrvoje Galijan dipl.ing.stroj. Construction exercises: Antonio Antunović dipl. ing. brodogradnje Construction exercises:dr. sc. Emil Barić mag. ing. mech. Construction exercises: Hrvoje Galijan dipl.ing.stroj. Construction exercises: Goran Lukić Construction exercises:mr.sc. Ante Zaninović dipl.ing.brod.				
Course objectives	To introduce students to the basics of machine elements (their functions, design and applications).				
Learning outcomes:	1.ability to calculate the appropriate dimensions, conjunction and tolerance of shapes and dimensions, and the appropriate texture of technical surfaces of mechatronics machine elements. Level:6 2.ability to anticipate the appropriate indecomposable welded, glued, brazed or bound joints. Level:6,7 3.ability to identify the appropriate decomposable joints, thread types and bolts, springs, etc. . Level:6 4.ability to calculate and choose between a sliding bearing and a roller bearing, and the appropriate way of lubrication and design of a bearing location. Level:6 5.ability to suggest the appropriate coupling. Level:6,7 6.ability to anticipate the necessary elements and ways of motion transfer (belt, chain or gear). Level:6,7 7.ability to calculate the necessary motor power of a device . Level:6 8.ability to prepare the technical documentation for a program task related to the function and work mode of a device, using the available literature on machine elements (manufacturer manuals and catalogues included). Level:6,7 9.present way of doing the exercises. Level:6,7				
Involvement of learning outcomes of the course in study programme:	1.2.OPĆI Primijeniti znanje matematike i fizike na inženjerske probleme.: 10h in 150h 1.3.OPĆI Koristiti tehnike, vještine i suvremene alate neophodne za inženjersku praksu.: 10h in 150h 1.5.OPĆI Identificirati, modelirati i rješavati inženjerske probleme.: 10h in 150h 3.1.MEH Konstruirati strojne elemente i sklopove sa stanovišta čvrstoće i deformacija, kinematike i dinamike: 100h in 150h 3.2.MEH Predložiti vrste materijala i tehnološki postupak izrade: 10h in 150h				
Methods of carrying out lectures	Ex cathedra teaching Lectures are auditory with graphical presentations using slides and foils together with models and films.				
Methods of carrying out auditory exercises	Group problem solving Interactive problem solving				
How construction exercises are held	Acquiring knowledge on shaping and function of machine parts of mechatronic systems. Programme assignment starts with explaining the total function and through the propositions of the bases of calculation, according to the pattern for the exercised, geometric values and the shapes of machine elements are defined. After making an assebly drawing and design analysis of the positions, while presenting the programme the students also take a preliminary exam.				
Course content lectures	1.The texture of the technical surfaces, 2h, Learning outcomes:1 2.Dimensional tolerances and fits, 2h, Learning outcomes:1 3.Tolerances of form and position, 2h, Learning outcomes:1 4.Undetachable joints: Welded, glued, brazed, screwed, 2h, Learning outcomes:2 5.Detachable joints: definition of threads, labels, screws, spring elements, hub joints, joints with pins and bolts, 2h, Learning outcomes:3 6.Elements of the transfer of motion: shafts and axletrees, 2h, Learning outcomes:6 7.Elements of the transfer motion: calculationt of twisting and bending, material selection, design, 2h, Learning outcomes:6 8.1. test, 2h, Learning outcomes:1,2,3,6 9.Sliding and roller bearings: calculation, selection, lubrication, design of the bearing flatbed place, 2h, Learning outcomes:4 10.Couplings: types, applications, 2h, Learning outcomes:5 11.Power transmission: belt (poly V, jagged, wedged); calculation, selection, 2h, Learning outcomes:6 12.Power transmission: chain and friction; calculation, selection, 2h, Learning outcomes:6 13.Power transmission: gears; calculation, selection, 2h, Learning outcomes:6 14.Sealing: static, dynamic, 2h, Learning outcomes:4 15.2. test, 2h, Learning outcomes:4,5,6				
Course content auditory	1.Getting familiar with the content of the auditory exercises and their realization, 1h, Learning outcomes:9 2.Assigning the 1st programmatic task of the brazed or bound -welded joint. Its Design using Excel. Calculation of the brazed joint-instructions and an explanation., 1h, Learning outcomes:1,2 3.The Calculation of the welded construction of the 1st programmatic task- instructions and an explanation., 1h, Learning outcomes:2 4.No classes, 2h 5.Answering exam questions on the welded and riveted joints with the springs., 1h, Learning outcomes:2,3 6.Answering exam questions on the welded and riveted joints with the springs., 2h, Learning outcomes:2,3 7.Assigning the 2nd programmatic task of the riveted joint. Its design using Excel. Calculation of the brazed joint-instructions and an explanation., 1h, Learning outcomes:3 8.Answering exam questions on ropes and bolts., 1h, Learning outcomes:4 9.Assigning the 3rd programmatic task of the car jack. Its Design using Excel. Calculation of the car jack-instructions and an explanation., 1h, Learning outcomes:4 10.No classes, 2h				

	11.Answering exam questions on power transfer with the cog and belt-drive Assistence., 2h, Learning outcomes:6,7 12.No classes, 2h 13.No classes, 2h 14.Assigning the 4th programmatic task of the shaft with 2-degree reduction gear. Its design using Excel. Calculation of the shaft-instructions and explanations., 2h, Learning outcomes:5,8 15.No classes, 2h
Course content constructures	1.getting familiar with the content of the construction exercises and their realization, 1h, Learning outcomes:9 2.Design calculations in Excel of the 1st part of the programmatic task- selection of the conjuctions, 1h, Learning outcomes:1 3.The calculation of the welded construction of the 1st programmatic task, 1h, Learning outcomes:2 4.Making of the workshop drawings of the 1st programmatic task with all the drawing, 2h, Learning outcomes:1,2,3,8 5.Designing assembly drawing of the 1st programmatic task with all the drawing, 1h, Learning outcomes:1,2,3,8 6.No classes, 2h 7.Design calculation in Excel of the 2nd programmatic task- number and arrangement of workshop sketches bolts, 1h, Learning outcomes:2 8.Making the workshop drawings of the 2nd programmatic task with all the drawing, 1h, Learning outcomes:8 9.Making the assembly drawing of the 2nd programmatic task with all the drawing, 1h, Learning outcomes:8 10.Design calculation in Excel of the 3rd programmatic task- selection of the arbor and the calculation of the array, 2h, Learning outcomes:3 11.No classes, 2h 12.Making the workshop drawings of the 3rd programmatic task with all the drawing, 2h, Learning outcomes:8 13.Making the assembly drawings of the 3rd programmatic task with all the drawing, 2h, Learning outcomes:8 14.No classes, 2h 15.Making the workshop drawings of the 4th programmatic task with all the drawing, 2h, Learning outcomes:8
Required materials	Basic: classroom, blackboard, chalk... Special purpose computer laboratory Whiteboard with markers Overhead projector
Exam literature	Osnovna: 1. K. H. Decker: Elementi strojeva, Golden marketing - Tehnička knjiga, Zagreb, 2006. 2. M.Kostelac, Z. Herold: Predložak za izradu programskog zadatka, TVZ, 2008. 3. Katalozi proizvođača: vijaka, ležaja: spojki, opruga, i dr. 4. Norme: EN, ISO, HRN, DIN Dodatna: 1. Studenti mogu koristiti svu raspoloživu literaturu iz područja elemenata strojeva, uključujući priručnike i kataloge s tvorničkim proračunima proizvođača strojarskih komponenata, opreme i uređaja.
Students obligations	regular class attendance
Knowledge evaluation during semester	two tests and programme assignments
Knowledge evaluation after semester	wrtiten and oral exam
Student activities:	Aktivnost — ECTS (Classes attendance) — 1 (Constantly tested knowledge) — 2 (Written exam) — 2
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
ISVU equivalents:	143203;
Proposal made by	Čedomir Jurčec, Hrvoje Galijan

Code WEB/ISVU	23762/170038	**ECTS**	4.0	**Academic year**	2018/2019
Name	Maintenance of Technical Systems in Mechatronics				
Status	5th semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+15 (10+5+0+0) 75
Teachers	Lectures: Vesna Alić-Kostešić dipl.ing.stroj. Lectures:mr.sc. Branimir Preprotić dipl. inž. stroj. Auditory exercises: Darko Mitrović Auditory exercises:mr.sc. Branimir Preprotić dipl. inž. stroj. Laboratory exercises:mr.sc. Branimir Preprotić dipl. inž. stroj.				
Course objectives	To transfer to students the knowledge related to life-cycle of technical systems (TS), approach development, concept and model of maintenance related to the TS development, strategies applied in TS and Mechatronics equipment maintenance, elaboration of maintenance processes, TS quality features, basic technologies, diagnostics, etc. in contemporary maintenance of Mechatronics equipment, basic elements of maintenance organisation, i.e. maintenance management.				
Learning outcomes:	1.ability to develop the foundations for a modern approach to maintenance. Level:6,7 2.ability to categorize technical systems by criticality. Level:6 3.ability to examine the recommendations issued by manufacturers of technical systems. Level:6 4.ability to keep data on delays in Mechatronics Engineering Systems. Level:6,7 5.ability to analyse data on delays and failures of technical systems. Level:6 6.ability to propose technological processes of preventive and corrective maintenance. Level:6,7 7.ability to propose a strategy for the maintenance of technical mechatronics systems. Level:6,7 8.calculate the number of employees in maintenance costs compared to TS. Level:6 9.calculate the parameters for a decision on replacing the old with the new TS. Level:6 10.examine the parameters of vibration and noise in the rotational TS. Level:6				
Methods of carrying out lectures	Ex cathedra teaching Guest lecturer Case studies Demonstration Discussion A traditional way of lecturing will be accompanied with presentations on foils or in Power Point using the LCD projector as well as with other presentations enabling better understanding of the material lectured (photos, diagrams of process flow in maintenance activity and films).				
Methods of carrying out auditory exercises	Group problem solving Discussion, brainstorming Interactive problem solving Solving numerical problems on the blackboard from all the fields of this course with students				
Methods of carrying out laboratory exercises	Using one of the available SW packages or a visit to a representative company which has it. Measuring of noise and vibrations by instruments in a laboratory.				
Course content lectures	1. General terms of maintaining equipment and terminology used, 2h, Learning outcomes:1 2. The development of approaches and concepts maintenance functions in relation to the development of technical systems, 1h, Learning outcomes:2,7 Terotechnology, TPM, Scheduled Maintenance, RCM, 1h, Learning outcomes:2,3,7 3.Terotechnology, TPM, Scheduled Maintenance, RCM, 2h, Learning outcomes:2,3,7 4.Terotechnology, TPM, Scheduled Maintenance, RCM, 1h, Learning outcomes:2,3,7 Maintenance strategy selection, 1h, Learning outcomes:7 5. Maintenance strategy selection, 1h, Learning outcomes:7 Primary and secondary maintenance tasks, 1h, Learning outcomes:6 6.Tub curve, drop the working abilities of technical systems, technical indicator correctness, 2h, Learning outcomes:4,5 7. Features quality equipment, classification equipment, 2h, Learning outcomes:3 8.Features quality equipment, classification equipment, 1h, Learning outcomes:3 The budget availability and extraction equipment reliability and use of the results, 1h, Learning outcomes:4,5 9. The budget availability and extraction equipment reliability and use of the results, 2h, Learning outcomes:4,5 10. First Colloquium on which examines the processed material (colloquium consists of theoretical and numerical problems, 1h, Learning outcomes:1,2,3,4,5,7 Technology to maintain mechatronic equipment: General approach to designing and implementing technology maintenance, 1h, Learning outcomes:3,6,7 11. Technology to maintain mechatronic equipment: General approach to designing and implementing technology maintenance, 1h, Learning outcomes:6,7 Parameters for determining the condition of equipment and types of diagnostics, 1h, Learning outcomes:6,7 12. Parameters for determining the condition of equipment and types of diagnostics, 1h, Learning outcomes:3,6,7 Using different technologies in the repair of machine parts, 1h, Learning outcomes:3,6 13. Using different technologies in the repair of machine parts, 1h, Learning outcomes:3,6 Lubrication and corrosion protection, 1h, Learning outcomes:3,6 14. Defining the process of maintaining their organizational implementation in different industries., 2h, Learning outcomes:1,7 15. Modern solutions maintenance organization and trends in the world, 1h, Learning outcomes:6,7 Second Colloquium on the material worked out the technology and organization (IT) maintenance, 1h, Learning outcomes:3,4,5,6,7				
Course content auditory	1. There was no need to exercise because the material has not yet been exposed, and instead exercise lecture, 1h 2. There was no need to exercise because the material has not yet been exposed, and instead exercise lecture, 1h 3. There was no need to exercise because the material has not yet been exposed, and instead exercise lecture, 1h 4.There was no need to exercise because the material has not yet been exposed, and instead exercise lecture , 1h 5. How to choose the right strategy to maintain, 1h, Learning outcomes:7				

	6. How to use the theoretical bases of the TS in the definition of maintenance activities?, 1h, Learning outcomes:4,5,7 7. Solving problems from time picture of the situation, the availability and reliability, 1h, Learning outcomes:3,4,5 8. Solving problems from time picture of the situation, the availability and reliability, 1h, Learning outcomes:3,4,5 9. Solving problems from time picture of the situation, the availability and reliability, 1h, Learning outcomes:3,4,5 10.laboratory exercises, 1h 11.laboratory exercises, 1h 12.laboratory exercises, 1h 13. laboratory exercises, 1h 14. Determination of the number of employees in relation to investment in TS, 1h, Learning outcomes:8 15. Calculation of required financial elements of the decision to acquire the new TS, 1h, Learning outcomes:8
Course content laboratory	1.lectures, 1h 2.lectures, 1h 3.lectures, 1h 4.lectures, 1h 5.exercises, 1h 6.exercises, 1h 7.exercises, 1h 8.exercises, 1h 9.exercises, 1h 10.Laboratory exercises in groups of diagnostic methods vibration and noise ball bearings, 1h, Learning outcomes:10 11.Laboratory exercises in groups of diagnostic methods vibration and noise ball bearings, 1h, Learning outcomes:10 12.Laboratory exercises in groups of diagnostic methods vibration and noise ball bearings, 1h, Learning outcomes:10 13.Laboratory exercises in groups of diagnostic methods vibration and noise ball bearings, 1h, Learning outcomes:10 14.Laboratory exercises in groups of diagnostic methods vibration and noise ball bearings, 1h, Learning outcomes:10 15.Calculation and comparison of different approaches to determine the possible replacement of the old TS new, 1h, Learning outcomes:9
Required materials	Basic: classroom, blackboard, chalk... Whiteboard with markers Overhead projector The subject will be exposed with the help of LCD projectors and using plates, and the lab will use the two diagnostic instrument
Exam literature	Osnovna: 1. I. Čala: Održavanje opreme, Inženjerski priručnik, Školska knjiga, Zagreb, 2002. 2. D. Dujmović, B. Androić: Inženjerstvo pouzdanosti, I.A. Projektiranje, Zagreb, 2006. 3. D. Dereani: Održavanje elektrotehničke opreme, FESB,Split, 2014. (pripremljena za tiskanje) Dodatna: 1. Časopis "Maintworld" u sklopu kojeg je Održavanje i eksploatacija HDO, Zagreb, 2014. 2. Nakajima, S: TPM, Introduction to TPM, Productivity Press, New York, 1988. 3. L. R. Higins: R.K. Mobley: Maintenance Engineering Hand Book, Mc Graw Hill, Now York, 2002, sixth edition, 4. J. Moubray, Reliability - centered Maintenance, Butterworth-Heinemann, Oxford, 1997.
Students obligations	maximum of 3 absences from exercises
Knowledge evaluation during semester	Each student can through two exams to pass the written part of the exam, and if the total of colloquia has 50% of the points. It's his condition to get out of the oral exam, which gives the remaining 50% impact on the assessment.
Knowledge evaluation after semester	The written exam consists of 5-6 theoretical questions and 2-3 numerical task, and the minimum to come out on the oral exam has won 50% of points on the written part.
Student activities:	Aktivnost — ECTS (Classes attendance) — 1 (Constantly tested knowledge) — 2 (Written exam) — 1
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
Proposal made by	Ivo Čala

Code WEB/ISVU	23247/143196	**ECTS**	5.0	**Academic year**	2018/2019
Name	Materials and Manufacturing Processes				
Status	1st semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (0+30+0+0) 90
Teachers	Lectures:1. izv.prof. dr. sc. Darko Landek Lectures:2. Mladen Šercer Lectures: Željko Alar Lectures: Vesna Alić-Kostešić dipl.ing.stroj. Lectures:Doc. dr. sc. Ana Pilipović Laboratory exercises: Željko Alar Laboratory exercises:izv.prof. dr. sc. Darko Landek Laboratory exercises:Doc. dr. sc. Ana Pilipović Laboratory exercises: Mladen Šercer				
Course objectives	To introduce students to the composition and structure of materials, phase diagrams, basics in hardening and basics in materials properties, procedures of heat treatment of metal. To teach students how to apply the proper materials. To introduce students to the basics of production procedures in metal and non-metal artefacts manufacturing.				
Learning outcomes:	1.ability to understand the basic groups and subgroups of materials and manufacturing processes suitable for certain materials as well as the features of materials essential for a machine element or a structure. Level:6 2.ability to understand the chemical composition, microstructure and characteristics of materials . Level:6,7 3. ability to identify the basic mechanical, tribological, corrosion and technological characteristics of materials. Level:6 4.ability to present the results of the analyses of characteristics, the suitability of a material for machine elements or structures and the suitability for the technological processing procedures. Level:6,7 5.ability to put a request for mechanical properties and heat treatment on a drawing. Level:6,7 6.identify identify machining procedures, metal forming procedures, foundry processes, procedures of polymer processing and additive procedures. Level:6 7.clasiffy manufacturing procedures of metal and polymer products according to various criteria. Level:6,7 8.suggest the type of material, technological processing procedure and the most important propreties of a specific construction. Level:6,7 9.compare the additive manufacturing procedures regarding the materials used and the final product properties with the procedures of processing polymers. Level:6,7				
Involvement of learning outcomes of the course in study programme:	1.5.OPĆI Identificirati, modelirati i rješavati inženjerske probleme.: 5h in 150h 2.2.OSOBNE Odgovornost, dosljednost, točnost, ažurnost.: 5h in 150h 2.10.OSOBNE Prilagodljivost novim tehnologijama i tehnikama kao dio procesa cjeloživotnog učenja.: 20h in 150h 2.11.OSOBNE Otvorenost za nova znanja, iskustva i kulturne okolnosti.: 10h in 150h 3.2.MEH Predložiti vrste materijala i tehnološki postupak izrade: 110h in 150h				
Methods of carrying out lectures	Ex cathedra teaching Case studies Discussion The lectures are given by designing the necessary diagrams and drawings on the blackboard and with foil projections by an overhead projector. A part of lectures is carried out by presentations using Power Point.				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Group problem solving Laboratory exercises are carried out in the Laboratories of the Department for Materials using the equipment for heat treatment (different chamber and pit heaters; salt baths, vacuum oven, industrial generator) where the trials of tempering, glowing, yielding, carbonizing, nitriting, boroning are carried out. The evaluation of the abilities achieved is carried out on solidity-meters, coding meters, Charpy				
Course content lectures	1.Mechanical properties of materials and their testing. Stress-strain testing. Hardness. Toughness and impact fracture energy for , 2h, Learning outcomes:1,2,3 2.Fatique and creep of materials. Other material properties., 2h, Learning outcomes:2,3 3.Procedures of heat treatment of metals annealing, hardening, tempering. Procedures for surface modifications, 2h, Learning outcomes:4,5 4.Systematization of materials. Abilities and use of iron castings and general construction steel. Abilities and use of steel of increased hardness, steel for tempering, steel for carburizing, steel for springs, 2h, Learning outcomes:1,2,3,4 5.Abilities and use of corrosively and chemically stable steel and steel for high and low temperatures. Abilities and use of tool steel. Abilities and use of copper, aluminium, nickel, cobalt, titan and magnesium alloys, 2h, Learning outcomes:1,2,3,4 6.Abilities and use of construction ceramics and hard metals. Abilities and use of polymer and composite materials, 2h, Learning outcomes:1,2,3,4,5 7.First preliminary exam., 2h, Learning outcomes:1,2,3,4,5 8.Production of artefacts and polymer properties. Continuous and cyclic polymer processing procedures., 2h, Learning outcomes:6,7,8 9.Additive manufacturing of prototypes, products, tools and moulds., 2h, Learning outcomes:9 10.Fundamentals of casting technology. Quality and casting defects., 2h, Learning outcomes:6,7,8 11.Physical fundamentals of metal forming. Forming procedures., 2h, Learning outcomes:6,7,8 12.The principle of achieving weld. Clasiffication of welding procedures., 2h, Learning outcomes:6,7,8 13.Processing procedures carried out by means of defined geometry tools, undefined geometry tools and non-conventional procedures. , 2h, Learning outcomes:6,7,8 14.Basic principles of protection against corrosion. Protective coating. Metal and non-metal coatings. Electrical methods of protection against corrosion, 2h, Learning outcomes:8 15.Second preliminary exam., 2h, Learning outcomes:6,7,8,9				
Course content laboratory	1.No classes., 2h 2.Crystallography, 2h, Learning outcomes:2 3.Fe-C phase diagram and metallography of Fe-C alloys , 2h, Learning outcomes:1,2 4.Stress-strain testing, 2h, Learning outcomes:2,3				

	5.Hardness testing and impact fracture testing, 2h, Learning outcomes:2,3 6.Tribology testing and analysis of wear, 2h, Learning outcomes:2,3,4 7.Testing of steel hardenability, 2h, Learning outcomes:2,3,5 8.No classes. 9.Injection moulding. Fused deposition modeling - additive production., 2h, Learning outcomes:6,7,8,9 10.Manufacturing of moulds and cores. Casting and moulding procedures., 2h, Learning outcomes:6,7,8 11.Full profile matrices. Free forging. Deep dragging of axial symmetry vessel., 2h, Learning outcomes:6,7,8 12.REL and MIG/MAG welding: the machines and devices used and techniques applied. Computer aided welding by means of a laser., 2h, Learning outcomes:6,7,8 13.Main and auxiliary motions on machine tools. Drilling, turning, milling and grinding procedures. Parameters of surface roughness in HSC and HM procedures on CNC milling machines. , 2h, Learning outcomes:6,7,8 14.Samples of different constructions and parts of a plant damaged by corrosion. Coatings used against corrosion., 2h, Learning outcomes:6,7,8 15.Nema nastave.
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory Whiteboard with markers Overhead projector Operating supplies Special equipment Laboratory exercises are carried out in the Laboratories of the Department for Materials using the equipment for heat treatment (different chamber and pit heaters; salt baths, vacuum oven, industrial generator) where the trials of tempering, glowing, yielding, carbonizing, nitriting, boroning are carried out. The evaluation of the abilities achieved is carried out on solidity-meters, coding meters, Charpy
Exam literature	Obavezna: Landek, D., Šercer, M.: Materijali i proizvodni postupci (autorizirana predavanja, FSB, Zagreb, 2013. Dodatna: Kovačiček, F., Španiček, Đ.: Materijali - Osnove znanosti o materijalima, FSB, Zagreb, 2000. Ivušić, V.: Dijagrami stanja metala i legura, FSB, 2003. Stupnišek, M., Cajner, F.: Osnove toplinske obradbe metala, FSB, 2001. Franz, M.: Mehanička svojstva materijala, FSB, Zagreb, 1998. Filetin, T. Kovačiček, F., Indof, J.: Svojstva i primjena materijala, FSB, Zagreb, 2002.
Students obligations	obligatory attendance of laboratory exercises
Knowledge evaluation during semester	Two preliminary exams, theoretical questions.
Knowledge evaluation after semester	Written exam
Student activities:	Aktivnost — ECTS (Classes attendance) — 1 (Constantly tested knowledge) — 3 (Written exam) — 1
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
Proposal made by	Darko Landek and Mladen Šercer

Code WEB/ISVU	23246/143194	**ECTS**	7.0	**Academic year**	2018/2019
Name	Mathematics				
Status	1st semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				45+45 (45+0+0+0) 120
Teachers	Lectures:1. dr.sc. Vlatko Mićković prof. Auditory exercises:dr.sc. Vlatko Mićković prof.				
Course objectives	To enable students to solve mathematical problems related to engineering practice				
Learning outcomes:	1.ability to calculate the value of units containing basic arithmetic operations consisting of complex numbers. Level:6 2.ability to draw the position of a complex number in gaussian plane. Level:6 3.ability to calculate the determinants and simple matrix units. Level:6 4.ability to calculate vector units. Level:6 5.ability to solve linear equations. Level:6 6.ability to understand the definition and composition of a function; to understand inverse functions. Level:6,7 7.ability to classify functions: even functions/odd functions, injections/surjections/bijections. Level:6,7 8.ability to classify basic types of elementary function: exponential functions, polynomials, logarithm functions. Level:6,7 9.ability to sketch graphs of polynomials, trigonometric functions and rational functions without using derivatives. Level:6 10.ability to calculate the limit of a function. Level:6 11.ability to calculate the derivative of a function. Level:6 12.ability to sketch function graphs by means of derivatives and critical points. Level:6				
Involvement of learning outcomes of the course in study programme:	1.1.OPĆI Služiti se stranim jezikom u literaturi i svakodnevnoj stručnoj komunikaciji. : 10h in 210h 1.2.OPĆI Primijeniti znanje matematike i fizike na inženjerske probleme.: 150h in 210h 1.3.OPĆI Koristiti tehnike, vještine i suvremene alate neophodne za inženjersku praksu.: 10h in 210h 1.5.OPĆI Identificirati, modelirati i rješavati inženjerske probleme.: 10h in 210h 2.2.OSOBNE Odgovornost, dosljednost, točnost, ažurnost.: 10h in 210h 2.3.OSOBNE Etički i moralni pristup radu.: 10h in 210h 2.4.OSOBNE Kritička evaluacija argumenata, pretpostavki i podataka u cilju stvaranja mišljenja i pridonošenja rješenju problema.: 10h in 210h				
Methods of carrying out lectures	Ex cathedra teaching Case studies Discussion Questions and answers Other The chalkboard lectures include theory and many examples clearly analyzed step by step, in cooperation with students.				
Methods of carrying out auditory exercises	Group problem solving Discussion, brainstorming Other Exercises are solved on the blackboard in cooperation with students.				
Course content lectures	1.Complex numbers, algebraic and trigonometric form, basic arithmetic operations with complex numbers (addition, subtraction, multiplication, division, raising to an integer power, and taking roots (fractional power)), Gauss plane, 3h, Learning outcomes:1,2 2.Determinant (2nd order - by formula, 3rd order - by rule of Sarrus and Laplaces expansion, 4th order - by Laplaces expansion and using elementary transformations), 3h, Learning outcomes:3,5 3.System of linear equations, solving by Cramers rule and by Gauss-Jordan elimination method , 3h, Learning outcomes:5 4.Vectors, 3h, Learning outcomes:4,5 5.Functions, definition, domain, range, codomain, injection, surjection, bijection, graph, increasing and decreasing functions, monotonicity, composition, inverse, even and odd functions, 3h, Learning outcomes:6,7 6.Elementary functions: power functions, polynomials, exponential functions, logarithmic functions, trigonometric functions, hyperbolic functions, 3h, Learning outcomes:6,7,8 7.1. exam, 3h, Learning outcomes:1,2,3,4,5,6,7,8 8.Limit, sequence, 3h, Learning outcomes:10 9.Sketching graphs of some functions (polynomials, trigonometric functions), 3h, Learning outcomes:9 10.Problem of finding a tangent, derivative of function, rules for derivative of a sum, product and quotient of two functions, 3h, Learning outcomes:9,12 11.Differential, implicit differentiation, parametric differentiation, 3h, Learning outcomes:10,11 12.Derivative of a composite function, derivative of function f(x)=x^x, 3h, Learning outcomes:5,11 13.LHopitals rule, 3h, Learning outcomes:11 14.Taylor polinomial of a function centered at zero, 3h, Learning outcomes:11 15.2. exam, 3h, Learning outcomes:9,10,11,12				
Course content auditory	1.Complex numbers, algebraic and trigonometric form, basic arithmetic operations with complex numbers (addition, subtraction, multiplication, division, raising to an integer power, and taking roots (fractional power)), Gauss plane, 3h, Learning outcomes:1,2 2.Determinant (2nd order - by formula, 3rd order - by rule of Sarrus and Laplaces expansion, 4th order - by Laplaces expansion and using elementary transformations), 3h, Learning outcomes:3,5 3.System of linear equations, solving by Cramers rule and by Gauss-Jordan elimination method , 3h, Learning outcomes:6 4.Vectors, 3h, Learning outcomes:4,5 5.Functions, definition, domain, range, codomain, injection, surjection, bijection, graph, increasing and decreasing functions, monotonicity, composition, inverse, even and odd functions, 3h, Learning outcomes:6,7 6.Elementary functions: power functions, polynomials, exponential functions, logarithmic functions, trigonometric functions, hyperbolic functions, 3h, Learning outcomes:6,7,8 7.1. exam, 3h, Learning outcomes:1,2,3,4,5,6,7,8				

	8.Limit, sequence, 3h, Learning outcomes:10 9.Sketching graphs of some functions (polynomials, trigonometric functions), 3h, Learning outcomes:9 10.Problem of finding a tangent, derivative of function, rules for derivative of a sum, product and quotient of two functions, 3h, Learning outcomes:9,12 11.Differential, implicit differentiation, parametric differentiation, 3h, Learning outcomes:10,11 12.Derivative of a composite function, derivative of function f(x)=x^x, 3h, Learning outcomes:11 13.LHopitals rule, 3h, Learning outcomes:11 14.Taylor polinomial of a function centered at zero, 3h, Learning outcomes:11 15.2. exam, 3h, Learning outcomes:9,10,11,12
Required materials	Basic: classroom, blackboard, chalk... Whiteboard with markers Special equipment Some of the problems are solved using the appropriate software Mathematica.
Exam literature	Basic literature: 1. P. Javor: Uvod u matematičku analizu, Školska knjiga, Zagreb, 1983. 2. S. Suljagić: Matematika I, skripta, Zagreb, 2005 3. I. Slapničar: Matematika 1, skripta, Split, 2002. 4. B. P. Deminovič: Zadaci i rješeni primjeri iz više matematike, Danjar, Zagreb, 1995. 5. N. Elezović: Linearna algebra, Element, Zagreb, 1995. Additional literature: 1. L. Krnić, Z. Šikić: Račun diferencijalni i integralni, I dio, Školska knjiga, Zagreb, 1992. 2. V. Devide: Riješeni zadaci iz više matematike, svezak i i II, Školska knjiga, Zagreb, 1985. 3. T. Bradić, R. Roki, J. Pečarić, M. Strunje: Matematika za tehničke fakultete, Multigraf, Zagreb, 1994.
Students obligations	No special requirements
Knowledge evaluation during semester	Two exams during semester Ratings by the outcome: maximum 100 points 50-62 sufficient (2) 63-75 good (3) 76-88 very good (4) 89-100 excellent (5)
Knowledge evaluation after semester	Written exam 60% of mark Ratings of written part of the exam: maximum 100 points 50-62 sufficient (2) 63-75 good (3) 76-88 very good (4) 89-100 excellent (5) Oral exam 40% of mark
Student activities:	Aktivnost — ECTS (Written exam) — 4 (Oral exam) — 2 (Constantly tested knowledge) — 1
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
Proposal made by	dipl.ing.mat Tihana Strmečki., 19.05.2016.

Code WEB/ISVU	23249/143201	**ECTS**	2.0	**Academic year**	2018/2019
Name	Matlab				
Status	2nd semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				15+30 (0+30+0+0) 15
Teachers	Lectures:1. Hrvoje Rakić , dipl.ing.stroj., pred. Laboratory exercises: Hrvoje Rakić , dipl.ing.stroj., pred.				
Course objectives	Acquiring basic knowledge and skills in work with program package Matlab/Simulink.				
Learning outcomes:	1.ability to create different types of variables in Matlab, and execute basic relational and logic operations with that variables. Level:6,7 2.ability to draw a graph of given mathematical function in Matlab using M-functions and scripts. Level:6 3.ability to solve algebraic, non-algebraic, ordinary differential equations and systems of equations using Matlab Symbolic Toolbox. Level:6 4.ability to draw a graph of given mathematical function in Matlab using Symbolic Toolbox. Level:6 5.ability to write simple computer programs in Matlab. Level:6,7 6.ability to solve algebraic, non-algebraic and ordinary differential equations by simulation in Simulink. Level:6				
Involvement of learning outcomes of the course in study programme:	1.1.OPĆI Služiti se stranim jezikom u literaturi i svakodnevnoj stručnoj komunikaciji. : 5h in 60h 1.2.OPĆI Primijeniti znanje matematike i fizike na inženjerske probleme.: 5h in 60h 1.3.OPĆI Koristiti tehnike, vještine i suvremene alate neophodne za inženjersku praksu.: 5h in 60h 1.5.OPĆI Identificirati, modelirati i rješavati inženjerske probleme.: 10h in 60h 2.2.OSOBNE Odgovornost, dosljednost, točnost, ažurnost.: 5h in 60h 3.4.MEH Predložiti senzore, aktuatore, energetske i upravljačke jedinice, komunikacijske protokole i popratnu opremu za automatizaciju različitih tehničkih procesa u mehatronici (elektromotorni pogoni, alatni strojevi, procesi skladištenja fluida, toplinski i tra: 10h in 60h 3.5.MEH Proračunati parametre regulatora za regulaciju različitih tehničkih procesa u mehatronici: 10h in 60h 3.11.MEH Analizirati rad robota i manipulatora u mehatronici (izborni predmet): 10h in 60h				
Methods of carrying out lectures	Ex cathedra teaching Simulations Modelling Discussion Questions and answers				
Methods of carrying out laboratory exercises	Laboratory exercises, computer simulations Group problem solving Discussion, brainstorming Computer simulations				
Course content lectures	1.Introductory lecture; Introduction to Matlab, 0.5h 2.Starting and organization of Matlab; Variables in Matlab; Operations in Matlab; Relational operators; Logic operators: Decision and loop statements, 1.5h, Learning outcomes:1 3.Elementary mathematical functions in Matlab; Vector and matrix processing functions; String processing functions; Polynomial functions, 1.5h, Learning outcomes:2 4.M-functions and scripts; Functions for 2D and 3D graphs plotting, 1.5h, Learning outcomes:2,5 5.Basic functions of Symbolic Toolbox; Mathematical analysis in Symbolic Toolbox, 1.5h, Learning outcomes:3,6 6.Linear algebra functions in Symbolic Toolbox; Functions for solving algebraic and differential equations, 1.5h, Learning outcomes:3,5 7.Integral transformations (Fourier, Laplace); Simplification and substitution of symbolic expressions, 1.5h, Learning outcomes:3,5 8.Graphical functions of Symbolic Toolbox, 1h, Learning outcomes:4,5 9.Basic work techniques in Simulink; Introduction to simulation of dynamical systems in Simulink, 1.5h, Learning outcomes:6 10.Examples of dynamical systems simulation in Simulink, 1.5h, Learning outcomes:5,6 11.Advanced work techniques in Simulink, 1.5h, Learning outcomes:5,6 12.No lectures 13.No lectures 14.No lectures 15.No lectures				
Course content laboratory	1.No exercises 2.No exercises 3.Variables in Matlab; Operations in Matlab; Relational operators; Logic operators; Making desicions and performing loops, 3h, Learning outcomes:1 4.Elementary mathematical functions in Matlab; Vector and matrix processing functions; String processing functions; Polynomial functions, 3h, Learning outcomes:2 5.M-functions and scripts; Matlab functions for 2D and 3D graphical plotting, 3h, Learning outcomes:2,5 6.Basic functions of Symbolic Toolbox; Mathematical analysis functions in Symbolic Toolbox, 3h, Learning outcomes:3 7.Linear algebra functions in Symbolic Toolbox; Functions for solving of algebraic and differential equations, 3h, Learning outcomes:3,5 8.Integral transformations (Fourier, Laplace); Simplifications and substitutions of symbolic expressions, 3h, Learning outcomes:3,5 9.Graphical functions of Symbolic Toolbox, 3h, Learning outcomes:4,5 10.Basic work techniques in Simulink; Introduction to simulation of dynamical systems in Simulink, 3h, Learning outcomes:6 11.Examples of dynamic systems simulation in Simulink, 3h, Learning outcomes:5,6 12.Advanced work techniques in Simulink, 3h, Learning outcomes:5,6 13.No exercises				

	14.No exercises 15.No exercises
Required materials	Basic: classroom, blackboard, chalk... General purpose computer laboratory Whiteboard with markers Overhead projector
Exam literature	Basic literature: 1. Ž. Ban, J. Matuško, I. Petrović: Primjena programskog sustava MATLAB za rješavanje tehničkih problema, Graphis, Zagreb, 2010. Additional literature: 1. B. Kovačić: Matematički alati u elektrotehnici, udžbenik, Tehničko veleučilište u Zagrebu, Zagreb, 2013. 2. MATLAB Product Help, The MathWorks Inc., Natick, 2013.
Students obligations	Student must achieve minimum 30 points during semester.
Knowledge evaluation during semester	A maximum of 60 points can be earned during the semester through the following activities: 1. presence on lectures and laboratory exercises maximum 10 points, minimum 7 points to pass, 2. test on laboratory exercises maximum 50 points (10 x 5), minimum 0 points to pass, A prerequisite to take the final exam is earning at least 30 points during the semester. Students which earn less than 15 points are graded F (unsuccesfull) and they have to enroll the course again in the next academic year. Students which earn between 15 and 30 points are graded FX (insufficient), but they can approach an additional exam. The additional exam is carried out on the first exam term, and it contains tasks from 2, 3 and 4 enumeration above with a total of 30 points. If the student earns 15 or more points on the additional exam, the total points earned during the semester will be set to 30 and student can approach the final exam.
Knowledge evaluation after semester	A maximum of 40 points can be earned on the final exam, so the total number of points on the course is equal to 100. The grading is carried out according to the following scales (ISVU and ECTS scales): [50, 60) grade 2 (pass) or ECTS grade E [60, 65) grade 2 (pass) or ECTS grade D [65, 80) grade 3 (good) or ECTS grade C [80, 90) grade 4 (very good) or ECTS grade B [90, 100] grade 5 (excellent) or ECTS grade A
Student activities:	Aktivnost ECTS (Classes attendance) 2
Remark	This course can not be used for final thesis theme
Prerequisites:	No prerequisites.
Proposal made by	Toni Bjažić, Ph.D., senior lecturer

Code WEB/ISVU	23401/155777	**ECTS**	6.0	**Academic year**	2018/2019
Name	Mechanics				
Status	2nd semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+45 (45+0+0+0) 105
Teachers	Lectures:1. Branimir Markulin Grgić Lectures: Vesna Alić-Kostešić dipl.ing.stroj. Auditory exercises: Miroslav Radaković				
Course objectives	To enable a student to understand the basic knowledge and to solve problems in the field of engineering mechanics statics and strength of materials				
Learning outcomes:	1.Applying basic axioms and mechanics theorems to certain problem examples. Level:6,7 2.Analyze the reduction of forces and describe the force systems. Level:6 3.Analyzing the balance of rigid bodies with and without friction. Level:6 4.Identifying the problems of straight beams / beams, console, Gerber beams. Level:6 5.Drawing diagrams of the basic inner physical values on straight beams . Level:6 6.Calculation of the geometric features and moments of inertia of simple and complex bodies. Level:6 7.Explanation of the basic terms and basic mechanical loads in strength of materials. Level:6 8.Calculation of the stresses, deformations and displacements of the rod structures. Level:6				
Involvement of learning outcomes of the course in study programme:	1.1.OPĆI Služiti se stranim jezikom u literaturi i svakodnevnoj stručnoj komunikaciji. : 10h in 180h 1.4.OPĆI Povezati inženjerske aktivnosti konstruiranja, proizvodnje i marketinga s potrebama korisnika proizvoda i usluge.: 10h in 180h 1.5.OPĆI Identificirati, modelirati i rješavati inženjerske probleme.: 20h in 180h 2.1.OSOBNE Znanje o suvremenim pitanjima struke i društva.: 10h in 180h 2.2.OSOBNE Odgovornost, dosljednost, točnost, ažurnost.: 10h in 180h 2.3.OSOBNE Etički i moralni pristup radu.: 10h in 180h 2.4.OSOBNE Kritička evaluacija argumenata, pretpostavki i podataka u cilju stvaranja mišljenja i pridonošenja rješenju problema.: 20h in 180h 2.5.OSOBNE Spremnost za rad na terenu i u nestandardnim uvjetima.: 10h in 180h 2.6.OSOBNE Iskustva rada u projektnim timovima i industriji.: 10h in 180h 2.7.OSOBNE Predstavljanje informacija, ideja, problema i rješenja stručnoj i općoj publici.: 10h in 180h 2.10.OSOBNE Prilagodljivost novim tehnologijama i tehnikama kao dio procesa cjeloživotnog učenja.: 10h in 180h 2.11.OSOBNE Otvorenost za nova znanja, iskustva i kulturne okolnosti.: 10h in 180h 3.2.MEH Predložiti vrste materijala i tehnološki postupak izrade: 10h in 180h				
Methods of carrying out lectures	Ex cathedra teaching Case studies Demonstration Discussion Questions and answers Seminar, students presentation and discussion Auditory lectures.				
Methods of carrying out auditory exercises	Group problem solving Traditional literature analysis Data mining and knowledge discovery on the Web Essay writing Discussion, brainstorming Auditory exercises.				
Course content lectures	1.Introduction.History of classical mechanics.Definition and division of classical mechanics.Physical foundations of classical mechanics. Methods and objectives of classical mechanics., 3h, Learning outcomes:1,8 2.Basics of vector algebra. Mathematical operations with vectors. Vectors in a rectangular coordinate system. Other concepts and problems of vector algebra., 3h, Learning outcomes:1 3.Basic concepts of static solid bodies. Axioms in mechanics of solid bodies. Fundamental principles of static solid bodies. Connections and reactions., 3h, Learning outcomes:1,2 4.Classification of force system. Competitive system of forces. The general spatial force system. Parallel forces system. Raven System Force.Momentum., 3h, Learning outcomes:1,2 5.Classification of forces, vector equilibrium conditions. Canonal Balance. Nano-equilibrium conditions. The basics of graphostatics. Mechanical system equilibrium. Spatial force system., 3h, Learning outcomes:1,2 6.Introductory considerations and basic terms of friction. Sliding friction analysis on simple technical devices. Stitches of straps, ropes and other flexible elements., 3h, Learning outcomes:1,2,3 7.Basic concepts and definitions of geometrical features of body, surface and line. The center of gravity of simple and complex bodies The moments of smooth cross-section. Moments of body shyness., 3h, Learning outcomes:6 8.Division of construction. Grid construction. Static determination and deterioration of Planar and Spatial Grid. Determination of force in rods by knot method. Cross section method., 3h, Learning outcomes:4,5 9.Flat full carriers. Types of brackets, their load and fixing. Longitudinal and transverse forces, bending and twisting moments. Drawing diagrams Q and M., 3h, Learning outcomes:4,5 10.Introduction to Mechanics of Materials. External Loads and Support Reactions.Tasks and Methods of Mechanics of Materials., 3h, Learning outcomes:7 11.Average Normal Stress Distribution. Internal Loading. Average Shear Stress. Internal Shear. , 3h, Learning outcomes:7,8 12.Deformation. Strain, Normal Strain, Shear Strain. Cartesian Strain Components., 3h, Learning outcomes:7,8 13.Tension or Compression test. Conventional StressStrain Diagram. True StressStrain Diagram. Hookes law. Allowed and estimate strain, security factor., 3h, Learning outcomes:7,8 14.Components of the inner forces at the cross section of the rod. The basic load of the rods., 3h, Learning outcomes:7,8 15.Torsion of flat rods of round cross-section, bending of rods. Angle of Twist, 3h, Learning outcomes:7,8				

Course content auditory	1.Repeating high school maths needed to solve static tasks. Vector sum of forces. Calculating the resultant force in space., 5h, Learning outcomes:1,2 2.Balance of force system in space and plane. Drawing Free-Body Diagram., 7h, Learning outcomes:1,2 3.Drawing Free-Body Diagram by affecting the friction and setting equilibrium equations., 6h, Learning outcomes:1,2,3,4 4.Example of determination of force in Girder Truss Rod., 6h, Learning outcomes:1,2,3,4 5.1st preliminary exam, 6h, Learning outcomes:1,2,3,4 6.Calculation of longitudinal and transverse forces, bending moments and torsion., 6h, Learning outcomes:4,5 7.Differential equation of the rod balance., 6h, Learning outcomes:4,5 8.Cross section method., 6h, Learning outcomes:4,5 9.Drawing the Q and M Diagrams (Transverse Force and Moment Diagram), 8h, Learning outcomes:4,5 10.Determine the coordinates of the center of gravity of the complex lines and surfaces, the center of gravity and the moments of straight cross-sectional inertia., 8h, Learning outcomes:6 11.Moments of a flat cross-section., 4h, Learning outcomes:4,5 12.2nd preliminary exam, 4h, Learning outcomes:3,4,5,6 13.Stress Analysis in beams loaded to the train, pressure and bending. Calculation of beams., 6h, Learning outcomes:6,7 14.Deflection and elongation of bending, torzion, and shear stresses. Strength and stiffness., 6h, Learning outcomes:7,8 15.3rd preliminary exam, 6h, Learning outcomes:7,8
Required materials	Basic: classroom, blackboard, chalk... Whiteboard with markers Overhead projector Operating supplies
Exam literature	1. Alfirević,I. Saucha, J., Tonković,Z., Kodvanj, J., Uvod u mehaniku I. Statika krutih tijela, Golden marketing, Zagreb, 2010. 2. Alfirević,I. Saucha, J., Tonković,Z., Kodvanj, J., Uvod u mehaniku II.Statika krutih tijela, Golden marketing, 3. Matejiček, F., Semenski, D., Vnučec, Z., Uvod statiku sa zbirkom zadataka, Golden marketing, Zagreb, 2005. 4. Russell C. Hibbeler, Engineering Mechanics: Statics (13th Edition), Prentice Hall, 2012, 5. Bazjanac, D.: Tehnička mehanika, I. dio, Statika. Tehnička knjiga, Zagreb, 1963. 6. Alfirević, I., Nauka o čvrstoći, Tehnička knjiga, Zagreb, 1989.
Students obligations	Maximum of 3 absences from exercises
Knowledge evaluation during semester	Numerical tasks, theoretical questions, short period questions
Knowledge evaluation after semester	The exam is conducted through three preliminary exams and oral exam, or through the written and oral exam at the end of the semester
Student activities:	Aktivnost — ECTS (Classes attendance) — 1 (Constantly tested knowledge) — 3 (Written exam) — 2
Remark	This course can not be used for final thesis theme
Prerequisites:	No prerequisites.
ISVU equivalents:	143202;
Proposal made by	Petra Bonačić Bartolin, mag.ing.mech.

Code WEB/ISVU	23814/172305	**ECTS**	2.0	**Academic year**	2018/2019
Name	Methodology of professional and scientific research				
Status	1st semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				15+30 (0+30+0+0) 15
Teachers	Lectures:1. Vesna Alić-Kostešić dipl.ing.stroj. Laboratory exercises: Miroslav Radaković				
Course objectives	To enable students to design and implement quality professional work				
Learning outcomes:	1.formulate research hypotheses framework solution to the problem and the subject of research. Level:6,7 2.generate professional solution of the problem through research. Level:6,7 3.identify the rules and procedures of the methodology of professional work. Level:6 4.allocate option procedures for the transformation of good ideas for quality professional work. Level:6 5.predict method for the preparation of professional work. Level:6,7 6.formulate research results. Level:6,7 7.present the results of the target audience. Level:6,7 8.create a text document by using an advanced text formatting commands (generating content, a list of tables, files, collaboration, indexing). Level:6 9.create a spreadsheet using advanced commands (conditional formatting, production scenarios, pivot tables, filtering). Level:6,7				
Involvement of learning outcomes of the course in study programme:	1.1.OPĆI Služiti se stranim jezikom u literaturi i svakodnevnoj stručnoj komunikaciji. : 5h in 60h 1.2.OPĆI Primijeniti znanje matematike i fizike na inženjerske probleme.: 4h in 60h 1.3.OPĆI Koristiti tehnike, vještine i suvremene alate neophodne za inženjersku praksu.: 4h in 60h 1.4.OPĆI Povezati inženjerske aktivnosti konstruiranja, proizvodnje i marketinga s potrebama korisnika proizvoda i usluge.: 4h in 60h 1.5.OPĆI Identificirati, modelirati i rješavati inženjerske probleme.: 4h in 60h 2.1.OSOBNE Znanje o suvremenim pitanjima struke i društva.: 4h in 60h 2.2.OSOBNE Odgovornost, dosljednost, točnost, ažurnost.: 4h in 60h 2.3.OSOBNE Etički i moralni pristup radu.: 4h in 60h 2.4.OSOBNE Kritička evaluacija argumenata, pretpostavki i podataka u cilju stvaranja mišljenja i pridonošenja rješenju problema.: 4h in 60h 2.5.OSOBNE Spremnost za rad na terenu i u nestandardnim uvjetima.: 1h in 60h 2.7.OSOBNE Predstavljanje informacija, ideja, problema i rješenja stručnoj i općoj publici.: 4h in 60h 2.8.OSOBNE Komunikacijske vještine u okviru struke te s klijentima, na hrvatskom i engleskom jeziku.: 3h in 60h 2.9.OSOBNE Profesionalna i ljudska osobnost.: 3h in 60h 2.10.OSOBNE Prilagodljivost novim tehnologijama i tehnikama kao dio procesa cjeloživotnog učenja.: 4h in 60h 2.11.OSOBNE Otvorenost za nova znanja, iskustva i kulturne okolnosti.: 4h in 60h 2.12.OSOBNE Fleksibilnost i prilagodljivost u iznalaženju tehničkih rješenja uz neupitno poštivanje temeljnih etičkih načela, pravnih normi i pravila struke.: 4h in 60h				
Methods of carrying out lectures	Ex cathedra teaching Case studies Discussion Seminar, students presentation and discussion				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment				
Course content lectures	1.Introduction to professional work. Education and research activities .. The concept and types of professional works, 1h, Learning outcomes:1,2 2.Introduction to professional work. Education and research activities .. The concept and types of professional works, 1h, Learning outcomes:1,2 3.Introduction to professional work. Education and research activities .. The concept and types of professional works, 1h, Learning outcomes:1,2 4.The methodology of professional work. Concept and classification of professional methods, 1h, Learning outcomes:5,7 5.The methodology of professional work. Concept and classification of professional methods, 1h, Learning outcomes:5,7 6.The methodology of professional work. Concept and classification of professional methods, 1h, Learning outcomes:5,7 7.Technology of professional work. Choice of research topics. The planning and organization of research work, 1h, Learning outcomes:3 8.Technology of professional work. Choice of research topics. The planning and organization of research work, 1h, Learning outcomes:3 9.Technology of professional work. Choice of research topics. The planning and organization of research work, 1h, Learning outcomes:3 10.Research and development. Writing and technical processing of professional work. Using literature and citation; Parts of work and research documentation, 1h, Learning outcomes:6 11.Research and development. Writing and technical processing of professional work. Using literature and citation; Parts of work and research documentation, 1h, Learning outcomes:6 12.Research and development. Writing and technical processing of professional work. Using literature and citation; Parts of work and research documentation, 1h, Learning outcomes:6 13.Plagiarism. Professional and scientific journals and publications. Database search, 1h, Learning outcomes:1 14.Plagiarism. Professional and scientific journals and publications. Database search, 1h, Learning outcomes:1 15.Plagiarism. Professional and scientific journals and publications. Database search, 1h, Learning outcomes:1				
Course content laboratory	1.introduction and familiarization with the available e services for students, 2h 2.Advanced text processing, 2h, Learning outcomes:8 3.Advanced text processing, 2h, Learning outcomes:8 4.Advanced text processing, 2h, Learning outcomes:8 5.Advanced text processing, 2h, Learning outcomes:8				

	6.colloquium, 2h, Learning outcomes:8 7.Advanced use of spreadsheet, 2h, Learning outcomes:9 8.Advanced use of spreadsheet, 2h, Learning outcomes:9 9.Advanced use of spreadsheet, 2h, Learning outcomes:9 10.Advanced use of spreadsheet, 2h, Learning outcomes:9 11.colloquium, 2h, Learning outcomes:9 12.Making presentations, 2h, Learning outcomes:6,7 13.Making presentations, 2h, Learning outcomes:6,7 14.Correction of Collapse, 2h, Learning outcomes:7,8 15.exame, 2h, Learning outcomes:1,2,3,4,5,6,7
Required materials	Basic: classroom, blackboard, chalk... General purpose computer laboratory Whiteboard with markers Overhead projector
Exam literature	1. M.Žugaj, K.Dumičić, V.Dušak: Temelji znanstvenoistraživačkog rada- Metodologija i metodika, FOI, Varaždin, 2006.g. 2. R. Zelenika: Metodologija i tehnologija izrade znanstvenog i stručnog djela. Ekonomski fakultet, Rijeka, 2000.g. 3. Lj. Baban, K. Ivić, S. Jelinić, M. Lamza-Maronić, A. Šundalić: Primjena metodologije stručnog i znanstvenog istraživanja.Ekonomski fakultet, Osijek, 2000. H.Birola, odabrane teme iz Informatike, POU, Zagreb portal Nikola Tesla, LMS tečaj
Students obligations	Regular attending -20%
Knowledge evaluation during semester	check preparedness exercise 25% of the grade Colloquium processing - min 75%, 25% of the grade outcome 8 Colloquium budget tablice- min 75%, 25% of the grade outcome 9 Seminar work - outcomes 1,2,3,4,5,6,7; 25% rating of the grade
Knowledge evaluation after semester	Written exam
Student activities:	Aktivnost ECTS (Seminar Work) 2
Remark	This course can not be used for final thesis theme
Prerequisites:	No prerequisites.
ISVU equivalents:	143197;
Proposal made by	Vesna Alić-Kostešić mag.ing.mech., 2.6.2016

Code WEB/ISVU	23771/170047	**ECTS**	2.0	**Academic year**	2018/2019
Name	Methodology of professional and scientific research				
Status	6th semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - elective course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				15+15 (0+0+15+0) 30
Teachers	Lectures:1. Vesna Alić-Kostešić dipl.ing.stroj. Seminar exercises: Vesna Alić-Kostešić dipl.ing.stroj.				
Course objectives	To enable students to design and implement quality professional work				
Learning outcomes:	1.formulate research hypotheses framework solution to the problem and the subject of research. Level:6,7 2.generate professional solution of the problem through research. Level:6,7 3.identify the rules and procedures of the methodology of professional work. Level:6 4.allocate option procedures for the transformation of good ideas for quality professional work. Level:6 5.predict method for the preparation of professional work. Level:6,7 6.formulate research results. Level:6,7 7.present the results of the target audience. Level:6,7 8.create a text document by using an advanced text formatting commands (generating content, a list of tables, files, collaboration, indexing). Level:6 9.create a spreadsheet using advanced commands (conditional formatting, production scenarios, pivot tables, filtering). Level:6,7				
Methods of carrying out lectures	Ex cathedra teaching Case studies Discussion Seminar, students presentation and discussion				
Methods of carrying out seminars	Group problem solving Data mining and knowledge discovery on the Web Discussion, brainstorming				
Course content lectures	1.Introduction to professional work. Education and research activities .. The concept and types of professional works, 1h, Learning outcomes:1,2 2.Introduction to professional work. Education and research activities .. The concept and types of professional works, 1h, Learning outcomes:1,2 3.Introduction to professional work. Education and research activities .. The concept and types of professional works, 1h, Learning outcomes:1,2 4.The methodology of professional work. Concept and classification of professional methods, 1h, Learning outcomes:5,7 5.The methodology of professional work. Concept and classification of professional methods, 1h, Learning outcomes:5,7 6.The methodology of professional work. Concept and classification of professional methods, 1h, Learning outcomes:5,7 7.Technology of professional work. Choice of research topics. The planning and organization of research work, 1h, Learning outcomes:3 8.Technology of professional work. Choice of research topics. The planning and organization of research work, 1h, Learning outcomes:3 9.Technology of professional work. Choice of research topics. The planning and organization of research work, 1h, Learning outcomes:3 10.Research and development. Writing and technical processing of professional work. Using literature and citation; Parts of work and research documentation, 1h, Learning outcomes:6 11.Research and development. Writing and technical processing of professional work. Using literature and citation; Parts of work and research documentation, 1h, Learning outcomes:6 12.Research and development. Writing and technical processing of professional work. Using literature and citation; Parts of work and research documentation, 1h, Learning outcomes:6 13.Plagiarism. Professional and scientific journals and publications. Database search, 1h, Learning outcomes:1 14.Plagiarism. Professional and scientific journals and publications. Database search, 1h, Learning outcomes:1 15.Plagiarism. Professional and scientific journals and publications. Database search, 1h, Learning outcomes:1				
Course content seminars	1.in consultation with the advisor, 1h, Learning outcomes:2 2.in consultation with the advisor, 1h, Learning outcomes:2 3.in consultation with the advisor, 1h, Learning outcomes:2 4.in consultation with the advisor, 1h, Learning outcomes:2 5.in consultation with the advisor, 1h, Learning outcomes:2,3 6.in consultation with the advisor, 1h, Learning outcomes:2,3 7.in consultation with the advisor, 1h, Learning outcomes:3 8.in consultation with the advisor, 1h, Learning outcomes:3 9.in consultation with the advisor, 1h, Learning outcomes:3 10.in consultation with the advisor, 1h, Learning outcomes:2 11.in consultation with the advisor, 1h, Learning outcomes:2 12.in consultation with the advisor, 1h, Learning outcomes:2 13.in consultation with the advisor, 1h, Learning outcomes:2,7 14.in consultation with the advisor, 1h, Learning outcomes:2,7 15.in consultation with the advisor, 1h, Learning outcomes:2,6				
Required materials	Basic: classroom, blackboard, chalk... General purpose computer laboratory Whiteboard with markers Overhead projector				
Exam literature	1. M.Žugaj, K.Dumičić, V.Dušak: Temelji znanstvenoistraživačkog rada- Metodologija i metodika, FOI, Varaždin, 2006.g. 2. R. Zelenika: Metodologija i tehnologija izrade znanstvenog i stručnog djela. Ekonomski fakultet, Rijeka, 2000.g.				

	3. Lj. Baban, K. Ivić, S. Jelinić, M. Lamza-Maronić, A. Šundalić: Primjena metodologije stručnog i znanstvenog istraživanja.Ekonomski fakultet, Osijek, 2000. H.Birola, odabrane teme iz Informatike, POU, Zagreb portal Nikola Tesla, LMS tečaj
Students obligations	Regular attending -20%
Knowledge evaluation during semester	check preparedness exercise 25% of the grade Colloquium processing - min 75%, 25% of the grade outcome 8 Colloquium budget tablice- min 75%, 25% of the grade outcome 9 Seminar work - outcomes 1,2,3,4,5,6,7; 25% rating of the grade
Knowledge evaluation after semester	Written exam
Student activities:	Aktivnost ECTS (Seminar Work) 2
Remark	This course can not be used for final thesis theme
Prerequisites:	No prerequisites.
Proposal made by	Vesna Alić-Kostešić mag.ing.mech., 2.6.2016

Code WEB/ISVU	23761/170037	**ECTS**	4.0	**Academic year**	2018/2019
Name	Metrology and Quality Control				
Status	5th semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (15+15+0+0) 60
Teachers	Lectures:1. Vesna Alić-Kostešić dipl.ing.stroj. Lectures:mr.sc. Ante Zaninović dipl.ing.brod. Auditory exercises:mr.sc. Ante Zaninović dipl.ing.brod. Laboratory exercises:mr.sc. Ante Zaninović dipl.ing.brod.				
Course objectives	To transfer to students the basic knowledge related to metrology and quality, placing a special emphasis on Mechatronics metrology				
Learning outcomes:	1.distinguish and interpret basic metrological terms and methods. Level:6 2.assess the ability of the measurement system. Level:6,7 3.analyze the results of comparative measurements. Level:6 4.estimate the measurement uncertainty of measurement results. Level:6,7 5.estimate process capability. Level:6,7 6.analyze the requirements of the quality management system according to ISO 9001. Level:6 7.design of control charts. Level:6				
Methods of carrying out lectures	Ex cathedra teaching Case studies Lectures are conducted using LCD projectors, overhead projectors and white boards.				
Methods of carrying out auditory exercises	Group problem solving Interactive problem solving Workshop				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Group problem solving Workshop				
Course content lectures	1.Scientific metrology. Technical metrology. Legislative metrology., 2h, Learning outcomes:1 2.Measurement traceability. Elements of traceability. Terminology in metrology hierarchy. Metrology infrastructure in Republic of Croatia., 2h, Learning outcomes:1,3 3.Units of measurement, Standards, Measurement unity, Measurement systems and measurement, 2h, Learning outcomes:1,2,4 4.Fundamental statistical values, Measuring methods, Errors, Assessment of measurement system, Measuring features, 2h, Learning outcomes:1 5.Measurement result, Measurement uncertainty, Expressing measurement results, 2h, Learning outcomes:1,2 6.General requirements for the competence of testing and calibration laboratories (ISO/IEC 17025). Differences between accredited and non-accredited laboratories. Measurement laboratories in manufacturing., 2h, Learning outcomes:1,3,4 7.The first control task., 2h, Learning outcomes:1,2,3,4 8.Introduction to quality management, Definition of quality and development path, 8 principles of QM, 2h, Learning outcomes:5 9.The requirements of ISO 9001; 2015 Part 1, 2h, Learning outcomes:5 10.Requirements of ISO9001; 2015 part 2, Internal audit, 2h, Learning outcomes:5 11.Data collection, Histogram, Sampling planes, 2h, Learning outcomes:5 12.Control Charts for Attributes and Variables., 2h, Learning outcomes:5,6 13.Quality control in the production, QM in procurement, 8D method, 2h, Learning outcomes:5,7 14.Quality in the development of products and project, 2h, Learning outcomes:5 15.The second control task., 2h, Learning outcomes:5,6,7				
Course content auditory	1.NA 2.NA 3.Questionnaire for check of the laboratory quality system (example of LFSB). Discussion about advantages and disadvantages of laboratory accreditation., 2h, Learning outcomes:1,2,4 4.NA 5.control charts, 2h, Learning outcomes:1,2,3 6.NA 7.The first control task., 2h, Learning outcomes:1,2,3,4 8.NA 9.KPI, Pareto, 8D method, 2h, Learning outcomes:5,6,7 10.Management of suppliers, SWOT, 2h, Learning outcomes:5,6,7 11.NA 12.NA 13.Quality plans , 2h, Learning outcomes:5,6,7 14.FMEA analysis, 2h, Learning outcomes:5,6,7 15.The second control task., 2h, Learning outcomes:5,6,7				
Course content laboratory	1.NA 2.Demonstration of traceability assurance in LFSB., 2h, Learning outcomes:1,3 3.NA 4.NA 5.Performing length measurement with determination of measurement repeatability and reproducibility., 2h, Learning outcomes:1,2 6.Examples of measurement uncertainty., 2h, Learning outcomes:1,3,4 7.NA				

	8.NA 9.NA 10.NA 11.Examples of Quality Method selection in function of Control Costs., 2h, Learning outcomes:5 12.Examples of Control Charts for Attributes and Variables., 2h, Learning outcomes:5,6 13.Examples of Sampling Planes for Attributes and Variables., 2h, Learning outcomes:5,7 14.Examples of Process Capability. Process capability indices., 2h, Learning outcomes:5 15.NA
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory Whiteboard with markers Overhead projector
Exam literature	Osnovna: 1. M.Brezinšćak, Mjerenje i računanje u tehnici i znanosti, Tehnička knjiga, Zagreb, 1971. 2. D.M.Anthony, Engineering Metrology, Pergamon Press, New York, 1986. 3. A.Morris, Principles of Mesurement and Instrumentation, Prentice Hall, New Jersey, 1988. 4. Bego, V.: "Mjerenja u elektrotehnici", Školska knjiga, Zagreb, 1990. Dodatna: 1. Šantić, A.: "Elektronička instrumentacija", Školska knjiga, Zagreb, 1991. 2. J.M.Juran, Quality Control Handbook, McGraw-Hill, New York, 1989.
Students obligations	maximum of 3 absences from exercises
Knowledge evaluation during semester	Two writen tests during semester.
Knowledge evaluation after semester	Writen and oral exam.
Student activities:	Aktivnost — ECTS (Classes attendance) — 1 (Constantly tested knowledge) — 2 (Written exam) — 1
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
Proposal made by	Ljubivoj Cvitaš, Sanja Đonlić

Code WEB/ISVU	23548/156319	**ECTS**	4.0	**Academic year**	2018/2019
Name	Numerically Controlled Machine Tools				
Status	4th semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - elective course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (0+30+0+0) 60
Teachers	Lectures:1. Vesna Alić-Kostešić dipl.ing.stroj. Lectures: Zvonimir Petković mag. ing. mech. Laboratory exercises: Zvonimir Petković mag. ing. mech.				
Course objectives	To introduce students to technical possibilities of traditional machine tools, CNC machines and variants of machining systems. To transfer to students the knowledge related to proper design of work pieces parts and surfaces in order to achieve high efficiency and efficacy of machining. To introduce students to the basics of manual programming of CNC machines and programming in CAD/CAM systems.				
Learning outcomes:	1.discern electrical drives at CNC machines. Level:6 2.schedule the work of individual modules NUAS and make technical and technological documentation. Level:6,7 3. write first NC programs. Level:6,7 4.select advanced NC programming commands. Level:7 5.classify machine tools. Level:6,7 6.link types of foundations with machine tools. Level:6,7 7.write NC programs for turning. Level:6,7 8.identify NUAS, machining centers and machining systems. Level:6 9.resolve flexible automation. Level:6 10.control of flexible manufacturing systems. Level:6,7 11.create CAD - CAM milling in ESPRIT. Level:6,7 12.create CAD CAM turning in ESPRIT. Level:6,7 13.plan warehouse and transportation systems. Level:6,7 14.create CAD - CAM milling in SolidCAM. Level:6,7 15.CAD CAM turning in SolidCAM. Level:6,7				
Methods of carrying out lectures	Ex cathedra teaching Guest lecturer Case studies Demonstration Simulations Modelling Discussion Questions and answers The lectures are given by combining traditional ways of lecturing, "MS PowerPoint" presentations and film shows.				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Laboratory exercises, computer simulations Group problem solving Data mining and knowledge discovery on the Web Discussion, brainstorming Computer simulations Workshop The exercises are carried out in the laboratory for machine tools equipped with conventional and numerically controlled machines and other necessary equipment. A part of the programme is performed by the students on their own, but verification is carried out by simulation. A visit to one of the tool rooms is also a part of the exercises.				
Course content lectures	1.Introduction and basics of machining systems, the working principle of drive module, 2h, Learning outcomes:1 2.Modules in CNC machine and method of operation of individual modules, technical and technological documentation, 2h, Learning outcomes:2 3.Manual programming milling - NC commands for Sinumerik 840D, 2h, Learning outcomes:3 4.Advanced Programming - Milling, subprograms, cycles for Sinumerik 840D, 2h, Learning outcomes:4 5.Types of machine tools, the module drives, main spindle, 2h, Learning outcomes:5 6.Elements and assemblies foundations, carrying and guiding, 2h, Learning outcomes:6 7.Manual programming of turning - NC commands for Sinumerik 840D, 2h, Learning outcomes:7 8.Numerically Controlled Machine Tools - Machining centers - Machining Systems, 2h, Learning outcomes:8 9.Flexible Automation, 2h, Learning outcomes:9 10.Control of flexible machining systems, Adaptive Control Constraint (ACC). Adaptive Control Optimization (ACO), 2h, Learning outcomes:10 11.CAD CAM Esprit - milling, 2h, Learning outcomes:11 12.CAD CAM Esprit - turning, 2h, Learning outcomes:12 13.Transport and storage systems, 2h, Learning outcomes:13 14.CAD CAM Solid CAM - milling, 2h, Learning outcomes:14 15.CAD CAM Solid CAM - turning, 2h, Learning outcomes:15				
Course content laboratory	1.Introduction to NUAS milling machine, an explanation of the machine, and the main drives, 2h, Learning outcomes:1 2.Technical and technological documentation in milling, 2h, Learning outcomes:2 3.Basic commands for NC milling in Sinumerik 840D, 2h, Learning outcomes:3 4.Routines, frames, compensation in milling, 2h, Learning outcomes:4 5.Defining the null point and setting tools in milling, 2h, Learning outcomes:5 6.Cycles in milling, 2h, Learning outcomes:6 7.Work on CNC milling machine, 2h, Learning outcomes:7 8.Introduction to NUAS lathe, technical and technological documentation at turning, 2h, Learning outcomes:8 9.Basic commands for NC turning in Sinumerik 840D, 2h, Learning outcomes:7,9 10.Routines, frames, compensation in turning, 2h, Learning outcomes:10 11.Defining the null point and setting tools in turning, 2h, Learning outcomes:11 12.Cycles in turning, 2h, Learning outcomes:12				

	13.Work on the lathe CNC, 2h, Learning outcomes:12 14.Generating code from SolidCAM in milling, 2h, Learning outcomes:13 15.Generating code from SolidCAM in turning, 2h, Learning outcomes:15
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory Whiteboard with markers Overhead projector
Exam literature	Obavezna: 1. www.fsb.hr 2. Cebalo, R., Ciglar, D., Stoić, A.: Obradni sustavi, Zagreb, 2005. 3. Altintas, Y., Manufacturing Automation, Cambridge University Press, Cambridge 2000. 4. Kief, H., NC/CNC - Handbuch, NC-Verlag, Michelstadt, 1989. Dodatna: 1. Internet: stranice drugih sveučilišta i veleučilišta te stranice proizvođača alatnih strojeva i reznih alata 2. www.mmsonline.com
Students obligations	maximum of 3 absences from exercises
Knowledge evaluation during semester	Redovitost pohaa#10#10#0$Kolokvij, numeri zadaci#2#45#50$Kolokvij, teorijska pitanja#2#45#50$
Knowledge evaluation after semester	Taking the exam by two preliminary exams.
Student activities:	Aktivnost — ECTS (Constantly tested knowledge) — 2 (Written exam) — 2
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
Proposal made by	Vesna Alić Kostešić

Code WEB/ISVU	23812/172303	**ECTS**	5.0	**Academic year**	2018/2019
Name	Osnove programiranja				
Status	1st semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+45 (0+45+0+0) 75
Teachers	Lectures:1. Mia Čarapina dipl. ing., pred. Laboratory exercises: Goran Sirovatka				
Course objectives	To introduce students to the basics of C programming language				
Learning outcomes:	1.ability to create simple algorithms using software tool. Level:6,7 2.basic software development tools managing. Level:6,7 3.zadani algoritam ili programski kod na postojanje grešaka. Level:6 4.ability to create algorithm for solving problem. Level:6,7 5.abilitiy to differentiate among various data types. Level:6 6.ability to identify basic C program elements. Level:6 7.ability to connect C programming language elements into functional unit. Level:6,7				
Involvement of learning outcomes of the course in study programme:	1.2.OPĆI Primijeniti znanje matematike i fizike na inženjerske probleme.: 20h in 150h 1.3.OPĆI Koristiti tehnike, vještine i suvremene alate neophodne za inženjersku praksu.: 20h in 150h 1.5.OPĆI Identificirati, modelirati i rješavati inženjerske probleme.: 20h in 150h 2.7.OSOBNE Predstavljanje informacija, ideja, problema i rješenja stručnoj i općoj publici.: 20h in 150h 3.7.MEH Osmisliti programsko rješenje ugrađenog računalnog sustava za vođenje različitih tehničkih procesa u mehatronici: 70h in 150h				
Methods of carrying out lectures	Ex cathedra teaching Demonstration Discussion Questions and answers Material is delivered frontally, presentations, interviews				
Methods of carrying out laboratory exercises	Laboratory exercises, computer simulations Group problem solving Computer simulations Exercises are performed in groups, using the talks and demonstrations, as well as individual work.				
Course content lectures	1.Introduction., 2h, Learning outcomes:4,6 2.Data Types., 2h, Learning outcomes:5 3.C program basic structure., 2h, Learning outcomes:1,2,4,6 4.Number systems, variable types., 2h, Learning outcomes:5,6 5.Expressions and operators., 2h, Learning outcomes:5,6,7 6.Program flow control., 2h, Learning outcomes:1,2,3,4,5,6,7 7.Loops., 2h, Learning outcomes:1,2,3,4,5,6,7 8.Arrays., 2h, Learning outcomes:1,2,3,4,5,6,7 9.Functions., 2h, Learning outcomes:1,2,3,4,5,6,7 10.Pointers., 2h, Learning outcomes:1,2,3,4,5,6,7 11.Pointers and functions., 2h, Learning outcomes:1,2,3,4,5,6,7 12.Pointers and arrays, dynamic memory allocation., 2h, Learning outcomes:1,2,3,4,5,6,7 13.Character arrays (strings), formatted input and output., 2h, Learning outcomes:1,2,3,4,5,6,7 14.Formatted files and structures., 2h, Learning outcomes:1,2,3,4,5,6,7 15.Unformatted files., 2h, Learning outcomes:1,2,3,4,5,6,7				
Course content laboratory	1.C program basic structure., 3h, Learning outcomes:1,2,4,6 2.Number systems, variable types., 3h, Learning outcomes:5,6 3.Expressions and operators., 3h, Learning outcomes:5,6,7 4.Program flow control., 3h, Learning outcomes:1,2,3,4,5,6,7 5.Loops., 3h, Learning outcomes:1,2,3,4,5,6,7 6.Arrays., 3h, Learning outcomes:1,2,3,4,5,6,7 7.Functions, 3h, Learning outcomes:1,2,3,4,5,6,7 8.Pointers., 3h, Learning outcomes:1,2,3,4,5,6,7 9.Pointers and functions., 3h, Learning outcomes:1,2,3,4,5,6,7 10.Pointers and arrays, dynamic memory allocation., 3h, Learning outcomes:1,2,3,4,5,6,7 11.Character arrays (strings), formatted input and output., 3h, Learning outcomes:1,2,3,4,5,6,7 12.Formatted files and structures., 3h, Learning outcomes:1,2,3,4,5,6,7 13.Unformatted files., 3h, Learning outcomes:1,2,3,4,5,6,7 14.Extrams., 3h, Learning outcomes:1,2,3,4,5,6,7 15.Extrams., 3h, Learning outcomes:1,2,3,4,5,6,7				
Required materials	Basic: classroom, blackboard, chalk... General purpose computer laboratory Whiteboard with markers Overhead projector classroom, PC, projector, computer lab				
Exam literature	1. Stranjak, Tomić: C jezik, Školska knjiga, 2009. 2. Vulin: OD SADA PROGRAMIRAMO U C-u, Školska knjiga, 2010. 3. Vulin: ZBIRKA RIJEŠENIH ZADATAKA IZ C-a, Školska knjiga, 2010. 4. T. Tucaković: C programer za 15 dana, PRO-MIL 5. L. Ullman, M. Liyanage: C osnove programiranja, MIŠ 6. B.W. Kernighan, D.M. Ritchie: The C Programming Language, Prentice Hall				
Students obligations	1. maximum of 2 absences from lectures 2. maximum of 2 absences from exercises				

Knowledge evaluation during semester	1. laboratory exercises preparations 2. laboratory exercises 3. preliminary exams	
Knowledge evaluation after semester	Written exam, oral exam	
Student activities:	Aktivnost (Classes attendance) (Constantly tested knowledge) (Written exam)	ECTS 2 1 2
Remark	This course can not be used for final thesis theme	
Prerequisites:	No prerequisites.	
ISVU equivalents:	143198;	
Proposal made by	Mia Čarapina, dipl. ing., lecturer,19.06.2017.	

Code WEB/ISVU	23807/171224	**ECTS**	1.0	**Academic year**	2018/2019
Name	Physical Education				
Status	4th semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				0+30 (30+0+0+0) 0
Teachers	Auditory exercises:1. pred. Valter Perinović mag. kineziologije				
Course objectives	To develop in students the habit of practising sports and improving their psychophysical condition and conduct				
Learning outcomes:	1.ability to demonstrate how to perform properly technical elements of certain sports. Level: 2.ability to explain the basic terms related to certain sports. Level: 3.ability to explain the basic rules of certain sports. Level: 4.ability to recognize the muscle building exercises. Level: 5.ability to explain the importance of warming up and stretching. Level: 6.ability to describe the organisation of sport competitions. Level: 7.ability to understand the importance of daily workout throughout one's life. Level:				
Methods of carrying out auditory exercises	Other				
Course content auditory	1.Repeating technical elements of a specific kinesiologic activity, 2h, Learning outcomes:1 2.Repeating technical elements of a specific kinesiologic activity, 2h, Learning outcomes:1 3.Adopting new elements of a specific kinesiologic activity, 2h, Learning outcomes:2 4.Adopting new elements of a specific kinesiologic activity, 2h, Learning outcomes:2 5.Improving the elements of a specific kinesiologic activity, 2h, Learning outcomes:3 6.Improving the elements of a specific kinesiologic activity, 2h, Learning outcomes:3 7.Adopting a set of warm-up exercises for a specific kinesiologic activity, 2h, Learning outcomes:4 8.Adopting a set of stretching exercises for a specific kinesiologic activity, 2h, Learning outcomes:5 9.Repeating the basic rules of a specific kinesiologic activity, 2h, Learning outcomes:6 10.Using auxiliary and elementary games in the learning process of a specific kinesiologic activity, 2h, Learning outcomes:7 11.Adoption of basic technical and tactical elements of a specific kinesiologic activity, 2h, Learning outcomes:6 12.Adoption of basic technical and tactical elements of a specific kinesiologic activity, 2h, Learning outcomes:6 13.Competition and Games, 2h, Learning outcomes:5 14.Competition and Games, 2h, Learning outcomes:5 15.Training and automation of injury prevention exercises, 2h, Learning outcomes:4				
Required materials	Special equipment				
Exam literature	Nema				
Students obligations	maximum of 3 absences from exercises				
Knowledge evaluation during semester	Prakti ispit#1#1#100$				
Knowledge evaluation after semester	Laboratory exercises				
Student activities:	Aktivnost (Classes attendance)			ECTS 1	
Remark	This course can not be used for final thesis theme				
Prerequisites:	No prerequisites.				
ISVU equivalents:	156307;				

Code WEB/ISVU	23806/171223	**ECTS**	1.0	**Academic year**	2018/2019
Name	Physical Education				
Status	3rd semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				0+30 (30+0+0+0) 0
Teachers	Auditory exercises:1. pred. Valter Perinović mag. kineziologije				
Course objectives	To develop in students the habit of practising sports and improving their psychophysical condition and conduct				
Learning outcomes:	1.ability to demonstrate how to perform properly technical elements of certain sports. Level: 2.ability to explain the basic terms related to certain sports. Level: 3.ability to explain the basic rules of certain sports. Level: 4.ability to recognize the muscle building exercises. Level: 5.ability to explain the importance of warming up and stretching. Level: 6.ability to describe the organisation of sport competitions. Level: 7.ability to understand the importance of daily workout throughout one's life. Level:				
Methods of carrying out auditory exercises	Other				
Course content auditory	1.Repeating technical elements of a specific kinesiologic activity, 2h, Learning outcomes:1 2.Repeating technical elements of a specific kinesiologic activity, 2h, Learning outcomes:1 3.Adopting new elements of a specific kinesiologic activity, 2h, Learning outcomes:2 4.Adopting new elements of a specific kinesiologic activity, 2h, Learning outcomes:2 5.Improving the elements of a specific kinesiologic activity, 2h, Learning outcomes:3 6.Improving the elements of a specific kinesiologic activity, 2h, Learning outcomes:3 7.Adopting a set of warm-up exercises for a specific kinesiologic activity, 2h, Learning outcomes:4 8.Adopting a set of stretching exercises for a specific kinesiologic activity, 2h, Learning outcomes:5 9.Repeating the basic rules of a specific kinesiologic activity, 2h, Learning outcomes:6 10.Using auxiliary and elementary games in the learning process of a specific kinesiologic activity, 2h, Learning outcomes:7 11.Adoption of basic technical and tactical elements of a specific kinesiologic activity, 2h, Learning outcomes:6 12.Adoption of basic technical and tactical elements of a specific kinesiologic activity, 2h, Learning outcomes:6 13.Competition and Games, 2h, Learning outcomes:5 14.Competition and Games, 2h, Learning outcomes:5 15.Training and automation of injury prevention exercises, 2h, Learning outcomes:4				
Required materials	Special equipment				
Exam literature	Nema				
Students obligations	maximum of 3 absences from exercises				
Knowledge evaluation during semester	Prakti ispit#1#1#100$				
Knowledge evaluation after semester	Laboratory exercises				
Student activities:	Aktivnost (Classes attendance)			ECTS 1	
Remark	This course can not be used for final thesis theme				
Prerequisites:	No prerequisites.				
ISVU equivalents:	156301;				

Code WEB/ISVU	23805/171222	**ECTS**	1.0	**Academic year**	2018/2019
Name	Physical Education				
Status	2nd semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				0+30 (30+0+0+0) 0
Teachers	Auditory exercises:1. pred. Valter Perinović mag. kineziologije				
Course objectives	To develop in students the habit of practising sports and improving their psychophysical condition and conduct				
Learning outcomes:	1.ability to demonstrate how to perform properly technical elements of certain sports. Level: 2.ability to organise exercises for groups of muscles. Level: 3.ability to distinguish between different types of workout carried out to achieve different motoric and functional capabilities. Level:6 4.ability to compare various body activities and their influences on anthropological features . Level:6,7 5.ability to explain the basic facts about the influence of daily workout on one's health . Level: 6.ability to distinguish between different nutrients and their effects on a body. Level:6 7.ability to explain the basic facts about the relation between workout and a body volume. Level:				
Involvement of learning outcomes of the course in study programme:	2.1.OSOBNE Znanje o suvremenim pitanjima struke i društva.: 5h in 30h 2.2.OSOBNE Odgovornost, dosljednost, točnost, ažurnost.: 10h in 30h 2.3.OSOBNE Etički i moralni pristup radu.: 10h in 30h 2.4.OSOBNE Kritička evaluacija argumenata, pretpostavki i podataka u cilju stvaranja mišljenja i pridonošenja rješenju problema.: 5h in 30h 2.5.OSOBNE Spremnost za rad na terenu i u nestandardnim uvjetima.: 5h in 30h 2.9.OSOBNE Profesionalna i ljudska osobnost.: 20h in 30h 2.11.OSOBNE Otvorenost za nova znanja, iskustva i kulturne okolnosti.: 10h in 30h				
Methods of carrying out auditory exercises	Other				
Course content auditory	1.Repeating technical elements of a specific kinesiologic activity, 2h, Learning outcomes:1 2.Repeating technical elements of a specific kinesiologic activity, 2h, Learning outcomes:1 3.Adopting new elements of a specific kinesiologic activity, 2h, Learning outcomes:2 4.Adopting new elements of a specific kinesiologic activity, 2h, Learning outcomes:2 5.Adopting a set of exercises for each muscle group, 2h, Learning outcomes:3 6.Adopting a set of exercises for each muscle group, 2h, Learning outcomes:3 7.Establishing the rules of a specific kinesiologic activity, 2h, Learning outcomes:4 8.Adopting different training methods , 2h, Learning outcomes:4 9.Adopting different training methods , 2h, Learning outcomes:5 10.Implementation of the elements of various sporting activities, 2h, Learning outcomes:5 11.Training of injury prevention exercises , 2h, Learning outcomes:6 12.Adoption of basic technical and tactical elements of a specific kinesiologic activity, 2h, Learning outcomes:7 13.Adoption of basic technical and tactical elements of a specific kinesiologic activity, 2h, Learning outcomes:7 14.Competition and Games, 2h, Learning outcomes:6 15.Competition and Games, 2h, Learning outcomes:5				
Required materials	Special equipment				
Exam literature	Basic literature: 1. M. Dodik, Tjelesna i zdravstvena kultura, Sveučilište u Rijeci, Rijeka, 1992. 2. I. Belan, Aerobik, Ivo Balen, Koprivnica, 1988. 3. I. Horvat, Pravila nogometne igre, Novinsko-izdavačko propagandno poduzeće, Zagreb, 1994. 4. I. Tocigl, Taktika igre u obrani, Novinsko-izdavačko propagandno poduzeće, Zagreb, 1989. Additional literature: 1. D. Milanović, Dopunski sadržaji sportske pripreme, Sportska tribina i Kineziološki fakultet Zagreb, Zagreb, 2002.				
Students obligations	Students are required to actively participate in exercises during 30 hours per semester, during four semesters. First semester students must go through the swimming test (non-swimmers have to attend the swimming school during the second semester). Second semester students must be present at both lectures and exercises. Students who are not required to attend because of active participation in sports are however required to attend all lectures, assist in the organization and implementation of lectures, and attend a specially devised program if permitted to do so by the sports doctor.				
Knowledge evaluation during semester	Prakti ispit#1#1#100$				
Knowledge evaluation after semester	The exam is not graded but the knowledge is checked at the beginning of the new semester.				
Student activities:	Aktivnost (Classes attendance)		ECTS 1		
Remark	This course can not be used for final thesis theme				
Prerequisites:	No prerequisites.				
ISVU equivalents:	143207;				
Proposal made by	Marko Milanovic, prof.				

Code WEB/ISVU	23804/171221	**ECTS**	1.0	**Academic year**	2018/2019
Name	Physical Education				
Status	1st semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				0+30 (30+0+0+0) 0
Teachers	Auditory exercises:1. pred. Valter Perinović mag. kineziologije				
Course objectives	To develop in students the habit of practising sports and improving their psychophysical condition and conduct				
Learning outcomes:	1.ability to demonstrate how to perform properly technical elements of certain sports. Level: 2.ability to explain the basic terms related to certain sports. Level: 3.ability to explain the basic rules of certain sports. Level: 4.ability to recognize the muscle building exercises. Level: 5.ability to explain the importance of warming up and stretching. Level: 6.ability to describe the organisation of sport competitions. Level: 7.ability to understand the importance of daily workout throughout one's life. Level:				
Involvement of learning outcomes of the course in study programme:	2.1.OSOBNE Znanje o suvremenim pitanjima struke i društva.: 5h in 30h 2.2.OSOBNE Odgovornost, dosljednost, točnost, ažurnost.: 10h in 30h 2.3.OSOBNE Etički i moralni pristup radu.: 10h in 30h 2.4.OSOBNE Kritička evaluacija argumenata, pretpostavki i podataka u cilju stvaranja mišljenja i pridonošenja rješenju problema.: 5h in 30h 2.5.OSOBNE Spremnost za rad na terenu i u nestandardnim uvjetima.: 5h in 30h 2.9.OSOBNE Profesionalna i ljudska osobnost.: 20h in 30h 2.11.OSOBNE Otvorenost za nova znanja, iskustva i kulturne okolnosti.: 10h in 30h				
Methods of carrying out auditory exercises	Other				
Course content auditory	1.Repeating technical elements of a specific kinesiologic activity, 2h, Learning outcomes:1 2.Repeating technical elements of a specific kinesiologic activity, 2h, Learning outcomes:1 3.Adopting new elements of a specific kinesiologic activity, 2h, Learning outcomes:2 4.Adopting new elements of a specific kinesiologic activity, 2h, Learning outcomes:2 5.Improving the elements of a specific kinesiologic activity, 2h, Learning outcomes:2 6.Improving the elements of a specific kinesiologic activity, 2h, Learning outcomes:2 7.Adopting a set of warm-up exercises for a specific kinesiologic activity, 2h, Learning outcomes:3 8.Adopting a set of stretching exercises for a specific kinesiologic activity, 2h, Learning outcomes:3 9.Repeating the basic rules of a specific kinesiologic activity, 2h, Learning outcomes:5 10.Using auxiliary and elementary games in the learning process of a specific kinesiologic activity, 2h, Learning outcomes:5 11.Adoption of basic technical and tactical elements of a specific kinesiologic activity, 2h, Learning outcomes:6 12.Adoption of basic technical and tactical elements of a specific kinesiologic activity, 2h, Learning outcomes:6 13.Competition and Games, 2h, Learning outcomes:4 14.Competition and Games, 2h, Learning outcomes:5 15.Training and automation of injury prevention exercises, 2h, Learning outcomes:5				
Required materials	Special equipment				
Exam literature	Basic literature: 1. M. Dodik, Tjelesna i zdravstvena kultura, Sveučilište u Rijeci, Rijeka, 1992. 2. I. Belan, Aerobik, Ivo Balen, Koprivnica, 1988. 3. I. Horvat, Pravila nogometne igre, Novinsko-izdavačko propagandno poduzeće, Zagreb, 1994. 4. I. Tocigl, Taktika igre u obrani, Novinsko-izdavačko propagandno poduzeće, Zagreb, 1989. Additional literature: 1. D. Milanović, Dopunski sadržaji sportske pripreme, Sportska tribina i Kineziološki fakultet Zagreb, Zagreb, 2002.				
Students obligations	Students are required to actively participate in exercises during 30 hours per semester, during four semesters. First semester students must go through the swimming test (non-swimmers have to attend the swimming school during the second semester). Second semester students must be present at both lectures and exercises. Students who are not required to attend because of active participation in sports are however required to attend all lectures, assist in the organization and implementation of lectures, and attend a specially devised program if permitted to do so by the sports doctor.				
Knowledge evaluation during semester	Practical test				
Knowledge evaluation after semester	The exam is not graded but the knowledge is checked at the beginning of the new semester.				
Student activities:	Aktivnost (Classes attendance)		ECTS 1		
Remark	This course can not be used for final thesis theme				
Prerequisites:	No prerequisites.				
ISVU equivalents:	143200;				
Proposal made by	Marko Milanović, prof.				

Code WEB/ISVU	23400/155776	**ECTS**	6.0	**Academic year**	2018/2019
Name	Physics				
Status	1st semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+45 (30+15+0+0) 105
Teachers	Lectures:1. prof.vis.šk. Ivica Levanat Lectures:2. Alemka Knapp Auditory exercises: Alemka Knapp Auditory exercises:prof.vis.šk. Ivica Levanat Laboratory exercises:prof.dr. Dubravko Horvat Laboratory exercises: Diana Šaponja-Milutinović dipl.ing.fizike, pred.				
Course objectives	To introduce students to the physical phenomena occurring in the Mechatronics study where they are described in a wider context of basic laws of Physics. (The areas which are dealt with in other courses are not included in this course).				
Learning outcomes:	1. ability to calculate the basic rectilinear and circular motions together with projectile motion . Level:6 2. ability to analyse kinematic quantities in curvilinear motion. Level:6 3. ability to calculate the translational acceleration of a body acted upon by a force, as well as to provide basic examples of angular acceleration. Level:6 4. ability to relate the work of forces with the changes in both kinetic and potential energy of a body. Level:6,7 5. ability to distinguish between a classical mechanical description of a motion and special relativity. Level:6 6. ability to analyse heat and temperature in ideal gas. Level:6 7.ability to formulate the laws of thermodynamics. Level:6,7 8. ability to sketch the Carnot cycle process. Level:6 9.ability to calculate the basic mechanisms of heat transfer. Level:6				
Involvement of learning outcomes of the course in study programme:	1.2.OPĆI Primijeniti znanje matematike i fizike na inženjerske probleme.: 60h in 180h 1.5.OPĆI Identificirati, modelirati i rješavati inženjerske probleme.: 20h in 180h 2.4.OSOBNE Kritička evaluacija argumenata, pretpostavki i podataka u cilju stvaranja mišljenja i pridonošenja rješenju problema.: 20h in 180h				
Methods of carrying out lectures	Ex cathedra teaching Case studies Demonstration Discussion Questions and answers Other Oral presentation, including communication with students; their active participation is stimulated during formulation and analysis of physical laws. Physical phenomena and laws are illustrated by familiar examples or improvised demonstrations, and by simple experiments where possible. Equations and their derivations are fully outlined on the blackboard, illustrated by sketches and diagrams as appropriate.				
Methods of carrying out auditory exercises	Group problem solving Discussion, brainstorming Interactive problem solving Other Solving simple problems in the topics covered by the lectures, in order to increase understanding of physical quantities and their interrelations. Calculations include numerical values which appear in technical applications.				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Group problem solving Other Measurements of physical quantities illustrating physical laws explained in the lectures; the focus is on understanding energy and heat. Measurement results evaluation.				
Course content lectures	1.Physical quantities and units., 2h, Learning outcomes:1,2 2.Introduction to calculus., 2h, Learning outcomes:1,2 3.Rectilinear motion, free fall., 2h, Learning outcomes:1 4.Curcilinear and cirular motion., 2h, Learning outcomes:1,2 5.Newton aksioms, momentum., 2h, Learning outcomes:3 6.Work and power., 2h, Learning outcomes:4 7.Energy., 2h, Learning outcomes:4 8.Rigid body rotation., 2h, Learning outcomes:1,3 9.Motion in gravitational field., 2h, Learning outcomes:1,4 10.Einstein relativity., 2h, Learning outcomes:5 11.Harmonic oscilations., 2h, Learning outcomes:1,4,6 12.Heat and temperature, ideal gas., 2h, Learning outcomes:6 13.Laws of thermodynamics., 2h, Learning outcomes:7 14.Carnot cycle., 1h, Learning outcomes:8 Heat transfer mechanisms (conduction)., 1h, Learning outcomes:9 15.Heat transfer mechanisms (convection, radiation)., 2h, Learning outcomes:9				
Course content auditory	1.Rectilinear motion., 2h, Learning outcomes:1 2.Rectilinear motion., 2h, Learning outcomes:1 3.Projectile motion., 2h, Learning outcomes:1,2 4.Circular motion., 2h, Learning outcomes:1,2 5.Newton axioms., 2h, Learning outcomes:3 6.Work and power, energy., 2h, Learning outcomes:4 7.Collisions., 2h, Learning outcomes:4 8.1st partial exam, 2h, Learning outcomes:1,2,3,4 9.Rigid body rotation., 2h, Learning outcomes:2,3 10.Motion in gravitational field., 2h, Learning outcomes:1,2 11.Thermal expansion. Ideal gas laws., 2h, Learning outcomes:6				

	12.Laws of thermodynamics. Carnot cycle., 2h, Learning outcomes:7,8 13.Heat transfer mechanisms (conduction)., 2h, Learning outcomes:9 14.Heat transfer mechanisms (convection, radiation)., 2h, Learning outcomes:9 15.2nd partial exam, 2h, Learning outcomes:5,6,7,8,9
Course content laboratory	1.No classes 2.No classes 3.No classes 4.No classes 5.No classes 6.Measurement and processing of the measurement results, 2h 7.Measurement by vernier caliper and micrometer caliper, 2h 8.Determination of acceleration of gravity by mathematical pendulum, 2h, Learning outcomes:1,2 9.Determining the constant of torsion by torsion pendulum, 2h, Learning outcomes:3 10.Density of the solid and liquid, 2h, Learning outcomes:6 11.Measurements of temperature and heat capacity, 2h, Learning outcomes:7 12.Determination of the latent heat of vaporization, 2h, Learning outcomes:7 13.Final practicum exam, 1h, Learning outcomes:1,2,3,6,7 14.No classes 15.No classes
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory Whiteboard with markers Overhead projector
Exam literature	Obavezna: 1. Levanat, I., Fizika za TVZ: Kinematika i dinamika, TVZ, Zagreb, 2010 2. Kulišić, P., Mehanika i toplina, Školska knjiga, Zagreb, 2005 Dodatna: 1. Young Freedman, University Physics, Addison Wesley, San Francisco, 2004.
Students obligations	Final practicum exam
Knowledge evaluation during semester	Two partial exams, each with numerical problems and theoretical questions. Minimum to pass each partial exam: theory 40%, problems 50%. For attending lectures up to 10% of theory maximum added.
Knowledge evaluation after semester	Full exam, with numerical problems and theoretical questions. Minimum to pass: 40% problems and 40% theory.
Student activities:	Aktivnost — ECTS (Classes attendance) — 3 (Constantly tested knowledge) — 3
Remark	This course can not be used for final thesis theme
Prerequisites:	No prerequisites.
ISVU equivalents:	143193;
Proposal made by	Ivica Levanat, prof.v.šk, 24.06.2014.

Code WEB/ISVU	23542/156309	**ECTS**	6.0	**Academic year**	2018/2019
Name	Pneumatics and Hydraulics				
Status	4th semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+45 (33+12+0+0) 105
Teachers	Lectures:1. Vesna Alić-Kostešić dipl.ing.stroj. Lectures: Filip Mateša mag. ing. mech. Auditory exercises: Filip Mateša mag. ing. mech. Laboratory exercises: Filip Mateša mag. ing. mech.				
Course objectives	To introduce students to the basics of pneumatics and hydraulics. To qualify students to solve simple engineering tasks related to this area of expertise. To qualify students for further education in order to be apt to solve more complex engineering tasks related to pneumatics and hydraulics.				
Learning outcomes:	1.identify basics of pneumatics, hydraulics, fluidic. Level:6 2.connect the physical fundamentals and gas laws. Level:6,7 3.Plan preparation and distribution of compressed air. Level:6,7 4.combine pneumatic actuators. Level:6,7 5.connect pneumatic controls. Level:6,7 6.solve the cascade control method. Level:6 7. solve the step by step method. Level:6,7 8.analyze electropneumatics. Level:6 9.solve complex logic functions. Level:6 10.calculate sizes in hydraulics. Level:6 11.categorize pumps and motors. Level:6 12.combine hydraulic control elements. Level:6,7 13.design hydraulic equipment. Level:6,7 14.select hydraulic systems. Level:7 15.set proportional and Servo Systems. Level:6,7				
Methods of carrying out lectures	Ex cathedra teaching Case studies Demonstration Simulations Discussion Questions and answers Lectures with Power Point presentation.				
Methods of carrying out auditory exercises	Group problem solving Computer simulations Solving numerical problems, solving schemes.				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Laboratory exercises, computer simulations Computer simulations Workshop Solving practical problems with hydraulic and pneumatic elements and system in a Practicum.				
Course content lectures	1.Introduction and basics of pneumatics, hydraulics, fluidic, 2h, Learning outcomes:1 2.Physical fundamentals, gas laws, 2h, Learning outcomes:2 3.Preparation and distribution of compressed air, 2h, Learning outcomes:3 4.Pneumatic actuators, 2h, Learning outcomes:4 5.Pneumatic Controls, 2h, Learning outcomes:5 6.Methods pneumatic control - Cascade Method, 2h, Learning outcomes:6 7.Methods pneumatic control - Step by step method, 2h, Learning outcomes:7 8.Electropneumatics, 2h, Learning outcomes:8 9.Complex logic functions, 2h, Learning outcomes:9 10.Hydraulics-sizes in hydraulics, 2h, Learning outcomes:10 11.Pumps and motors, 2h, Learning outcomes:11 12.Hydraulic control elements, 2h, Learning outcomes:12 13.Hydraulic equipment, 2h, Learning outcomes:13 14.Hydraulic systems, 2h, Learning outcomes:14 15.Proportional and Servo Systems, 2h, Learning outcomes:15				
Course content auditory	1.Consumption and air condition, 2h, Learning outcomes:1 2.The symbols and diagrams, 2h, Learning outcomes:2 3.Basic pneumatic diagrams work with one cylinder, 2h, Learning outcomes:3 4.Schemes of pneumatic control, 2h, Learning outcomes:4 5.Cascade method, 2h, Learning outcomes:5 6.Method step by step, 2h, Learning outcomes:6 7.Electro-pneumatic diagrams, 2h, Learning outcomes:7 8.Electro-pneumatic diagrams and pressure in the hydraulic circuit, 2h, Learning outcomes:8 9.Speed of movement of cylinders and motors, and calculations of forces and moments, 2h, Learning outcomes:9 10.Compressibility and fluid losses, 2h, Learning outcomes:10 11.Calculation of operating power, 2h, Learning outcomes:11 12.Schemes of connecting the hydraulic system, 2h, Learning outcomes:12 13.Schemes connecting the hydraulic system and tank calculation, 2h, Learning outcomes:13 14.Calculation of hydrostatic transmission and mobile hydraulics, 2h, Learning outcomes:14 15.Proportional and Servo Systems, 2h, Learning outcomes:15				
Course content laboratory	1.Single acting cylinder and double acting cylinder, 2h, Learning outcomes:1 2.Logical functions AND, OR, NOT and self-holding, 2h, Learning outcomes:2				

	3.Sequence control, 2h, Learning outcomes:3 4.Cycle method; cascade method, 2h, Learning outcomes:4 5.Characteristics of pumps and friction losses, 2h, Learning outcomes:5 6.Limit pressure valve, 2h, Learning outcomes:6 7.Only 6 labs, Learning outcomes:7 8.Only 6 labs, Learning outcomes:8 9.Only 6 labs, Learning outcomes:9 10.Only 6 labs, Learning outcomes:10 11.Only 6 labs, Learning outcomes:11 12.Only 6 labs, Learning outcomes:12 13.Only 6 labs, Learning outcomes:13 14.Only 6 labs, Learning outcomes:14 15.Only 6 labs, Learning outcomes:15
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory Whiteboard with markers Overhead projector
Exam literature	Osnovna: 1. Nikolić G.: Pneumatika i elektropneumatika, veleučilišni udžbenik, TVZ, Zagreb 2007. 2. Nikolić G.: Zbirka zadataka iz pneumatskog upravljanja, sveučilišni priručnik, 3 izdanje FSB, Zagreb 1998. 3. Nikolić G., Novaković J.: Hidraulika, Školske Novine, Zagreb 2006. Dodatna: 1. Pashkov E.,Osinskiy Y.,Chetviorkin A.: Elektropneumatics in Manufacturing Processes, Sevastopol 2004. 2. Stacey C.: Practical Pneumatics., Arnold, London 1998.
Students obligations	maximum of 3 absences from exercises
Knowledge evaluation during semester	Redovitost pohaa#10#10#0$Kolokvij, numeri zadaci#2#45#50$Kolokvij, teorijska pitanja#2#45#50$
Knowledge evaluation after semester	Taking the exam by two preliminary exams.
Student activities:	Aktivnost — ECTS (Classes attendance) — 1 (Practical work) — 3 (Written exam) — 2
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
Proposal made by	Ivo Čala

Code WEB/ISVU	23768/170044	**ECTS**	7.0	**Academic year**	2018/2019
Name	Practical Work				
Status	6th semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				0+144 (0+0+0+144) 66
Teachers	Construction exercises:1. Hrvoje Rakić , dipl.ing.stroj., pred. Construction exercises: Antonia Penđer mag. ing. stroj.				
Course objectives	To introduce students to practical work in companies.				
Learning outcomes:	1.ability to solve a given task. Level:6,7 2.ability to compare the theoretical knowledge with the practical knowledge. Level:6,7 3.combined techniques, skills and modern tools necessary for engineering practice.. Level:6,7 4.ability to estimate the possibility of the application of theoretical knowledge. Level:6,7 5.present accountability, consistency, accuracy, timeliness.. Level:6,7				
How construction exercises are held	Other -				
Course content constructures	1.Consultations, 2h, Learning outcomes:1,2,3 2.Consultations, 2h, Learning outcomes:1,2,3 3.Consultations, 2h, Learning outcomes:1,2,3 4.Consultations, 2h, Learning outcomes:1,2,3 5.Consultations, 2h, Learning outcomes:1,2,3 6.Consultations, 2h, Learning outcomes:1,2,3 7.Consultations, 2h, Learning outcomes:1,2,3 8.Consultations, 2h, Learning outcomes:1,2,3 9.Consultations, 2h, Learning outcomes:1,2,3 10.Consultations, 2h, Learning outcomes:1,2,3 11.Consultations, 2h, Learning outcomes:1,2,3 12.Consultations, 2h, Learning outcomes:1,2,3 13.Consultations, 2h, Learning outcomes:1,2,3 14.Consultations, 2h, Learning outcomes:1,2,3 15.Consultations, 2h, Learning outcomes:1,2,3				
Required materials	Special purpose laboratory General purpose computer laboratory -				
Exam literature	Prema izboru i preporuci predmetnog nastavnika koji zadaje zadatak za praksu u odnosu na zadanu temu. According to the selection and recommendation of the teacher who sets the task to practice in relation to a given topic				
Students obligations	ragular work attendance at appropriate company				
Knowledge evaluation during semester	Practice diary				
Knowledge evaluation after semester	A written work diary on the training completed and a successfully written and defended professional work being determined by the assignment for training.				
Student activities:	Aktivnost (Practical work) (Report) (Project)			ECTS 5 1 1	
Remark	This course can not be used for final thesis theme				
Prerequisites:	No prerequisites.				
Proposal made by	Čedomir Jurčec				

Code WEB/ISVU	23970/185366	**ECTS**	4.0	**Academic year**	2018/2019
Name	Printed Circuit Board Design				
Status	5th semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				15+30 (0+30+0+0) 75
Teachers	Lectures:1. dr. sc. Toni Bjažić prof. v. š. Lectures: Boris Matjačić Laboratory exercises: Boris Matjačić				
Course objectives	Design a printed circuit boards (PCBs) using professional tools and prepare a documentation for PCB manufacturing.				
Learning outcomes:	1.draw an electrical schematics, taking into account the conventions and rules for better readability of the schematics. Level:6 2.select assembly components that will be soldered on the board. Level:7 3.create footprints and 3D models of the missing library components. Level:6,7 4.create a printed circuit board (PCB) layout according to desired shape and dimensions. Level:6 5.layout the components on the board, taking into account mechanical and electrical limitations. Level:6,7 6.route all layers of the board according to design rules (clearance, routing width, board edge clearance etc.). Level:6 7.prepare a documentation (output files) for PCB manufacturing. Level:6,7				
Methods of carrying out lectures	Ex cathedra teaching Guest lecturer Case studies Demonstration				
Methods of carrying out laboratory exercises	Laboratory exercises, computer simulations				
Course content lectures	1.Introductory lecture., 1h, Learning outcomes:1,2,3,4,5,6,7 2.Creating a project, basic settings, navigation, working with libraries of components, placing the components on the schematics, annotation, 1h, Learning outcomes:1,2 3.Creating custom components (electrical schematics symbol and footprint)., 1h, Learning outcomes:3 4.Components' settings, parameter's values, rotating and mirroring, connecting components and using nets, adding power supply and connectors, bypass capacitors., 1h, Learning outcomes:1,2 5.Importing components from electrical schematics to PCB, selecting components' footprints, layout of components considering electrical and mechanical limitations., 1h, Learning outcomes:4,5 6.Defining PCB shape and dimensions, setting grid, layers management, keep-out layer, placing the components and bottom layer of the PCB., 1h, Learning outcomes:4,5 7.PCB stack, mounting holes, pads, vias, polygon pours, board and pads size check (default prints)., 1h, Learning outcomes:6 8.Routing and defining design rules., 1h, Learning outcomes:6 9.Internal planes and signal layers., 1h, Learning outcomes:6 10.Using autorouter with design rules., 1h, Learning outcomes:6 11.Generating output files for PCB manufacturing., 1h, Learning outcomes:7 12.Lectures from industry - good practice examples., 1h, Learning outcomes:1,2,3,4,5,6,7 13.Lectures from industry - good practice examples., 1h, Learning outcomes:1,2,3,4,5,6,7 14.Lectures from industry - good practice examples., 1h, Learning outcomes:1,2,3,4,5,6,7 15.Lectures from industry - good practice examples., 1h, Learning outcomes:1,2,3,4,5,6,7				
Course content laboratory	1.No lectures. 2.No lectures. 3.Introductory exercise, creating a project, defining necessary project documentation., 2.5h, Learning outcomes:1,2,3,4,5,6,7 4.Creating custom footprints (symbol, footprint, parameters) according to IPC standards., 2.5h, Learning outcomes:1,2,3 5.Schematics capture, work on project., 2.5h, Learning outcomes:1,2,3 6.Importing components from elecrtical schematics to PCB, defining shape, dimensions and PCB stackup, setting grid, work on project., 2.5h, Learning outcomes:4,5 7.Defining design rules, component layout, work on project., 2.5h, Learning outcomes:4,5 8.Routing, setting power supply and ground layers, work on project., 2.5h, Learning outcomes:4,5,6 9.Work on project, consultations., 2.5h, Learning outcomes:1,2,3,4,5,6 10.Work on project, consultations., 2.5h, Learning outcomes:1,2,3,4,5,6,7 11.Work on project, consultations., 2.5h, Learning outcomes:1,2,3,4,5,6 12.Consultations, project review., 2.5h, Learning outcomes:1,2,3,4,5,6 13.Final project review., 2.5h, Learning outcomes:1,2,3,4,5,6 14.Setting parameters for documentation (output job) creation and creating output files., 2.5h, Learning outcomes:7 15.The term for reimbursement of exercises., Learning outcomes:1,2,3,4,5,6,7				
Required materials	Basic: classroom, blackboard, chalk... General purpose computer laboratory Whiteboard with markers Overhead projector Special equipment licenced software for PCB design				
Exam literature	Osnovna: 1. Materijali i poveznice na online sadržaje dani u sklopu predmeta 2. CircuitMaker documentation, https://documentation.circuitmaker.com/ Dodatna: 1. Printed Circuits Handbook, Seventh Edition, McGraw-Hill Education, ISBN-10: 0071833951, ISBN-13:				

	978-0071833950, 2016.
Students obligations	All laboratory exercises completed.
Knowledge evaluation during semester	A maximum of 100 points can be earned through a project that has been developed and defended.
Knowledge evaluation after semester	If a student does not finish the project until the end of the semester, he/she continues to work on it after the semester. On regular exams, a student can defend a project and gain up to 100 points. Grading is done according to the following scales (ISVU and ECTS scales): [50, 60] - grade 2 (pass) or ECTS grade E [60, 65] - grade 2 (pass) or ECTS score D [65, 80) - grade 3 (good) or ECTS grade C [80, 90] - grade 4 (very good) or ECTS grade B [90, 100] - grade 5 (excellent) or ECTS grade A
Student activities:	Aktivnost — ECTS (Classes attendance) — 2 (Project) — 2
Remark	This course can be used for final thesis theme
Prerequisites:	Students cannot enroll in this course unless they have completed Elektronički elementi i sklopovi
ISVU equivalents:	170040;
Proposal made by	prof. Toni Bjažić, Ph.D. and Boris Matjačić (Končar Electrical Engineering Institute)

Code WEB/ISVU	23541/156308	**ECTS**	5.0	**Academic year**	2018/2019
Name	Process modeling and simulation				
Status	4th semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+45 (15+30+0+0) 75
Teachers	Lectures:1. dr. sc. Toni Bjažić prof. v. š. Auditory exercises: Josip Ćurković mag. ing. el. techn. inf. Laboratory exercises: Josip Ćurković mag. ing. el. techn. inf. Laboratory exercises: Tin Mohor Laboratory exercises: Antonia Penđer mag. ing. stroj.				
Course objectives	To qualify students to use the technique of defining the control and regulation properties by modelling and simulation.				
Learning outcomes:	1.ability to create a mathematical model of a system based on the knowledge of physical laws related to it. Level:6,7 2.ability to create a mathematical model of a process in state space using state variables based on psysical process values. Level:6,7 3.ability to draw a canonical implementations of a mathematical model of a system based on its differential equation or transfer function. Level:6 4.ability to draw the simulation scheme of a system using the Matlab/Simulink software package. Level:6 5.ability to design a physical model of a simple system using operational amplifier circuits. Level:6 6.ability to design a physical model of a simple system using a digital microcontroller. Level:6				
Methods of carrying out lectures	Ex cathedra teaching Simulations Modelling Discussion				
Methods of carrying out auditory exercises	Group problem solving Discussion, brainstorming Computer simulations				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Laboratory exercises, computer simulations Discussion, brainstorming Computer simulations				
Course content lectures	1.Introductory lecture; Introduction to modeling and simulation of systems, 1h, Learning outcomes:1 Modeling of passive electrical systems using fundamental physical laws, 2h, Learning outcomes:1,4 2.State-space representation of the system, 1h, Learning outcomes:1,2,4 3.Choosing the state-variables based on the system, 2h, Learning outcomes:1,2,4 4.Canonical realizations of system in state space, 2h, Learning outcomes:3,4 5.Modeling of mechanical systems with translatory motion, 2h, Learning outcomes:1,2,4 6.Modeling of mechanical systems with rotary motion, 2h, Learning outcomes:1,2,3,4 7.Modeling of system with fluids leakage; Coupled tanks, 2h, Learning outcomes:1,2,3,4 8.Linearization of system with fluids leakage in coupled tanks, 2h, Learning outcomes:1,2,3,4 9.Modeling of process with heat exchange; Linearization and state space description using Matlab, 2h, Learning outcomes:1,2,3,4 10.Modeling of electronic circuits with ideal operational amplifiers, 2h, Learning outcomes:1,5 11.Modeling of real properties of operational amplifiers, 2h, Learning outcomes:1,5 12.Generating nonlinear characteristics using circuits with operational amplifiers, 2h, Learning outcomes:5 13.Modeling of digital control systems - part 1, 2h, Learning outcomes:6 14.Modeling of digital control systems - part 2, 2h, Learning outcomes:6 15.Numerical integration methods; Generating analitical functions of an independent variable, 2h, Learning outcomes:5,6				
Course content auditory	1.No exercises 2.Calculation of transfer functions of the passive electrical systems, 2h, Learning outcomes:1 3.State-space description of the passive electrical system, 1h, Learning outcomes:1,2,4 4.Canonical realizations of system in state space - numerical examples, 1h, Learning outcomes:3,4 5.Calculation of the transfer function and state space description of the mechanical system with translatory motion, 1h, Learning outcomes:1,2,4 6.Calculation of the transfer function and state space description of the mechanical system with rotary motion, 1h, Learning outcomes:1,2,4 7.Linearization of nonlinear system - numerical examples - part 1, 1h, Learning outcomes:1,2,4 8.Linearization of nonlinear system - numerical examples - part 2, 1h, Learning outcomes:1,2,4 9.Linearization of nonlinear system - numerical examples - part 3, 1h, Learning outcomes:1,2,4 10.Calculation of transfer functions of electronic circuits with ideal operational amplifiers - part 1, 1h, Learning outcomes:1,5 11.Calculation of transfer functions of electronic circuits with ideal operational amplifiers - part 2, 1h, Learning outcomes:1,5 12.Modeling of real properties of operational amplifiers - numerical examples, 1h, Learning outcomes:1,5 13.Calculation of discrete transfer functions of the system, 1h, Learning outcomes:6 14.Calculation of recursive equations of the system and example of implementation in C++ program language, 1h, Learning outcomes:6 15.Generating analitical functions of an independent variable - numerical examples, 1h, Learning outcomes:5,6				
Course content laboratory	1.No exercises 2.No exercises 3.Modeling of passive electric system using Ohms and Kirchhoffs laws, 2.5h, Learning outcomes:1,4				

	4.Modeling of passive electric system in state-space, 2.5h, Learning outcomes:1,2,4 5.Canonical realizations of system in state space - simulation in Matlab/Simulink, 2.5h, Learning outcomes:3,4 6.Modeling and simulation of mechanical system with translatory motion, 2.5h, Learning outcomes:1,2,3,4 7.Modeling and simulation of mechanical system with rotary motion, 2.5h, Learning outcomes:1,2,3,4 8.Exam 1, 2.5h, Learning outcomes:1,2,3,4 9.Modeling of systems with fluids leakage in coupled tanks, 2.5h, Learning outcomes:1,2,3,4 10.Linearization of nonlinear systems using Matlab, 2.5h, Learning outcomes:1,2,3,4 11.Simulation of electronic circuits with ideal operational amplifiers in SPICE simulator, 2.5h, Learning outcomes:5 12.Simulation of real properties of operational amplifiers in SPICE simulator, 2.5h, Learning outcomes:5 13.Simulation of electronic circuits with commercial operational amplifiers in SPICE simulator, 2.5h, Learning outcomes:6 14.No exercises 15.Exam 2, 2.5h, Learning outcomes:1,2,3,4,5,6
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory General purpose computer laboratory Whiteboard with markers Overhead projector
Exam literature	Osnovna: 1. T. Bjažić: Modeliranje i simuliranje sustava - e-knjiga - radni materijali, TVZ, Zagreb, 2017. 2. N.S. Nise: Control Systems Engineering, 6th edition, John Wiley Sons, New Jersey, 2011. ISBN13: 978-0470-54756-4 3. Ž. Ban, J. Matuško, I. Petrović: Primjena Matlaba za rješavanje tehničkih problema, Graphis, Zagreb, 2010. 4. Matlab Product Help, The Mathworks Inc., 2013. Dodatna: 1. D. Hanselman, B. Littlefield: Mastering Matlab; Prentice Hall, New Jersey, 2012.
Students obligations	Student must achieve minimum 30 points during semester.
Knowledge evaluation during semester	A maximum of 60 points can be earned during the semester through the following activities: 1. presence on lectures, auditory and laboratory exercises maximum 7.5 points, minimum 5 points to pass, 2. short exams on lectures and auditory exercises maximum 12.5 points, minimum 0 points to pass, 3. preparation tests on laboratory exercises (entrance tests) maximum 10 points, minimum 0 points to pass, 4. two main exams maximum 30 points (2 x 15), minimum 0 points to pass. A prerequisite to take the final exam is earning at least 30 points during the semester. Students which earn less than 15 points are graded F (unsuccesfull) and they have to enroll the course again in the next academic year. Students which earn between 15 and 30 points are graded FX (insufficient), but they can approach an additional exam. The additional exam is carried out on the first exam term, and it contains tasks from 2, 3 and 4 enumeration above with a total of 30 points. If the student earns 15 or more points on the additional exam, the total points earned during the semester will be set to 30 and student can approach the final exam.
Knowledge evaluation after semester	A maximum of 40 points can be earned on the final exam, so the total number of points on the course is equal to 100. The grading is carried out according to the following scales (ISVU and ECTS scales): [50, 60) grade 2 (pass) or ECTS grade E [60, 65) grade 2 (pass) or ECTS grade D [65, 80) grade 3 (good) or ECTS grade C [80, 90) grade 4 (very good) or ECTS grade B [90, 100] grade 5 (excellent) or ECTS grade A
Student activities:	Aktivnost — ECTS (Classes attendance) — 2 (Constantly tested knowledge) — 3
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
Proposal made by	Toni Bjažić, Ph.D., senior lecturer

Code WEB/ISVU	23543/156311	**ECTS**	6.0	**Academic year**	2018/2019
Name	Processing Computers				
Status	4th semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+45 (0+45+0+0) 105
Teachers	Lectures:1. mr.sc. Goran Malčić v.pred. Laboratory exercises: Ivica Vlašić				
Course objectives	To introduce students to the specific requirements set upon implemented computer systems				
Learning outcomes:	1.ability to distinguish between real-time computer system and others. Level:6 2.ability to connect the elements of a system with software. Level:6,7 3.ability to sketch control logic based on a graphic programming language. Level:6 4.ability to develop a control program for simple systems. Level:6,7 5.ability to develop a control program for simple systems. Level:6,7 6.ability to to build the relation between software, computer and end hardware elements of a system. Level:6,7				
Methods of carrying out lectures	Ex cathedra teaching The lectures are given with maximal presenting the specific materials related to management systems and standard PLC devices.				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Group problem solving Discussion, brainstorming Computer simulations Workshop The exercises are carried out in a laboratory with PLC devices connected to PCs				
Course content lectures	1.Introduction, 2h 2.One stage amplifiers. Common emitter amplifier, 2h 3.One stage amplifiers. Common emitter amplifier, 2h 4.One stage amplifiers. Common emitter amplifier, 2h 5.One stage amplifiers. Common collector amplifier, 2h 6.Transistor series voltage regulator, 2h 7.Common source amplifier, 2h 8.Common drain amplifier, 2h 9.Multistage amplifiers, 2h 10.Amplitude and phase frequency response, 2h 11.Amplitude and phase frequency response, 2h 12.Differential amplifier, 2h 13.Power amplifiers, 2h 14.Feedback, 2h 15.Oscillators, 2h				
Course content laboratory	1.Basic units of programmable logic controller (PLC), 2h 2. Interaction with the environment and the PLC input and output control , 2h 3.Direct and indirect addressing, 2h 4.Programming language and the application development software, 2h 5.Application simulation on a PC, 2h 6.Operating with timers, 2h 7.Examples of work from timers, 2h 8.Operating with counters, 2h 9.Control switching equipment, sequential control, 2h 10.Examples of processes combined timers and counters, 2h 11.Analog modules, analog value scaling, 2h 12.Operating with analog values, 2h 13.Operating with mathematical instructions, 2h 14.Interruptive subroutines and operation jump start program, 2h 15.Writing the software project documentation, 2h				
Required materials	Basic: classroom, blackboard, chalk... Special purpose computer laboratory Whiteboard with markers Overhead projector PLC computer, switching equipment				
Exam literature	Osnovna: 1. Hugh Jack: Automating manufacturing systems with PLCs, 2003. 2. John R. Hackworth and Frederick D. Hackworth: Programmable logic controllers: Programming methods and applications, 2003 3. G. Malčić: Programibilni logički kontroleri, interna skripta za kolegij Procesna računala, Tehničko veleučilište u Zagrebu, Elektrotehnički odjel, Zagreb 2004. 4. Priručnici za rad sa odabranim PLC-om. Dodatna: 1. G. Smiljanić: Mikroračunala, Školska knjiga, Zagreb, 1990 2. G. Smiljanić: Računala i procesi, Školska knjiga, Zagreb, 1991 3. Priručnici za rad sa odabranim PLC-om.				
Students obligations	Mandatory attendance (80% level)				
Knowledge	Colloquium numerical tasks, Seminar Verbal knowledge testin				

evaluation during semester		
Knowledge evaluation after semester	The written exam Verbal exam Seminar	
Student activities:	Aktivnost (Written exam) (Oral exam)	ECTS 3 3
Remark	This course can be used for final thesis theme	
Prerequisites:	No prerequisites.	

Code WEB/ISVU	23547/156318	**ECTS**	4.0	**Academic year**	2018/2019
Name	Robots and Manipulators				
Status	4th semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - elective course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (14+16+0+0) 60
Teachers	Lectures:1. prof. dr. sc. Dario Matika Auditory exercises:prof. dr. sc. Dario Matika Laboratory exercises: Antonia Penđer mag. ing. stroj.				
Course objectives	To introduce students to robot functioning and its applications. To qualify students to do programming and plan robot applications in various production processes.				
Learning outcomes:	1. . Level:6 2. . Level:6 3. . Level:6 4. . Level:6 5. . Level:6 6. . Level:6,7 7. . Level:6 8. . Level:6				
Methods of carrying out lectures	Ex cathedra teaching Lectures with PPT presentation.				
Methods of carrying out auditory exercises	Group problem solving Other calculation of parameters				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Laboratory exercises, computer simulations Computer simulations Workshop Other Robot Mitsubishi RV-2AJ (Robots AdeptSix300, Mitsubishi RM501 and Pioneer3)				
Course content lectures	1.Introduction to robotics and development of the robot through history, 2h 2.Classification of robots and their applications, 2h, Learning outcomes:1,2 3.Industrial Robots, 2h, Learning outcomes:1,2 4.Mobile robots, 2h, Learning outcomes:1,2 5.Robot control, 2h, Learning outcomes:1,2,3 6.Mechanical robot subsystem, 2h, Learning outcomes:1,2,3 7.Energy robot subsystem, 2h, Learning outcomes:1,2,3 8.The first control task, 2h, Learning outcomes:1,2,3 9.Robot sensors, 2h, Learning outcomes:1,2 10.The kinematics of the robot, 2h, Learning outcomes:4,5 11.The dynamics of the robot, 2h, Learning outcomes:4,5 12.Programming a robot, 2h, Learning outcomes:3,4,8 13.The application of robots in practice - Part 1, 2h, Learning outcomes:6,7,8 14.The application of robots in practice - part 2, 2h, Learning outcomes:6,7,8 15.The second control task, 2h, Learning outcomes:6,7,8				
Course content auditory	1.Calculation of parameters of the decentralized robot control - Part I, 1h, Learning outcomes:1,2 2.Calculation of parameters of the decentralized robot control- Part II, 1h, Learning outcomes:1,2 3.Calculation of parameters PD position control robotic wrist - Part I, 1h, Learning outcomes:3,4 4.Calculation of parameters of PD position control of robotic wrist-Part II, 1h, Learning outcomes:3,4 5.Calculation of parameters cascade control of robotic manipulators - Part I, 1h, Learning outcomes:3,4 6.Calculation of parameters cascade control of robotic manipulators - Part II, 1h, Learning outcomes:3,4 7.The first control task, 1h, Learning outcomes:3,4 8.Calculation of parameters of robot kinematics - Part I, 1h, Learning outcomes:3,4 9.Calculation of parameters of robot kinematics - Part II, 1h, Learning outcomes:3,4 10.Calculation of parameters of robot dynamics - Part I, 1h, Learning outcomes:3,4 11.Calculation of parameters of robot dynamics - Part II, 1h, Learning outcomes:3,4,7 12.Calculation of parameters of centralized management robot - Part I, 1h, Learning outcomes:3,4,7 13.Calculation of parameters of centralized management robot - Part II, 1h, Learning outcomes:3,4,7 14.The second control task, 1h, Learning outcomes:1,2 15.The second control task, 1h, Learning outcomes:3,4,7				
Course content laboratory	1.Working with simulation program - Part I, 1h, Learning outcomes:5,8 2.Working with simulation program -Part II, 1h, Learning outcomes:5,8 3.Simulation of robotic manipulators -Part I, 1h, Learning outcomes:5,8 4.Simulation of robotic manipulators - Part II, 1h, Learning outcomes:5,8 5.Simulation of robotic manipulators - Part III, 1h, Learning outcomes:5,8 6.Programming robots work - Part I, 1h, Learning outcomes:5,8 7.Programming robots work - Part II, 1h, Learning outcomes:5,8 8.Programming robots work - Part III, 1h, Learning outcomes:5,8 9.Demonstration of robotic manipulators in practice -Part I, 1h, Learning outcomes:5,8 10.Demonstration of robotic manipulators in practice - Part II, 1h, Learning outcomes:5,8 11.Industrial robots - demonstrations in the installation - Part I, 1h, Learning outcomes:5,7,8 12.Industrial robots - demonstration at the plant - Part II, 1h, Learning outcomes:5,7,8 13.Mobile robots - demonstration at the plant - Part I, 1h, Learning outcomes:5,7,8 14.Mobile robots - demonstrations in the installation - Part II, 1h, Learning outcomes:5,7,8 15.Analysis and Synthesis demonstrations of robots, 1h, Learning outcomes:5,7,8				

Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory Special purpose computer laboratory Whiteboard with markers Overhead projector Robots AdeptSix300, Mitsubishi RM501 and Pioneer3
Exam literature	Osnovna: 1.Nikolić G.i dr. Roboti primjena u tekstilnoj industriji, Zagreb, 2008. 2.Doleček V., Karabegović I.: Robotika, Tehnički fakultet, Bihać 2002. 3.Šurina T., Crneković M.: Industrijski roboti, Školska knjiga, Zagreb, 1990. 4.http://karmela.fsb.hr/robotika
Students obligations	positive score in exercises
Knowledge evaluation during semester	Attendance, Numerical test, Theoretical test
Knowledge evaluation after semester	Numerical and oral exam
Student activities:	Aktivnost ECTS (Classes attendance) 2 (Constantly tested knowledge) 2
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
Proposal made by	Dario Matika

Code WEB/ISVU	23767/170043	**ECTS**	5.0	**Academic year**	2018/2019
Name	Semestral paper				
Status	6th semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				15+75 (0+0+75+0) 60
Teachers	Lectures:1. dr. sc. Toni Bjažić prof. v. š. Seminar exercises: Antonia Penđer mag. ing. stroj.				
Course objectives	To qualify students to implement in practice the knowledge acquired while solving simple tasks related to Mechatronics assemblies, such as various devices, passers, transporters, etc.				
Learning outcomes:	1.ability to single out knowledge from specific areas. Level:6 2.ability to devise a solution to a specific task. Level:6,7 3.ability to identify important parameters for a specific task. Level:6 4.connect knowledge of contemporary issues of the profession and society.. Level:6,7 5.present information, ideas, problems and solutions expert and general public.. Level:6,7				
Methods of carrying out lectures	Other consultations				
Methods of carrying out seminars	The teachers, lecturers and assistants shall assist the selected team in realization of the semestral work i.e. the project.On the basis of the agreement between the team of students (3-5) and the teacher concerned, a technical assignment i.e. a project shall be created, in which the students themselves shall carry out all the work from an idea to a concrete model or solution. Continuously, this work implicitly includes permanent monitoring of one or more supervising tutors.				
Course content lectures	1.introduce students to the tasks and manner of placing topics, 5h, Learning outcomes:1,2 2. methods of professional and research work, 5h, Learning outcomes:3,4 3. presentation, 5h, Learning outcomes:5 4. no class 5. no class 6. no class 7. no class 8. no class 9. no class 10. no class 11. no class 12. no class 13. no class 14. no class 15. no class				
Course content seminars	1.Consultations, 2h, Learning outcomes:1,2,3 2.Consultations, 2h, Learning outcomes:1,2,3 3.Consultations, 2h, Learning outcomes:1,2,3 4.Consultations, 2h, Learning outcomes:1,2,3 5.Consultations, 2h, Learning outcomes:1,2,3 6.Consultations, 2h, Learning outcomes:1,2,3 7.Consultations, 2h, Learning outcomes:1,2,3 8.Consultations, 2h, Learning outcomes:1,2,3 9.Consultations, 2h, Learning outcomes:1,2,3 10.Consultations, 2h, Learning outcomes:1,2,3 11.Consultations, 2h, Learning outcomes:1,2,3 12.Consultations, 2h, Learning outcomes:1,2,3 13.Consultations, 2h, Learning outcomes:1,2,3 14.Consultations, 2h, Learning outcomes:1,2,3 15.Consultations, 2h, Learning outcomes:1,2,3				
Required materials	Special purpose laboratory -				
Exam literature	Osnovna: Prema izboru mentora tj. predmetnog nastavnika izbornog predmeta. Dodatna: Preporučena litaratura ovisiti će o zadanom projektu.				
Students obligations	regular consultations with mentor				
Knowledge evaluation during semester	Consultations				
Knowledge evaluation after semester	Written, made and documented with technical documentation and successfully defended project or a seminar work is a test of knowledge for all the candidates participating in a concrete project i.e. seminar work.				
Student activities:	Aktivnost (Seminar Work)		ECTS 5		
Remark	This course can not be used for final thesis theme				
Prerequisites:	No prerequisites.				
Proposal made by	Čedomir Jurčec				

Code WEB/ISVU	23252/143206	**ECTS**	5.0	**Academic year**	2018/2019
Name	Sensors				
Status	2nd semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (10+20+0+0) 90
Teachers	Lectures:1. pred. Ivan Lujo , dipl.ing. Auditory exercises: Dean Fraj struč. spec. ing. el. Auditory exercises:pred. Ivan Lujo , dipl.ing. Laboratory exercises: Dean Fraj struč. spec. ing. el. Laboratory exercises:pred. Ivan Lujo , dipl.ing.				
Course objectives	To introduce students to the basics of sensory evaluation and its applications in Mechatronics.				
Learning outcomes:	1.ability to relate the knowledge in physics, electrical engineering and electronics to the work modes and construction of sensors used for monitoring mechanical and process values in automation systems. Level:6,7 2.To analyze the difference in properties of the analog, binary and digital sensors and their application. Level:6 3.Ability to test the static and dynamic properties of analog sensors. Level:6 4.Ability to test the static and dynamic properties of temperature sensors. Level:6 5.To choose the appropriate sensors for measurement and monitoring of certain variables in a specific system. Level:7 6.To detect the causes of sensor malfunction. Level:7 7.ability to draw a technical documentation using the standardised symbols and marks. Level:6 8.Calculate operational sensor parameters. Level:6				
Involvement of learning outcomes of the course in study programme:	1.1.OPĆI Služiti se stranim jezikom u literaturi i svakodnevnoj stručnoj komunikaciji. : 10h in 150h 1.2.OPĆI Primijeniti znanje matematike i fizike na inženjerske probleme.: 10h in 150h 1.3.OPĆI Koristiti tehnike, vještine i suvremene alate neophodne za inženjersku praksu.: 20h in 150h 2.3.OSOBNE Etički i moralni pristup radu.: 5h in 150h 2.9.OSOBNE Profesionalna i ljudska osobnost.: 5h in 150h 2.10.OSOBNE Prilagodljivost novim tehnologijama i tehnikama kao dio procesa cjeloživotnog učenja.: 5h in 150h 2.11.OSOBNE Otvorenost za nova znanja, iskustva i kulturne okolnosti.: 5h in 150h 3.4.MEH Predložiti senzore, aktuatore, energetske i upravljačke jedinice, komunikacijske protokole i popratnu opremu za automatizaciju različitih tehničkih procesa u mehatronici (elektromotorni pogoni, alatni strojevi, procesi skladištenja fluida, toplinski i tra: 60h in 150h 3.7.MEH Osmisliti programsko rješenje ugrađenog računalnog sustava za vođenje različitih tehničkih procesa u mehatronici: 10h in 150h 3.8.MEH Planirati proizvodnju i projekte te optimizirati resurse: 10h in 150h 3.9.MEH Razviti podloge za suvremeni pristup održavanju i osiguranju kvalitete: 10h in 150h				
Methods of carrying out lectures	Ex cathedra teaching Guest lecturer Case studies Demonstration Modelling Discussion Questions and answers Seminar, students presentation and discussion				
Methods of carrying out auditory exercises	Group problem solving Data mining and knowledge discovery on the Web Discussion, brainstorming Computer simulations Interactive problem solving				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Laboratory exercises, computer simulations Computer simulations Other Individual exercises on correct sensor usage and measuring of sensor characteristics. Students document exercises.				
Course content lectures	1.Introductory lecture, course and content elaboration, explanation of the course requisits, 2h, Learning outcomes:1,2 2.General terminology in connection to measurement and sensors, basic sensor characterstics, 2h, Learning outcomes:1,2,3 3.Sensor system properties, 2h, Learning outcomes:1,2,3,4,6,7,8 4.Tolerance, deformation and optical matrix sensor measurements (camera systems) - guest lecture, 2h, Learning outcomes:1,2,3,5,6,7,8 5.Sensor system properties, 2h, Learning outcomes:1,2,3,4,6,7,8 6.Resistance based sensors, variable resistors, voltage divider, 2h, Learning outcomes:1,2,3,4,7 7.Movement and position sensors, optical distance measurement, 2h, Learning outcomes:1,2,3,4,6,7,8 8.1st preliminary exam, 2h, Learning outcomes:1,2,3 9.Magnetism based sensors, operation principles, 2h, Learning outcomes:1,2,3,4,6,7,8 10.Computer data acquisition, basic terminology and operation principles, sensor systems, 2h, Learning outcomes:1,2,3,5,6,7,8 11.Computer data acquisition, basic terminology and operation principles, sensor systems, 2h, Learning outcomes:1,2,7,8 12.Optical and optical fiber sensors, smart structures, 2h, Learning outcomes:1,2,5,6,7,8 13.Ultrasound and MEMS, 2h, Learning outcomes:1,2,3,5,6,7,8 14.2nd preliminary exam, 2h 15.Student seminars, final lecture, summary of presented topics, exam explanation, 2h				
Course content auditory	1.No exercises 2.Static characteristic, sensitivity, linearization, 1h, Learning outcomes:1,2,3,5,6,7,8				

	3.Determining the transfer and the inverse transfer function, linearization, 1h, Learning outcomes:1,2,3,5,6,7,8 4.No exercises 5.Measurement conversion based on change of resistance, resistor bridge, 1h, Learning outcomes:1,2,3,4,5,6,7,8 6.Voltage divider, voltage measurement, 1h, Learning outcomes:1,2,3,5,6,7,8 7.No exercises 8.Power and the log scale, 1h, Learning outcomes:1,2,3,5,6,7,8 9.Directional characteristic, radiation width, 1h, Learning outcomes:1,2,3,5,6,7,8 10.No exercises 11.Geometry of an ultrasound distance measurement, 1h, Learning outcomes:1,2,3,5,6,7,8 12.Relative and absolute measurement error, 1h, Learning outcomes:1,2,3,5,6,7,8 13.Digitized signal resolution, sensitivity, binary numbers and codes, 1h, Learning outcomes:1,2,3,5,6,7,8 14.No exercises 15.Student seminars, 1h
Course content laboratory	1.No class 2.No class 3.No class 4.Virtual instrumentation, NI MyDAQ, protoboard, resistance and voltage measurement, resistor bridge, 3h, Learning outcomes:1,2,5,6,7,8 5.No class 6.Magnetic reed sensors (relays), 3h, Learning outcomes:1,2,3,4,5,6,7,8 7.No class 8.Digital temperature sensor, 3h, Learning outcomes:1,2,3,4,5,6,7,8 9.No class 10.Ultrasonic distance sensor, 3h, Learning outcomes:1,2,4,5,6,7,8 11.No class 12.Analog temperature sensor - Pt100 probe, 3h, Learning outcomes:1,2,3,4,5,6,7,8 13.No class 14.Completing the Pt100 temperature measurement system - result calculation and display, 3h, Learning outcomes:1,2,4,5,6,7,8 15.Additional work as needed, 2h, Learning outcomes:1,2,3,4,5,7,8
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory Special purpose computer laboratory Whiteboard with markers Overhead projector Individual exercises on correct sensor usage and measuring of sensor characteristics. Students document exercises.
Exam literature	Jacob Fraden: Handbook of Modern Sensors, Springer, 2010. Jon S. Wilson: Sensor Technology Handbook, Nevnes/Elsevier, 2004. John G. Webster: Measurement, Instrumentation, and Sensors Handbook, CRC Press LLC, 1999.
Students obligations	Maximum of 1 absence from exercises. 50% total of points eligible from laboratory exercises
Knowledge evaluation during semester	For a passing grade the following cumulative result (on two examinations) needs to be achieved: 50 - 65% => 2 65 - 80% => 3 80 - 90% => 4 90 - 100% => 5
Knowledge evaluation after semester	To pass the written exam a result of 50% or higher is needed. 50 - 65% => 2 65 - 80% => 3 80 - 90% => 4 90 - 100% => 5 For grades 4 and 5 the oral examination is optional.
Student activities:	Aktivnost ECTS (Classes attendance) 2 (Constantly tested knowledge) 2 (Written exam) 1
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
Proposal made by	Ivan Lujo, May 21st 2015

Code WEB/ISVU	23248/143199	**ECTS**	4.0	**Academic year**	2018/2019
Name	Technical Documentation				
Status	1st semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				15+45 (0+0+0+45) 60
Teachers	Lectures: Vesna Alić-Kostešić dipl.ing.stroj. Lectures: Hrvoje Galijan dipl.ing.stroj. Construction exercises: Antonio Antunović dipl. ing. brodogradnje Construction exercises: Hrvoje Galijan dipl.ing.stroj. Construction exercises: Saša Radić				
Course objectives	To transfer to students the knowledge necessary for designing, writing, reading and understanding technical documentation. To teach students how to communicate by means of an engineering drawing. To introduce to students the idea of 2D and 3D presentation possibilities and teach them to adopt conventions and standards used in technical documentation.				
Learning outcomes:	1.ability to create a technical drawing respecting standards, such as the choice of features, technical script, paper size, scale. Level:6 2.ability to design a mechanical element together with a necessary number of projections using the knowledge related to descriptive geometry. Level:6,7 3. ability to design the necessary cross-sections of mechanical elements. Level:6 4.ability to standardise the tolerance and conjunction related to specific mechanical elements. Level:6,7 5.ability to sketch a mechanical element in both orthogonal and isometric projection. Level:6 6.ability to design the necessary positions and an assembly drawing in both orthogonal and isometric projection. Level:6 7.ability to design a mechanical element and an assembly AD drawing using AutoCAD . Level:6,7 8.planning and preparing for the forthcoming workshops. Level:6,7 9.differentiating the coordinative systems and the methods of their application in AutoCAD. Level:6 10.create the prototype drawing in AutoCAD. Level:6,7 11.make a drawing with all kinds of coordinates. Level:6 12.combine the basic commands for drawing and modifying of the drawing Draw, Modify. Level:6,7 13.edit the methods of listing for different scales on the same document. Level:6,7 14.draw the machine part in section with the entry of symbols for surface roughness and the chart of the tolerance. Level:6 15.edit the section by hatching and marking the section. Level:6,7 16.draw the gear wheel in section with conical hub, and properly mark conus. Level:6 17.edit of dimension and tolerance. Level:6,7 18.connect the spatial isometric 3D projection with orthogonal 2D projection. Level:6,7 19.connect orthogonal 2D and spatial isometric 3D projection. Level:6,7 20.draw the shaft. Level:6 21.drawing of the consecutive sections and details of the shafts. Level:6 22.draw all the elements of the workshop drawings. Level:6 23.draw the assembly drawing of the hook with the pulley. Level:6 24.draw the position of the pulley and the hook. Level:6 25. . Level:6				
Involvement of learning outcomes of the course in study programme:	1.1.OPĆI Služiti se stranim jezikom u literaturi i svakodnevnoj stručnoj komunikaciji. : 10h in 120h 1.2.OPĆI Primijeniti znanje matematike i fizike na inženjerske probleme.: 10h in 120h 1.3.OPĆI Koristiti tehnike, vještine i suvremene alate neophodne za inženjersku praksu.: 10h in 120h 1.4.OPĆI Povezati inženjerske aktivnosti konstruiranja, proizvodnje i marketinga s potrebama korisnika proizvoda i usluge.: 10h in 120h 2.10.OSOBNE Prilagodljivost novim tehnologijama i tehnikama kao dio procesa cjeloživotnog učenja.: 10h in 120h 3.1.MEH Konstruirati strojne elemente i sklopove sa stanovišta čvrstoće i deformacija, kinematike i dinamike: 80h in 120h				
Methods of carrying out lectures	Ex cathedra teaching Case studies Demonstration Simulations Lectures are given frontally by oral presentations, method of demonstration with explanations of the rules of drawing technical drawings using contemporary teaching aids: models, computers, overhead projectors.				
How construction exercises are held	Exercises are carried out in groups, by the method of conversation also sketching, analysing and synthesizing projections according to a methodological exercise-book and by individual work with students during sketching machine parts on their own in orthogonal and isometric projection while making a workshop and assembly drawing by a 2D computer.				
Course content lectures	1. , 2h, Learning outcomes:1 2. , 2h, Learning outcomes:2,5 3. , 2h, Learning outcomes:3 4. , 2h, Learning outcomes:3 5. , 2h, Learning outcomes:1 6. , 2h, Learning outcomes:5 7. , 2h, Learning outcomes:4 8. , 2h, Learning outcomes:1,2,3,4,5 9. , 2h, Learning outcomes:4 10. , 2h, Learning outcomes:1,4 11. , 2h, Learning outcomes:4 12. , 2h, Learning outcomes:4 13. , 2h, Learning outcomes:25 14. , 2h, Learning outcomes:25 15. , 2h, Learning outcomes:1,4,25				

Course content constructures	1.No classes, 2h 2.getting familiar with the content of the construction exercises and their realization, 2h, Learning outcomes:8 coordinate system that si being used in AutoCAD, 2h, Learning outcomes:9 3.defining the settings of the protoype drawing, 2h, Learning outcomes:10 drawing of the examples with rectangular and polar, and absolute and relative coordinates, 2h, Learning outcomes:11 4.drawing the projections using the basic drawing commands (line, rectangle, circle) and modification of the drawing (erase, copy, offset, move, rotate, trim), 2h, Learning outcomes:12 5.making of the orthogonal projection of the symmetric machine part with the help of mirror and stretch command, 2h, Learning outcomes:12 6.making the object projection with the help of polar array command, dimensioning and preparing the draft for printing in M1:1 scale, and objects of small dimensions in M20:1 scale, 2h, Learning outcomes:12,13 7.making of the section of the machine part in the full section. Marking surface roughness and the chart of tolerance., 2h, Learning outcomes:14,15 8.the representation of the gear wheel leaving the representation rules in the descriptive geometry- the simplification., 2h, Learning outcomes:16,17 9.making of the orthogonal projections based on the complex isometric drawing., 2h, Learning outcomes:18 10.making of the isometric drawing based on 2 or 3 orthogonal projections., 2h, Learning outcomes:19 11.making of the shaft- the basic model with the groove for key , 2h, Learning outcomes:20 12.entry of the consecutive sections and details, 2h, Learning outcomes:21 13.dimensioning and entry of the symbols for the linear surveying, shapes, positioning and the spinning, and roughness of the technical surfaces, 2h, Learning outcomes:22 14.making of the assembly drawing of pullies with the hook on the paper of A3 format with marked positions and properly filled parts lists., 2h, Learning outcomes:23 15.making of the workshop drawings of the pullies and the hook based on the assembly drawing., 2h, Learning outcomes:24
Required materials	Basic: classroom, blackboard, chalk... General purpose computer laboratory Whiteboard with markers Overhead projector Exercises are carried out in groups, by the method of conversation also sketching, analysing and synthesizing projections according to a methodological exercise-book and by individual work with students during sketching machine parts on their own in orthogonal and isometric projection while making a workshop and assembly drawing by a 2D computer.
Exam literature	Osnovna: Z. Herold: Inženjerska grafika, Inženjerski priručnik, Školska knjiga, Zagreb, 1994. Z. Herold, D. Žeželj: Inženjerska grafika - Metodička vježbenica, FSB, Zagreb, 2006. D. Rohde, N. Bojčetić, D. Deković, Z. Herold, D. Marjanović, D. Žeželj: Računalna i inženjerska grafika, Podloge za vježbe iz Auto CAD, FSB, Zagreb, 2005. M. Opalić, M. Kljajin, S. Sebastijanović: Tehničko crtanje, Zrinski d.d., Čakovec, 2003. Dodatna: Koludrović: Tehničko crtanje u slici s kompjuterskim aplikacijama, Autorska naknada Koludrović Ć. I. R., Rijeka, 1997.
Students obligations	class attendance, submitted programme
Knowledge evaluation during semester	Regular class attendance, preliminary exam, programme problems
Knowledge evaluation after semester	Continuous knowledge checking: homeworks, programme problems and two preliminary exams: 1.PRELIMINARY EXAM: Orthogonal projections; isometry (1h). 2.PRELIMINARY EXAM: Dimensioning; space perception (1h).
Student activities:	Aktivnost — ECTS (Practical work) — 2 (Written exam) — 2
Remark	This course can not be used for final thesis theme
Prerequisites:	No prerequisites.
Proposal made by	Čedomir Jurčec, Hrvoje Galijan

Code WEB/ISVU	24063/196104	**ECTS**	6.0	**Academic year**	2018/2019
Name	Technologies and plants for waste treatment and recycling				
Status	4th semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - elective course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (0+30+0+0) 120
Teachers	Lectures:1. Mario Panjičko Laboratory exercises: Mario Panjičko				
Course objectives	Adopt specific knowledge of waste management, understanding of waste generation and their flows, legal requirements and restrictions on waste management, identification of key parameters for designing waste treatment facilities				
Learning outcomes:	1.Compare, state and describe key waste management legislation in the Republic of Croatia and the EU. Level:6,7 2.Identify and calculate the key process parameters for sizing the waste treatment plant. Level:6 3.Suggest and describe appropriate technical solutions for biological and thermal waste treatment. The student should also be able to present the shortcomings and preconditions for the chosen technical solution,. Level:6,7 4.formulating the processes to the extent necessary for dimensioning the drives and associated facilities. Level:6,7 5.Identify important concepts in the field of waste management, such as waste hierarchy, waste prevention, recycling and recovery, mixed communal waste, hazardous waste. Level:6 6.Identify key sources, generated quantities, composition and properties of mixed communal and hazardous waste. Level:6				
Methods of carrying out lectures	Ex cathedra teaching Case studies Discussion				
Methods of carrying out laboratory exercises	Group problem solving Discussion, brainstorming Computer simulations				
Course content lectures	1.Introduction and acquaintance with subject content, students' obligations, 2h, Learning outcomes:5 2.Sources, flows, quantities produced and physico-chemical properties of mixed communal and hazardous waste, 2h, Learning outcomes:6 3.Types of waste and waste classification, 2h, Learning outcomes:5 4.Waste management system hierarchy, 2h, Learning outcomes:5 5.Waste treatment and handling, biological and thermal processing methods, waste disposal, 2h, Learning outcomes:3 6.disposal of hazardous waste, 2h, Learning outcomes:5 7.Waste Disposal, Types of Landfill, 2h, Learning outcomes:5 8.Hazardous waste, 2h, Learning outcomes:6 9.Knowledge test, 2h, Learning outcomes:3,5,6 10.Initial basis for the technological dimensioning of waste processing facilities (loading stations, sorting plants, recycling facilities, mechanical-biological processing plants, waste disposal sites,, 2h, Learning outcomes:2,3,4 11.Starting Basics for Construction Design and Dimensioning of Waste Processing Facilities (Transfer Stations, Distillery, Recycling Facilities, Mechanical-Biological Processing Facilities, Waste Landfills, 2h, Learning outcomes:2,3,4 12.Starting Basics for Mechanical Design and Dimensioning of Waste Processing Facilities (Transfer Stations, Distilleries, Recycling Facilities, Mechanical-Biological Processing Facilities, Waste Disposal Facilities, 2h, Learning outcomes:2,3,4 13.Relevant Environmental and Waste Management Regulations in the Republic of Croatia and the EU, Legal and Economic Control of Waste Management, 2h, Learning outcomes:1 14.Economics of Waste Management, 2h, Learning outcomes:1 15.Knowledge test, 1h, Learning outcomes:1,2,3,4 Professional visit to the waste treatment plant, 1h, Learning outcomes:2,4,5,6				
Course content laboratory	1.Solving tasks related to the sizing of waste treatment facilities: Waste streams, 2h, Learning outcomes:2,4 2.Solving tasks related to the sizing of waste processing facilities: collection, 2h, Learning outcomes:2,4 3.Resolving tasks related to the sizing of waste processing facilities: transport, 2h, Learning outcomes:2,4 4.Resolving tasks related to the sizing of waste processing facilities: recycling, 2h, Learning outcomes:2,4 5.Resolving tasks related to the sizing of waste processing facilities: processing, 2h, Learning outcomes:2,4 6.Resolving tasks related to the sizing of waste processing facilities: recovery, 2h, Learning outcomes:2,4 7.Resolving tasks related to the sizing of waste processing facilities: disposal, 2h, Learning outcomes:2,4 8.Professional visit to the waste treatment plant, 2h, Learning outcomes:2,4,5,6 9.Professional visit to the waste treatment plant, 2h, Learning outcomes:2,4,5,6 10.Professional visit to the waste treatment plant, 2h, Learning outcomes:2,4,5,6 11.Professional visit to the waste treatment plant, 2h, Learning outcomes:2,4,5,6 12.Professional visit to the waste treatment plant, 2h, Learning outcomes:2,4,5,6 13.Professional visit to the waste treatment plant, 2h, Learning outcomes:2,4,5,6 14.Professional visit to the waste treatment plant, 2h, Learning outcomes:2,4,5,6 15.Professional visit to the waste treatment plant, 2h, Learning outcomes:2,4,5,6				
Required materials	Basic: classroom, blackboard, chalk... General purpose computer laboratory Whiteboard with markers Overhead projector 3D printer 3D scaner				
Exam literature	1. Hinrichs, R.A.; Kleinbach, M.: Energy - Its Use and the Environment, Harcourt College Publishers, 2002.				
Students obligations	Regularity of attendance -20%				
Knowledge evaluation during semester	Seminar paper and presentation, 2 colloquia with computational tasks				

Knowledge evaluation after semester	Written exam	
Student activities:	Aktivnost	ECTS
	(Classes attendance)	2
	(Practical work)	1
	(Constantly tested knowledge)	1
	(Written exam)	2
Remark	This course can be used for final thesis theme	
Prerequisites:	No prerequisites.	
Proposal made by	Mario Panjičko , 11.6.2019	

Code WEB/ISVU	23769/170045	**ECTS**	6.0	**Academic year**	2018/2019
Name	Technology Entrepreneurship				
Status	6th semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (15+0+15+0) 120
Teachers	Lectures:mr.sc. Sergej Lugović MBA Auditory exercises: Dinko Horvat struč.spec.ing.techn.inf. Seminar exercises: Dinko Horvat struč.spec.ing.techn.inf.				
Course objectives	To introduce students how to recognise business opportunity in technology development, information and communication science and society as whole. It is also necessary to develop disciplines which will enable continuous screening of technology development, so opportunity could be recognised. Along the screening and recognition, its important to transfer opportunity to product or service and sell it to customer creating the new value, through new or increased income and employment.				
Learning outcomes:	1.Business Opprtunity. Level:6 2.Business Organization. Level:6 3.Company resources. Level:6,7 4.Business Idea. Level:6,7 5.Opportunity. Level:6,7				
Methods of carrying out lectures	Ex cathedra teaching Case studies Demonstration Discussion Homework presentation				
Methods of carrying out auditory exercises	Laboratory exercises on laboratory equipment Group problem solving Interactive problem solving				
Methods of carrying out seminars	Group problem solving Essay writing				
Course content lectures	1.Introduction, 2h, Learning outcomes:1 2.The role of entrepreneurship in economy, 2h, Learning outcomes:1 3.Business opportunities, 2h, Learning outcomes:1 4.Vision and Business Model, 2h, Learning outcomes:1 5.Risk and Return, 2h, Learning outcomes:1 6.Marketing and Sales, 2h, Learning outcomes:1 7.Knowledge assessment, 2h, Learning outcomes:1 8.Intellectual Property, 2h, Learning outcomes:1 9.The new enterprise organization, 2h, Learning outcomes:1 10.Management of operations, 2h, Learning outcomes:1 11.Profit and Harvest, 2h, Learning outcomes:1 12.The Finacial Plan, 2h, Learning outcomes:1 13.Knowledge assessment, 2h, Learning outcomes:1 14.Business Model Canvas, 2h, Learning outcomes:1 15.Students work evaluation, 2h, Learning outcomes:1				
Course content auditory	1.Lab, 1h, Learning outcomes:1 2.Lab, 1h, Learning outcomes:1 3.Lab, 1h, Learning outcomes:1 4.Lab, 1h, Learning outcomes:1 5.Lab, 1h, Learning outcomes:1 6.Lab, 1h, Learning outcomes:1 7.Lab, 1h, Learning outcomes:1 8.Lab, 1h, Learning outcomes:1 9.Lab, 1h, Learning outcomes:1 10.Lab, 1h, Learning outcomes:1 11.Lab, 1h, Learning outcomes:1 12.Lab, 1h, Learning outcomes:1 13.Lab, 1h, Learning outcomes:1 14.Lab, 1h, Learning outcomes:1 15.Lab, 1h, Learning outcomes:1				
Course content seminars	1.Lab, 1h, Learning outcomes:1 2.Lab, 1h, Learning outcomes:1 3.Lab, 1h, Learning outcomes:1 4.Lab, 1h, Learning outcomes:1 5.Lab, 1h, Learning outcomes:1 6.Lab, 1h, Learning outcomes:1 7.Lab, 1h, Learning outcomes:1 8.Lab, 1h, Learning outcomes:1 9.Lab, 1h, Learning outcomes:1 10.Lab, 1h, Learning outcomes:1 11.Lab, 1h, Learning outcomes:1 12.Lab, 1h, Learning outcomes:1 13.Lab, 1h, Learning outcomes:1				

	14.Lab, 1h, Learning outcomes:1 15.Lab, 1h, Learning outcomes:1	
Required materials	Basic: classroom, blackboard, chalk... Whiteboard with markers Overhead projector	
Exam literature	Technology Ventures: From Idea to Enterprise Thomas Byers, Richard Dorf, Andrew Nelson U prijevodu	
Students obligations	Seminarski rad, dolazak na predavanja	
Knowledge evaluation during semester	Mini-test#1#20#0$Kolokvij, numeri zadaci#1#20#0$Seminarski rad#1#20#100$Prakti rad#1#20#0$Usmena provjera znanja#1#20#100$	
Knowledge evaluation after semester	Pismeni ispit#1#25#100$Usmeni ispit#1#25#100$Seminarski rad#1#25#100$Prakti rad#1#25#100$	
Student activities:	Aktivnost (Classes attendance) (Constantly tested knowledge) (Written exam)	ECTS 2 2 2
Remark	This course can be used for final thesis theme	
Prerequisites:	No prerequisites.	
Proposal made by	mr.sc. Sergej Lugović MBA, 10.6.2014	

Code WEB/ISVU	23766/170042	**ECTS**	4.0	**Academic year**	2018/2019
Name	Transportation Systems				
Status	5th semester - Undergraduate professional study in mechatronics (Izvanredni mehatronike) - elective course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (15+15+0+0) 60
Teachers	Lectures:1. Vesna Alić-Kostešić dipl.ing.stroj. Lectures:2. dr. sc. Emil Barić mag. ing. mech. Auditory exercises:dr. sc. Emil Barić mag. ing. mech. Laboratory exercises:dr. sc. Emil Barić mag. ing. mech.				
Course objectives	To introduce students to the elements and structures of transportation means and types of mechatronics components and devices, their selection and application areas, the application rules and technical regulations				
Learning outcomes:	1.Assess the importance and types of transport in the production process. Level:6,7 2.choose an option depending on the type of transported material. Level:7 3.calculate the elements of transport equipment as a function of operational continuity of the production process. Level:6 4.combine the available devices within the production process. Level:6,7 5.calculate the force, torque and power of engines. Level:6 6.calculate the kinematics of the drive (circular, linear and nonlinear motion). Level:6 7.choose sensors according to shape and size of the workpiece. Level:7 8.choose switches according to shape and size of the workpiece. Level:7 9.select the necessary transport means from manufacturers catalogue. Level:7				
Methods of carrying out lectures	Ex cathedra teaching Case studies Demonstration Simulations Discussion Seminar, students presentation and discussion				
Methods of carrying out auditory exercises	Group problem solving Traditional literature analysis Data mining and knowledge discovery on the Web Discussion, brainstorming Computer simulations Interactive problem solving Workshop				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment				
Course content lectures	1.Introduction: Division, meaning and role of internal transport. Features and types of vehicles. Means of periodic and continuous delivery, 2h, Learning outcomes:1 2.Selection criteria for transportation devices. Types of transported material., 2h, Learning outcomes:2 3.The choice of speed of transport means., 2h, Learning outcomes:3 4.Conveyor belts and drums., 2h, Learning outcomes:4 5.Pulleys as drive mechanisms., 2h, Learning outcomes:4 6.Vibrating conveyors, 2h, Learning outcomes:4 7.Electromagnets, 2h, Learning outcomes:4 8.1. test, 2h, Learning outcomes:1,2,3,4 9.Transport chains, 2h, Learning outcomes:5,6 10.Drive and free wheels , 2h, Learning outcomes:5,6 11.Screws, 2h, Learning outcomes:5,6 12.Load sensors., 2h, Learning outcomes:7 13.Displacement sensors., 2h, Learning outcomes:7 14.Rotary switch., 2h, Learning outcomes:8 15.2. test, 2h, Learning outcomes:5,6,7,8				
Course content auditory	1.NA 2.NA 3.NA 4.Analysis of literature and manufacturers catalogues, 3h, Learning outcomes:7,8,9 5.NA 6.Preparation and presentation of seminars on types of transport equipment, 3h, Learning outcomes:7,8,9 7.NA 8.The choice of means of transport and calculation under given conditions (power, torque and force), 3h, Learning outcomes:3,5,6 9.NA 10.NA 11.NA 12.NA 13.The choice of means of transport and calculation under given conditions (motion, rotation and linear speed), 3h, Learning outcomes:6 14.NA 15.Writen test, 3h, Learning outcomes:3,5,6,7,8				
Course content laboratory	1.NA 2.Overview of illustrated examples of different designs of transport means, 4h, Learning outcomes:9				

	3.NA 4.Examples of selection of engine drives and power transmission and steering mechanisms of transport equipment, 4h, Learning outcomes:5 5.NA 6.Examples of the measurement results on mechanical sets (gearbox, spindle) with discussion on the application and characteristics, 4h, Learning outcomes:6 7.NA 8.Examples of the measurement results on transport equipment (cranes...) with discussion on the application and characteristics, 3h, Learning outcomes:6 9.NA 10.NA 11.NA 12.NA 13.NA 14.NA 15.NA
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory Special purpose computer laboratory Overhead projector
Exam literature	Oluić, Č.: Transport u industriji, Sveučilišna naklada, Zagreb, 1991. D.Ščap, Prenosila i dizala, podloge za konstrukciju i proračun, Liber, Zagreb, 1990. D.Ščap, Prenosila i dizala, udžbenik u radu (raspoloživo za studente). D. Ščap, Zbirka zadataka iz prenosila i dizala (u radu - raspoloživo za studente).
Students obligations	regular class attendance, programme assignements and seminars
Knowledge evaluation during semester	2 tests
Knowledge evaluation after semester	writen and oral exam
Student activities:	Aktivnost — ECTS (Constantly tested knowledge) — 2 (Written exam) — 2
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
Proposal made by	Čedomir Jurčec