Semester 1		
Undergraduate professional study in electrical engineering obligatory courses		
P:prof.vis.šk. Ivica Levanat P: Alemka Knapp A: Alemka Knapp A: Diana Šaponja-Milutinović dipl.ing.fizike, pred. A: Borna Radatović A: Valentino Jadriško	Physics	ECTS:6.0
A: Boris Metikoš ,prof.	Kinesiology Education I	ECTS:1.0
P:mr.sc. Bojan Kovačić , viši predavač P: Luka Marohnić P:dr. sc. Anđa Valent viši predavač P: Ivica Vuković A: Ivica Vuković A: Luka Marohnić A:dr. sc. Anđa Valent viši predavač A:mr.sc. Bojan Kovačić , viši predavač	Mathematics I	ECTS:7.0
P: Vladimir Šimović P: Davor Šterc P:mr.sc. Veselko Tomljenović viši predavač A: Davor Šterc A:mr.sc. Veselko Tomljenović viši predavač L: Trpimir Alajbeg L:mr.sc. Darko Lukša dipl.ing L:mr.sc. Krunoslav Martinčić L: Tomislav Đuran , dipl. ing. L:pred. Ivan Lujo , dipl.ing. A:mr.sc. Zoran Kovačević predavač L:mr.sc. Zoran Kovačević predavač A: Mato Brizar L: Mato Brizar L: Siniša Lacković struč.spec.ing.el. A: Vladimir Šimović L: Vladimir Šimović L: Aleksandar Kiričenko A: Robert Herčeki A: Želimir Ivanović L: Želimir Ivanović L: Petar Tomljanović	Fundamentals of Electrical Engineering	ECTS:9.0
P:dr. sc. Mladen Sokele predavač P: Trpimir Alajbeg L: Trpimir Alajbeg L: Andrea Jurman L: Iva Lemac L: Robert Herčeki	Personal computers in electrical engineering	ECTS:4.0
Undergraduate professional study in electrical engineering elective courses		
P: Marija Krstinić P: Zoran Vulelija A: Marija Krstinić A: Zoran Vulelija	English Language	ECTS:2.0
P: Doc. dr. sc. Lidija Tepeš Golubić v. pred. A: Doc. dr. sc. Lidija Tepeš Golubić v. pred.	German Language	ECTS:2.0

Semester 2		
Undergraduate professional study in electrical engineering obligatory courses		
P: Vladimir Šimović P: Davor Šterc P:mr.sc. Veselko Tomljenović viši predavač A: Davor Šterc A:mr.sc. Veselko Tomljenović viši predavač L:mr.sc. Krunoslav Martinčić L: Tomislav Đuran , dipl. ing. L:mr.sc. Zoran Kovačević predavač A: Vladimir Šimović L: Vladimir Šimović L: Aleksandar Kiričenko L: Robert Herčeki A: Želimir Ivanović L: Želimir Ivanović L: Petar Tomljanović A: Vatroslav Zuppa Bakša L: Frane Brkić	Electricity and magnetism	ECTS:8.0
P: Aleksandar Kiričenko P:mr.sc. Krunoslav Martinčić P: Željko Stojanović A: Željko Stojanović L: Željko Stojanović L:mr.sc. Darko Lukša dipl.ing A:mr.sc. Krunoslav Martinčić L:mr.sc. Krunoslav Martinčić A: Aleksandar Kiričenko L: Aleksandar Kiričenko A: Robert Herčeki	Electronic Components	ECTS:6.0
A: Boris Metikoš ,prof.	Kinesiology Education II	ECTS:1.0
A:Prof.dr.sc. Slavica Ćosović Bajić A:dr.sc. Mandi Orlić Bachler v.pred A: Goran Sirovatka A: Luka Marohnić A:mr.sc. Bojan Kovačić , viši predavač A: Ivica Vuković A:dr. sc. Anđa Valent viši predavač	Mathematical Tools in Electrical Engineering	ECTS:2.0
P: Luka Marohnić P:mr.sc. Bojan Kovačić , viši predavač P: Ivica Vuković P:dr. sc. Anđa Valent viši predavač A: Ivica Vuković A: Luka Marohnić A:dr. sc. Anđa Valent viši predavač A:mr.sc. Bojan Kovačić , viši predavač	Mathematics II	ECTS:8.0
P:pred. Ivan Lujo , dipl.ing. P: Aleksandar Kiričenko A:pred. Ivan Lujo , dipl.ing. L:pred. Ivan Lujo , dipl.ing. A: Aleksandar Kiričenko L: Aleksandar Kiričenko L: Robert Herčeki L: Želimir Ivanović L: Frane Brkić	Electrical Measurements	ECTS:6.0

Semester 3		
Electrical power engineering obligatory courses		
P:mr.sc. Veselko Tomljenović viši predavač A:mr.sc. Veselko Tomljenović viši predavač A: Tomislav Đuran , dipl. ing.	Electrical Machines I	ECTS:5.0
P:mr.sc. Krunoslav Martinčić P: Željko Stojanović L: Željko Stojanović A: Aleksandar Kiričenko L: Aleksandar Kiričenko	Electronic Circuits	ECTS:5.0
A: Boris Metikoš ,prof.	Kinesiology Education III	ECTS:1.0
P:mr.sc. Darko Lukša dipl.ing A:mr.sc. Darko Lukša dipl.ing L:mr.sc. Darko Lukša dipl.ing L: Želimir Ivanović	Electrical Measurements	ECTS:6.0
P:Prof.dr.sc. Krešimir Meštrović A:Prof.dr.sc. Krešimir Meštrović	Switching Equipment	ECTS:4.0
P: Vesna Alić-Kostešić dipl.ing.stroj. P: Karmen Mott Bingula dipl.ing.stroj. A: Karmen Mott Bingula dipl.ing.stroj.	Engineering Mechanics	ECTS:4.0
P: Ivor Marković , mag. ing. L: Tomislav Đuran , dipl. ing. A: Ivor Marković , mag. ing. L: Ivor Marković , mag. ing. L: Marko Babić	Transformers	ECTS:5.0
P: Luka Marohnić P:mr.sc. Bojan Kovačić , viši predavač P:dr. sc. Anđa Valent viši predavač A: Luka Marohnić A:dr. sc. Anđa Valent viši predavač A:mr.sc. Bojan Kovačić , viši predavač	Probability and Statisics	ECTS:3.0
Electrical power engineering elective courses		
P: Marija Krstinić P: Zoran Vulelija A: Marija Krstinić	English Language 2	ECTS:2.0
P: Doc. dr. sc. Lidija Tepeš Golubić v. pred.	German Language 2	ECTS:2.0
Control and computer engineering in automation obligatory courses		
P:mr.sc. Krunoslav Martinčić P: Željko Stojanović A: Željko Stojanović L: Željko Stojanović A: Aleksandar Kiričenko L: Aleksandar Kiričenko L: Robert Herčeki	Analog Circuits	ECTS:6.0
P: Goran Vujisić P: Tomislav Špoljarić d. i. e., v. pred. L: Tomislav Špoljarić d. i. e., v. pred. L: Goran Vujisić	Automation Elements	ECTS:5.0
A: Boris Metikoš ,prof.	Kinesiology Education III	ECTS:1.0
P:mr.sc. Darko Lukša dipl.ing	Electrical Measurements	ECTS:6.0

A:mr.sc. Darko Lukša dipl.ing L:mr.sc. Darko Lukša dipl.ing L: Želimir Ivanović		
P:Pred. Ida Popčević prof. P: Doc. dr. sc. Lidija Tepeš Golubić v. pred.	Social Philosophy	ECTS:2.0
P: Vesna Alić-Kostešić dipl.ing.stroj. P: Karmen Mott Bingula dipl.ing.stroj. A: Karmen Mott Bingula dipl.ing.stroj.	Engineering Mechanics	ECTS:4.0
P: Luka Marohnić P:mr.sc. Bojan Kovačić , viši predavač P:dr. sc. Anđa Valent viši predavač A: Luka Marohnić A:dr. sc. Anđa Valent viši predavač A:mr.sc. Bojan Kovačić , viši predavač	Probability and Statisics	ECTS:3.0
Control and computer engineering in automation elective courses		
P: Marija Krstinić P: Zoran Vulelija A: Marija Krstinić	English Language 2	ECTS:2.0
P: Doc. dr. sc. Lidija Tepeš Golubić v. pred.	German Language 2	ECTS:2.0
Communication and computer technology obligatory courses		
P:mr.sc. Krunoslav Martinčić P: Željko Stojanović A: Željko Stojanović L: Željko Stojanović A: Aleksandar Kiričenko L: Aleksandar Kiričenko L: Robert Herčeki	Analog Circuits	ECTS:6.0
A: Boris Metikoš ,prof.	Kinesiology Education III	ECTS:1.0
P:mr.sc. Darko Lukša dipl.ing A:mr.sc. Darko Lukša dipl.ing L:mr.sc. Darko Lukša dipl.ing L: Želimir Ivanović	Electrical Measurements	ECTS:6.0
P:dr. sc. Mladen Sokele predavač L: Vjeran Šimunić A:dr. sc. Mladen Sokele predavač L:dr. sc. Mladen Sokele predavač	Signals, theory and processing	ECTS:6.0
P:mr.sc. Dubravko Žigman viši predavač L: Vedran Tadić struč.spec.ing.techn.inf. L: Tomislav Novak mag. ing. inf. et comm. techn. L: Nikolina Kasunić struč.spec.ing.techn.inf.	Introduction to networking technologies	ECTS:5.0
P: Luka Marohnić P:mr.sc. Bojan Kovačić , viši predavač P:dr. sc. Anđa Valent viši predavač A: Luka Marohnić A:dr. sc. Anđa Valent viši predavač A:mr.sc. Bojan Kovačić , viši predavač	Probability and Statisics	ECTS:3.0
Communication and computer technology elective courses		
P:pred. Ivan Lujo , dipl.ing. P: Tomislav Novak mag. ing. inf. et comm. techn. A:pred. Ivan Lujo , dipl.ing.	LabView graphic programming	ECTS:4.0

L:pred. Ivan Lujo , dipl.ing. A: Tomislav Novak mag. ing. inf. et comm. techn. L: Tomislav Novak mag. ing. inf. et comm. techn.		
P: Željko Stojanović A: Željko Stojanović	Linear and Nonlinear Networks	ECTS:4.0
Communication and computer technology elective courses		
P: Marija Krstinić P: Zoran Vulelija A: Marija Krstinić	English Language 2	ECTS:2.0
P: Doc. dr. sc. Lidija Tepeš Golubić v. pred.	German Language 2	ECTS:2.0

Semester 4		
Electrical power engineering obligatory courses		
P: Tomislav Špoljarić d. i. e., v. pred. P: Goran Vujisić P:v.pred. Mato Fruk dipl.ing. A:v.pred. Mato Fruk dipl.ing. L:v.pred. Mato Fruk dipl.ing. A: Tomislav Špoljarić d. i. e., v. pred. L: Tomislav Špoljarić d. i. e., v. pred. A: Goran Vujisić L: Goran Vujisić A: Ivan Šulekić dipl.ing.el. L: Ivan Šulekić dipl.ing.el.	Automatic Control	ECTS:6.0
P:mr.sc. Veselko Tomljenović viši predavač A: Tomislav Đuran , dipl. ing. L: Tomislav Đuran , dipl. ing. L: Alan Miletić L: Ivor Marković , mag. ing.	Electrical Machines II	ECTS:6.0
P:Prof.dr.sc. Krešimir Meštrović A: Ivor Marković , mag. ing. K: Ivor Marković , mag. ing.	Electrical Power Plants	ECTS:7.0
P: Željko Stojanović A: Željko Stojanović A: Neven Čobanov	Power Electronics	ECTS:5.0
A: Boris Metikoš ,prof.	Kinesiology Education IV	ECTS:1.0
Electrical power engineering elective courses		
P:v.pred. Mato Fruk dipl.ing. A:mr.sc. Goran Malčić v.pred. L:mr.sc. Goran Malčić v.pred. L: Mario Lučan	Process Measurements	ECTS:5.0
P: Tomislav Novak mag. ing. inf. et comm. techn. P:Prof.dr.sc. Slavica Ćosović Bajić L: Nikola Majstorović dipl.ing. L: Tomislav Novak mag. ing. inf. et comm. techn. L: Vatroslav Zuppa Bakša	Programming	ECTS:5.0
Electrical power engineering elective courses		
P: Zoran Vulelija P: Marija Krstinić A: Marija Krstinić A: Zoran Vulelija	English Language 3	ECTS:2.0
P: Doc. dr. sc. Lidija Tepeš Golubić v. pred.	German Language 3	ECTS:2.0
Control and computer engineering in automation obligatory courses		
P: Tomislav Špoljarić d. i. e., v. pred. P: Goran Vujisić P:v.pred. Mato Fruk dipl.ing. A:v.pred. Mato Fruk dipl.ing. L:v.pred. Mato Fruk dipl.ing. A: Tomislav Špoljarić d. i. e., v. pred. L: Tomislav Špoljarić d. i. e., v. pred. A: Goran Vujisić L: Goran Vujisić A: Ivan Šulekić dipl.ing.el. L: Ivan Šulekić dipl.ing.el.	Automatic Control	ECTS:6.0

P:dr. sc. Mladen Sokele predavač L: Siniša Lacković struč.spec.ing.el. A:dr. sc. Mladen Sokele predavač L:dr. sc. Mladen Sokele predavač	Digital Circuits	ECTS:5.0
A: Boris Metikoš ,prof.	Kinesiology Education IV	ECTS:1.0
P:v.pred. Mato Fruk dipl.ing. A:mr.sc. Goran Malčić v.pred. L:mr.sc. Goran Malčić v.pred. L: Mario Lučan	Process Measurements	ECTS:5.0
P: Tomislav Novak mag. ing. inf. et comm. techn. P:Prof.dr.sc. Slavica Ćosović Bajić L: Nikola Majstorović dipl.ing. L: Tomislav Novak mag. ing. inf. et comm. techn. L: Vatroslav Zuppa Bakša	Programming	ECTS:5.0
P:dr.sc. Davor Petranović dipl.ing.el. P:dr.sc. Ljubivoj Cvitaš dipl.ing.	Quality Management	ECTS:4.0
Control and computer engineering in automation elective courses		
P: Željko Stojanović A: Željko Stojanović A: Neven Čobanov	Power Electronics	ECTS:5.0
P:mr.sc. Veselko Tomljenović viši predavač A: Tomislav Đuran , dipl. ing. L: Tomislav Đuran , dipl. ing.	Transformers and Electrical Rotating Machines	ECTS:5.0
Control and computer engineering in automation elective courses		
P: Zoran Vulelija P: Marija Krstinić A: Marija Krstinić A: Zoran Vulelija	English Language 3	ECTS:2.0
P: Doc. dr. sc. Lidija Tepeš Golubić v. pred.	German Language 3	ECTS:2.0
Communication and computer technology obligatory courses		
P:dr. sc. Mladen Sokele predavač L: Siniša Lacković struč.spec.ing.el. A:dr. sc. Mladen Sokele predavač L:dr. sc. Mladen Sokele predavač	Digital Circuits	ECTS:5.0
P:dr. sc. Mladen Sokele predavač L:dr.sc. Krešimir Osman , dipl.ing. A:dr. sc. Mladen Sokele predavač L:dr. sc. Mladen Sokele predavač	Information, theory and coding	ECTS:5.0
A: Boris Metikoš ,prof.	Kinesiology Education IV	ECTS:1.0
P:dr. sc. Anđa Valent viši predavač P: Ivica Vuković A: Ivica Vuković A:dr. sc. Anđa Valent viši predavač	Numerical Mathematics	ECTS:5.0
P: Tomislav Novak mag. ing. inf. et comm. techn. P:Prof.dr.sc. Slavica Ćosović Bajić L: Nikola Majstorović dipl.ing. L: Tomislav Novak mag. ing. inf. et comm. techn.	Programming	ECTS:5.0

L: Vatroslav Zuppa Bakša		
P:Pred. Ida Popčević prof. P: Doc. dr. sc. Lidija Tepeš Golubić v. pred.	Social Philosophy	ECTS:2.0
P:Prof.dr.sc. Slavica Ćosović Bajić P:dr.sc Sonja Zentner Pilinsky prof.v.š. A:dr.sc Sonja Zentner Pilinsky prof.v.š. L:dr.sc Sonja Zentner Pilinsky prof.v.š. L: Siniša Lacković struč.spec.ing.el. L: Antonio Krajinović mag.ing.inf. et comm.techn	Lines and Antennas	ECTS:5.0
Communication and computer technology elective courses		
P: Zoran Vulelija P: Marija Krstinić A: Marija Krstinić A: Zoran Vulelija	English Language 3	ECTS:2.0
P: Doc. dr. sc. Lidija Tepeš Golubić v. pred.	German Language 3	ECTS:2.0

Semester 5		
Electrical power engineering obligatory courses		
P: Tomislav Špoljarić d. i. e., v. pred. A: Tomislav Špoljarić d. i. e., v. pred.	Electrical Power Networks	ECTS:5.0
P: Ivor Marković , mag. ing. L: Tomislav Đuran , dipl. ing. A: Ivor Marković , mag. ing. K: Ivor Marković , mag. ing. L: Ivor Marković , mag. ing. L: Marko Babić	Electrical Motor Drives	ECTS:6.0
P:dr.sc. Davor Petranović dipl.ing.el. L:dr.sc. Davor Petranović dipl.ing.el.	Lighting and Installations	ECTS:4.0
P: Zvonimir Meštrović mag. ing. A: Zvonimir Meštrović mag. ing. L: Zvonimir Meštrović mag. ing.	Renewable energy resources	ECTS:6.0
P:mr.sc. Goran Malčić v.pred. L:mr.sc. Goran Malčić v.pred. L: Ivica Vlašić L: Mario Lučan L: Pavao Maković	Process Control Computers	ECTS:5.0
Electrical power engineering elective courses		
P: Tomislav Špoljarić d. i. e., v. pred. P:mr.sc. Davor Gadže L:mr.sc. Davor Gadže L: Mario Ličanin L: Tomislav Špoljarić d. i. e., v. pred.	Power Plants Construction	ECTS:6.0
P:pred. Ivan Lujo , dipl.ing. P: Tomislav Novak mag. ing. inf. et comm. techn. A:pred. Ivan Lujo , dipl.ing. L:pred. Ivan Lujo , dipl.ing. A: Tomislav Novak mag. ing. inf. et comm. techn. L: Tomislav Novak mag. ing. inf. et comm. techn.	LabView graphic programming	ECTS:4.0
Control and computer engineering in automation obligatory courses		
P: Goran Vujisić P:v.pred. Mato Fruk dipl.ing. A:v.pred. Mato Fruk dipl.ing. L:v.pred. Mato Fruk dipl.ing. A: Goran Vujisić L: Goran Vujisić	Digital Control	ECTS:5.0
P:mr.sc. Davor Gadže P: Tomislav Špoljarić d. i. e., v. pred. A:mr.sc. Davor Gadže K:mr.sc. Davor Gadže L:mr.sc. Davor Gadže A: Tomislav Špoljarić d. i. e., v. pred. K: Tomislav Špoljarić d. i. e., v. pred. L: Tomislav Špoljarić d. i. e., v. pred.	Electrical Motor Drives	ECTS:6.0
P:mr.sc. Goran Malčić v.pred. L:mr.sc. Goran Malčić v.pred. L: Ivica Vlašić L: Mario Lučan L: Pavao Maković	Process Control Computers	ECTS:5.0
P:mr.sc. Davor Gadže P:mr. sc. Ivan Mišković dipl. ing. pred.	Automation Systems	ECTS:6.0

A:mr.sc. Davor Gadže L:mr.sc. Davor Gadže A:mr. sc. Ivan Mišković dipl. ing. pred. L:mr. sc. Ivan Mišković dipl. ing. pred. L: Ivan Šulekić dipl.ing.el.		
P:mag.oec Kristina Perec P:mr.sc. Sergej Lugović MBA	Technology Entrepreneurship	ECTS:2.0
Control and computer engineering in automation elective courses		
P: Marko Miletić L: Siniša Lacković struč.spec.ing.el. L: Marko Miletić	Computers and Computer Systems	ECTS:4.0
P: Tomislav Špoljarić d. i. e., v. pred. P:mr.sc. Davor Gadže L:mr.sc. Davor Gadže L: Mario Ličanin L: Tomislav Špoljarić d. i. e., v. pred.	Power Plants Construction	ECTS:6.0
P:pred. Ivan Lujo , dipl.ing. P: Tomislav Novak mag. ing. inf. et comm. techn. A:pred. Ivan Lujo , dipl.ing. L:pred. Ivan Lujo , dipl.ing. A: Tomislav Novak mag. ing. inf. et comm. techn. L: Tomislav Novak mag. ing. inf. et comm. techn.	LabView graphic programming	ECTS:4.0
Communication and computer technology obligatory courses		
P: Marko Miletić L: Siniša Lacković struč.spec.ing.el. L: Marko Miletić	Computers and Computer Systems	ECTS:4.0
P:mr.sc. Goran Malčić v.pred. L:mr.sc. Goran Malčić v.pred. L: Ivica Vlašić L: Mario Lučan L: Pavao Maković	Process Control Computers	ECTS:5.0
P:Prof.dr.sc. Slavica Ćosović Bajić P:mr.sc. Krunoslav Martinčić A:mr.sc. Krunoslav Martinčić L:mr.sc. Krunoslav Martinčić L: Siniša Lacković struč.spec.ing.el.	Radiocommunication Techniques and Systems	ECTS:4.0
P:mr.sc. Krunoslav Martinčić L:mr.sc. Krunoslav Martinčić	Radiofrequency and Microwave Electronics	ECTS:5.0
Communication and computer technology elective courses		
P:dr.sc. Predrag Valožić prof. vis. šk. L:dr.sc. Predrag Valožić prof. vis. šk.	Digital Signal Processing	ECTS:5.0
P:dr.sc Sonja Zentner Pilinsky prof.v.š. A:dr.sc Sonja Zentner Pilinsky prof.v.š. A: Siniša Lacković struč.spec.ing.el. L: Siniša Lacković struč.spec.ing.el.	Mobile Radiocommunication	ECTS:5.0
P: Tomislav Novak mag. ing. inf. et comm. techn. K: Tomislav Novak mag. ing. inf. et comm. techn. L: Tomislav Novak mag. ing. inf. et comm. techn.	Object-oriented programming	ECTS:5.0

P: Mirko Jukl A: Mirko Jukl L: Mirko Jukl L: Siniša Lacković struč.spec.ing.el.	Radar Systems	ECTS:5.0
P: Bruno Valić P:Mr.sc. Vladimir Lebinac dipl.ing. A:Mr.sc. Vladimir Lebinac dipl.ing. L:Mr.sc. Vladimir Lebinac dipl.ing. L: Bruno Valić	Telecommunication Networks	ECTS:5.0
P:v.pred. Mato Fruk dipl.ing. A:v.pred. Mato Fruk dipl.ing. L: Tomislav Špoljarić d. i. e., v. pred.	Control Devices and Systems	ECTS:5.0

Semester 6		
Electrical power engineering obligatory courses		
P: Davor Šterc A: Davor Šterc	Electrical Engineering	ECTS:6.0
P:Pred. Ida Popčević prof. P: Doc. dr. sc. Lidija Tepeš Golubić v. pred.	Social Philosophy	ECTS:2.0
P:mag.oec Kristina Perec P:mr.sc. Sergej Lugović MBA	Technology Entrepreneurship	ECTS:2.0
Electrical power engineering elective courses		
P:pred. Ivan Lujo , dipl.ing. A:pred. Ivan Lujo , dipl.ing. L: Tomislav Novak mag. ing. inf. et comm. techn.	Virtual Instrumentation	ECTS:5.0
P:dr.sc. Davor Petranović dipl.ing.el. A:dr.sc. Davor Petranović dipl.ing.el.	Protection and Measurements in Switchgear	ECTS:5.0
Electrical power engineering elective courses		
A: Tomislav Špoljarić d. i. e., v. pred.	Practical work	ECTS:6.0
Electrical power engineering elective courses		
P:mr.sc. Milivoj Puzak v. pred P: Trpimir Alajbeg P: Marija Krstinić P: Tomislav Novak mag. ing. inf. et comm. techn.	Final Thesis	ECTS:8.0
Control and computer engineering in automation obligatory courses		
P:mr.sc. Davor Gadže P: Tomislav Špoljarić d. i. e., v. pred. L:mr.sc. Davor Gadže L: Boris Peša L: Mario Ličanin L: Tomislav Špoljarić d. i. e., v. pred. L: Ivan Šulekić dipl.ing.el.	Automation of Plants	ECTS:6.0
P:mr.sc. Branimir Preprotić dipl. inž. stroj. A:mr.sc. Branimir Preprotić dipl. inž. stroj. A: Darko Mitrović	Maintenance	ECTS:5.0
Control and computer engineering in automation elective courses		
P: Ivica Vlašić P:mr.sc. Goran Malčić v.pred. L: Ivica Vlašić L: Mario Lučan	Programmable Logic Controllers	ECTS:5.0
P:pred. Ivan Lujo , dipl.ing. A:pred. Ivan Lujo , dipl.ing. L: Tomislav Novak mag. ing. inf. et comm. techn.	Virtual Instrumentation	ECTS:5.0
Control and computer engineering in automation elective courses		
A: Tomislav Špoljarić d. i. e., v. pred.	Practical work	ECTS:6.0
Control and computer engineering in automation elective courses		
P:mr.sc. Milivoj Puzak v. pred P: Trpimir Alajbeg P: Marija Krstinić P: Tomislav Novak mag. ing. inf. et comm. techn.	Final Thesis	ECTS:8.0

Communication and computer technology obligatory courses		
P:dr.sc Sonja Zentner Pilinsky prof.v.š. A:dr.sc Sonja Zentner Pilinsky prof.v.š. L:dr.sc Sonja Zentner Pilinsky prof.v.š. L: Siniša Lacković struč.spec.ing.el.	Optical communications	ECTS:5.0
P:mag.oec Kristina Perec P:mr.sc. Sergej Lugović MBA	Technology Entrepreneurship	ECTS:2.0
Communication and computer technology elective courses		
P:dr.sc. Predrag Valožić prof. vis. šk. A:dr.sc. Predrag Valožić prof. vis. šk.	Digital Signal Processors	ECTS:5.0
P:dr.sc Sonja Zentner Pilinsky prof.v.š. K:dr.sc Sonja Zentner Pilinsky prof.v.š. L:dr.sc Sonja Zentner Pilinsky prof.v.š.	4G and 5G mobile networks	ECTS:5.0
P: Ivica Vlašić P:mr.sc. Goran Malčić v.pred. L: Ivica Vlašić L: Mario Lučan	Programmable Logic Controllers	ECTS:5.0
P: Marko Miletić K: Marko Miletić L: Marko Miletić S: Marko Miletić	Embedded Systems Design and Applications	ECTS:5.0
P:pred. Ivan Lujo , dipl.ing. A:pred. Ivan Lujo , dipl.ing. L: Tomislav Novak mag. ing. inf. et comm. techn.	Virtual Instrumentation	ECTS:5.0
Communication and computer technology elective courses		
A: Tomislav Špoljarić d. i. e., v. pred.	Practical work	ECTS:6.0
Communication and computer technology elective courses		
P:mr.sc. Milivoj Puzak v. pred P: Trpimir Alajbeg P: Marija Krstinić P: Tomislav Novak mag. ing. inf. et comm. techn.	Final Thesis	ECTS:8.0

Code WEB/ISVU	23663/169758	**ECTS**	5.0	**Academic year**	2018/2019
Name	4G and 5G mobile networks				
Status	6th semester - Communication and computer technology (Redovni elektrotehnika) - elective course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (0+15+0+15) 90
Teachers	Lectures:1. dr.sc Sonja Zentner Pilinsky prof.v.š. Laboratory exercises:dr.sc Sonja Zentner Pilinsky prof.v.š. Construction exercises:dr.sc Sonja Zentner Pilinsky prof.v.š.				
Course objectives	Student will acquire knowledges of basic architecture and functionalities of 4G networks.Student will get acquainted with basic concepts of 5G networks. Student will acquire skills for 4G coverage measurements and analysis of measured data.				
Learning outcomes:	1.Ability to analize 4G network funcionalities for a particular 4G network. Level:6 2.Ability to compare advantages and disadvantages of implementation of various technologies in 4G network. Level:6,7 3.Ability to compare advantages and disadvantages of implementation of various technologies in 5G network. Level:6,7 4.Ability to test and analyze 4G coverage parameters. Level:6 5.Ability to test and analyze end-user satisfaction with 4G network performance. Level:6				
Methods of carrying out lectures	Ex cathedra teaching Case studies Discussion Questions and answers				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment				
How construction exercises are held	Group problem solving Data mining and knowledge discovery on the Web Other individual problem solving				
Course content lectures	1.4G Air Interface technologies in R9-R13, 2h, Learning outcomes:1,2 2.New physical, logical and transport channels in Air Interface, 2h, Learning outcomes:1,2 3.MBMS (Multimedia Broadcast Multicast Sevices) and eMBMSservices for LTE, 2h, Learning outcomes:1,2 4.LTE positioning, 2h, Learning outcomes:1,2 5.SON - Self Organizing Network, 2h, Learning outcomes:1,2 6.Enhancements in MIMO, 2h, Learning outcomes:1,2 7.Small Cells and Femtocells technologies, HetNet concept, 2h, Learning outcomes:1,2 8.CoMP, ICIC and eICIC concept for interference cancelation, 2h, Learning outcomes:1,2 9.D2D and M2M communication, 2h, Learning outcomes:1,2,3 10.IMS basics, VoLTE basics , 2h, Learning outcomes:1,2 11.5G system developmet - technologies for higer bitrates, technologies for smaller latencies, technologies for critical communications, 2h, Learning outcomes:3 12.5G system developmet - technologies for higer bitrates, technologies for smaller latencies, technologies for critical communications, 2h, Learning outcomes:3 13.enhanced LTE RAT and new RAT for higher frequencies, 2h, Learning outcomes:3 14.different antenna configurations and mMIMO, 2h, Learning outcomes:3 15.NOMA, interference and interference cancelation techniques, 2h, Learning outcomes:3				
Course content laboratory	1.Script making as preparation for Nemo Handy A measurements, 1h, Learning outcomes:4,5 2.4G measurements of end-user satisfaction of 4G network performace, 1h, Learning outcomes:4,5 3.4G coverage measurements, 1h, Learning outcomes:4,5 4.Analysis of performed measurements in Nemo Outdoor, 1h, Learning outcomes:4,5 5.Analysis of performed measurements in Nemo Outdoor, 1h, Learning outcomes:4,5 6.Analysis of performed measurements in Nemo Outdoor, 1h, Learning outcomes:4,5 7.Analysis of performed measurements in Excel, 1h, Learning outcomes:4,5 8.Analysis of performed measurements in Excel, 1h, Learning outcomes:4,5 9.Analysis of performed measurements in Excel, 1h, Learning outcomes:4,5 10.Individual measurement task, 1h, Learning outcomes:4,5 11.Individual task measurements analysis in Nemo Outdoor and Excel, 1h, Learning outcomes:4,5 12.Individual task measurements analysis in Nemo Outdoor and Excel, 1h, Learning outcomes:4,5 13.Individual task measurements analysis in Nemo Outdoor and Excel, 1h, Learning outcomes:4,5 14.Individual task measurements analysis in Nemo Outdoor and Excel, 1h, Learning outcomes:4,5 15.Individual task measurements analysis in Nemo Outdoor and Excel, 1h, Learning outcomes:4,5				
Course content constructures	1.Analysis of offered themes and themes asignment, 1h, Learning outcomes:1,2,3,4 2.Individual work on asigned theme in laboratory, 1h, Learning outcomes:1,2,3,4,5 3.Individual work on asigned theme in laboratory, 1h, Learning outcomes:1,2,3,4,5 4.Individual work on asigned theme in laboratory, 1h, Learning outcomes:1,2,3,4,5 5.Individual work on asigned theme in laboratory, 1h, Learning outcomes:1,2,3,4,5 6.Individual work on asigned theme in laboratory, 1h, Learning outcomes:1,2,3,4,5 7.Individual work on asigned theme in laboratory, 1h, Learning outcomes:1,2,3,4,5 8.Individual work on asigned theme in laboratory, 1h, Learning outcomes:1,2,3,4,5 9.Individual work on asigned theme in laboratory, 1h, Learning outcomes:1,2,3,4,5 10.Students present their seminars, 1h, Learning outcomes:1,2,3,4,5 11.Students present their seminars, 1h, Learning outcomes:1,2,3,4,5 12.Students present their seminars, 1h, Learning outcomes:1,2,3,4,5 13.Students present their seminars, 1h, Learning outcomes:1,2,3,4,5 14.Students present their seminars, 1h, Learning outcomes:1,2,3,4,5				

	15.Analysis of presented seminars, 1h, Learning outcomes:1,2,3,4,5
Required materials	Whiteboard with markers Overhead projector Tools for laboratory exercises computers with instaled Nemo Outdoor
Exam literature	prezentacije s predavanja - RhodeSchwartz: UMTS Long Term Evolution (LTE) Technology Introduction (Application Note) -RhodeSchwartz: LTE Release 9 Technology Introduction (White Paper) -RhodeSchwartz: LTE Advanced Technology Introduction (White Paper) -RhodeSchwartz: LTE Advanced (3GPP Rel.11) Technology Introduction (White Paper) -RhodeSchwartz: LTE Advanced (3GPP Rel.12) Technology Introduction (White Paper) -https://5g-ppp.eu/ -http://www.5gamericas.org/en/ -http://www.3gpp.org/
Students obligations	5 times during lectures short unexpected test - min. 50% correctly solved out of 20 points Seminar fabrication and presentation - min. 50% out of 80 points To be present to all lab exercises and write final report - min. 50% out of 80 points
Knowledge evaluation during semester	3 semiexams during the semester - each max. 40 points - min. 50% achieved at each semiexam
Knowledge evaluation after semester	Final exam - min. 50% out of 120 points
Remark	This course can be used for final thesis theme
Prerequisites:	Students cannot enroll in this course unless they have completed Mobilne radiokomunikacije

Code WEB/ISVU	22868/22300	**ECTS**	6.0	**Academic year**	2018/2019
Name	Analog Circuits				
Status	3rd semester - Control and computer engineering in automation (Redovni elektrotehnika) - obligatory course3rd semester - Communication and computer technology (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (15+15+0+0) 120
Teachers	Lectures:1. mr.sc. Krunoslav Martinčić Lectures:2. Željko Stojanović Auditory exercises: Aleksandar Kiričenko Auditory exercises: Željko Stojanović Laboratory exercises: Robert Herčeki Laboratory exercises: Aleksandar Kiričenko Laboratory exercises: Željko Stojanović				
Course objectives	students will acquire basic knowledge of analog circuits, their applications and properties				
Learning outcomes:	1.Ability to analyze simple voltage regulators. Level:6 2.Ability to analyze simple bipolar and unipolar transistor amplifiers. Level:6 3.Ability to construct simple amplifiers. Level:6,7 4.Ability to find amplitude and phase response. Level:6 5.Ability to classify types of analog circuits. Level:6,7 6.Ability to solve power consumption of each component of simpler analog circuits. Level:6 7.Ability to classify amplifier and oscillator feedback types. Level:6,7				
Methods of carrying out lectures	Ex cathedra teaching Case studies Discussion Questions and answers				
Methods of carrying out auditory exercises	Traditional literature analysis Discussion, brainstorming Mind mapping Other Problems solving				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Traditional literature analysis Discussion, brainstorming				
Course content lectures	1.Introduction, 2h, Learning outcomes:5 2.One stage amplifiers. Common emitter amplifier, 2h, Learning outcomes:2,3,5,6 3.One stage amplifiers. Common emitter amplifier, 2h, Learning outcomes:2,3,5,6 4.One stage amplifiers. Common emitter amplifier, 2h, Learning outcomes:2,3,5,6 5.One stage amplifiers. Common collector amplifier, 2h, Learning outcomes:2,3,5,6 6.Transistor series voltage regulator, 1h, Learning outcomes:1,6 Common source amplifier, 1h, Learning outcomes:2,3,5,6 7.Common source amplifier, 1h, Learning outcomes:2,3,5,6 Common drain amplifier, 1h, Learning outcomes:2,3,5,6 8.Common drain amplifier, 1h, Learning outcomes:2,3,5,6 Multistage amplifiers, 1h, Learning outcomes:2,3,5 9.Multistage amplifiers, 1h, Learning outcomes:2,3,5 Amplitude and phase frequency response, 1h, Learning outcomes:2,3,4,5,6 10.Amplitude and phase frequency response, 2h, Learning outcomes:2,3,4,5,6 11.Amplitude and phase frequency response, 1h, Learning outcomes:2,3,4,5,6 Differential amplifier, 1h, Learning outcomes:2,3,5,6 12.Differential amplifier, 1h, Learning outcomes:2,3,5,6 Power amplifiers, 1h, Learning outcomes:2,3,5,6 13.Power amplifiers, 2h, Learning outcomes:2,3,5,6 14.Feedback, 2h, Learning outcomes:2,3,5,7 15.Oscillators, 2h, Learning outcomes:5,7				
Course content auditory	1.Introduction, 1h, Learning outcomes:2,4,6 2.Introduction, 1h, Learning outcomes:2,4,6 3.One stage amplifiers. Common emitter amplifier, 1h, Learning outcomes:2,3,5,6 4.One stage amplifiers. Common emitter amplifier, 1h, Learning outcomes:2,3,5,6 5.One stage amplifiers. Common collector amplifier, 1h, Learning outcomes:2,3,5,6 6.Transistor series voltage regulator, 1h, Learning outcomes:1,6 7.Common source amplifier, 1h, Learning outcomes:2,3,5,6 8.Common drain amplifier, 1h, Learning outcomes:2,3,5,6 9.Amplitude and phase frequency response, 1h, Learning outcomes:2,3,4,5,6 10.Amplitude and phase frequency response, 1h, Learning outcomes:2,3,4,5,6 11.Amplitude and phase frequency response, 1h, Learning outcomes:2,3,4,5,6 12.Differential amplifier, 1h, Learning outcomes:2,5,6 13.Power amplifiers, 1h, Learning outcomes:2,3,5,6 14.Power amplifiers, 1h, Learning outcomes:2,3,5,6 15.Repeating and revision, 1h, Learning outcomes:2,4,5				
Course content laboratory	1.There is no lessons 2.There is no lessons 3.There is no lessons				

	4.There is no lessons 5.Common emitter amplifier, 2h, Learning outcomes:2,3,5,6 6.There is no lessons 7.Common collector amplifier, 2h, Learning outcomes:2,3,5,6 8.Common source amplifier, 2h, Learning outcomes:2,3,5,6 9.There is no lessons 10.There is no lessons 11.Amplitude and phase frequency response, 2h, Learning outcomes:2,3,4,5,6 12.There is no lessons 13.Differential amplifier, 2h, Learning outcomes:2,5,6 14.Power amplifiers, 2h, Learning outcomes:2,3,5,6 15.There is no lessons
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory Whiteboard with markers Maquette Tools Operating supplies Special equipment Transistors, operational amplifiers, various connectors
Exam literature	Basic literature: 1. P. Biljanović, Elektronički sklopovi, Školska knjiga, Zagreb, 1993 2. Ž. Butković, J.Divković-Pukšec, A.Barić, Elektronika II , FER, Zagreb, 2010 3. Ž. Stojanović, Elektronički sklopovi - laboratorijske vježbe, TVZ, Zagreb, 2017 Dodatna: 1. R. Boylestad, L. Nashelsky, Electronic devices and circuit theory, Prentice-Hall, 1987 2. Ž. Butković, G. Zelić, Elektronički sklopovi-Zbirka zadataka, FER, Zagreb, 1995
Students obligations	Students have to earn 50% of total points in laboratory. Assesment: - Attendance - 1 point - Preparation for laboratory - 1 point - Measurement report - 1 point - Exam instead laboratory exercises - 3 points. The total number of points is 18.
Knowledge evaluation during semester	Conditions for passing the exam: - At least 9 points of 18 at laboratory exercises, - At least 43 points of 82 on two partial exams, each exam at least 35%, - Complete oral exam at first terms for exams. Maximum number of points is 42 at first exam and 40 at second exam. Overal scoring: a) - Laboratory exercises - at least 14 points of 18 - Partial exams - at least 56 points of 82, and each exam at least 50% Evaluation 90-100 points - 5 80-90 points - 4 70-80 points - 3 Students do not have to take oral exam. They passed the exam completely. b) - Laboratory exercises - at least 12 points of 18 - Partial exams - at least 43 points of 82, and each exam at least 35% Evaluation 69-76 points - 3 55-69 points - 2 Students have to take oral exam at the first term of exam.
Knowledge evaluation after semester	Written exam comprises 5 tasks. Value of each task is 10 points. Evaluation less then 50% points#8594;1 50% - 60% points#8594;2 61% - 74% points#8594;3 75% - 89% points#8594;4 More then 89% points#8594;5 Students who pass the written exam have to take oral exam.
Student activities:	Aktivnost ECTS (Experimental work) 1 (Constantly tested knowledge) 5
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
ISVU equivalents:	22263;
Proposal made by	Željko Stojanović

Code WEB/ISVU	23098/93349	**ECTS**	6.0	**Academic year**	2018/2019
Name	Automatic Control				
Status	4th semester - Electrical power engineering (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				45+30 (15+15+0+0) 105
Teachers	Lectures:1. v.pred. Mato Fruk dipl.ing. Lectures: Tomislav Špoljarić d. i. e., v. pred. Lectures: Goran Vujisić Auditory exercises:v.pred. Mato Fruk dipl.ing. Auditory exercises: Tomislav Špoljarić d. i. e., v. pred. Auditory exercises: Ivan Šulekić dipl.ing.el. Auditory exercises: Goran Vujisić Laboratory exercises:v.pred. Mato Fruk dipl.ing. Laboratory exercises: Tomislav Špoljarić d. i. e., v. pred. Laboratory exercises: Ivan Šulekić dipl.ing.el. Laboratory exercises: Goran Vujisić				
Course objectives	Students will learn to describe, analyze and design continuous controllers of control systems				
Learning outcomes:	1.categorize control systems. Level:6 2.solve differential equations. Level:6 3.relate time and Laplace domain. Level:6,7 4.ability to analyze the control system. Level:6 5.ability to analyze the process. Level:6 6.anlyze control element. Level:6 7.ability to calculate the controller parameters. Level:6 8.ability to integrate selected type of controller into the system. Level:6,7 9.ability to analyze the operating of automatic closed-loop system. Level:6 10.ability to test the automatic closed-loop system. Level:6				
Involvement of learning outcomes of the course in study programme:	5.1.EE Razumjeti princip rada električnih rotacijskih strojeva, transformatora, dalekovoda i sklopnih aparata: 5h in 180h				
Methods of carrying out lectures	Ex cathedra teaching Case studies Simulations Discussion The mater is presented by mathematical models, tables and diagrams using illustrative examples in practice.				
Methods of carrying out auditory exercises	Group problem solving Computer simulations Examples are discussed and solved on the blackboard for every topic with student participation				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Laboratory exercises, computer simulations Group problem solving Exercises are done on prepared devices and systems				
Course content lectures	1.Introduction, 3h, Learning outcomes:1 2.One stage amplifiers. Common emitter amplifier, 3h, Learning outcomes:2 3.One stage amplifiers. Common emitter amplifier, 3h, Learning outcomes:3 4.One stage amplifiers. Common emitter amplifier, 3h, Learning outcomes:2,4,5 5.One stage amplifiers. Common collector amplifier, 3h, Learning outcomes:5 6.Transistor series voltage regulator, 2h, Learning outcomes:6 Common source amplifier, 1h, Learning outcomes:2,6 7.Common source amplifier, 3h, Learning outcomes:2,6 8.Common drain amplifier, 3h, Learning outcomes:6 9.Multistage amplifiers, 3h, Learning outcomes:5,6 10.Amplitude and phase frequency response, 3h, Learning outcomes:5,6 11.Amplitude and phase frequency response, 3h, Learning outcomes:9 12.Differential amplifier, 3h, Learning outcomes:3,4,7,8 13.Power amplifiers, 3h, Learning outcomes:7,8,9,10 14.Feedback, 3h, Learning outcomes:5,7,8,9,10 15.Oscillators, 3h, Learning outcomes:5,7,8,9,10				
Course content auditory	1.No class. 2.No class. 3.No class. 4.Laplace transforms of differential equations and transfer functions., 2h, Learning outcomes:2 5.Time responses of the first and second order elements., 2h, Learning outcomes:2,3,5 6.Time responses of the first and second order elements., 2h, Learning outcomes:2,3,5 7.Structural and algebra block diagrams., 2h, Learning outcomes:4 8.No class. 9.Examples of time and frequency responses of various control elements (PT1,PT2,PT2S,PI,PDT1)., 2h, Learning outcomes:6 10.Principle of SG excitation and the value of closed-loop system of SG excitation control., 2h, Learning outcomes:5 11.No class. 12.No class. 13.Examples of analysis and synthesis of circuits automatic control according to frequency characteristics., 2h, Learning outcomes:7,8,9,10 14.Examples of analysis and synthesis of circuits automatic control according to frequency characteristics., 1h,				

	Learning outcomes:7,8,9,10 15.No class.
Course content laboratory	1.No class. 2.No class. 3.No class. 4.No class. 5.No class. 6.No class. 7.Experimental determination of transient and frequency response of P, PT1 and PI element., 2h, Learning outcomes:3,5,6 8.Parametar determination of SG transfer function., 2h, Learning outcomes:5,6 9.Parametar determination of power amplifiers., 2h, Learning outcomes:5,6 10.Parameter determination of serial RLC circuit., 2h, Learning outcomes:5,6 11.Parameter determination of DC motor., 2h, Learning outcomes:5,6 12.PI controller setup in closed loop excitation systems for SG., 2h, Learning outcomes:5,6,7,8,9,10 13.PI controller setup for voltage control of SG, 3h, Learning outcomes:5,6,7,8,9,10 14.No class. 15.No class., 2h
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory Special purpose computer laboratory Overhead projector Video equipment Operating supplies Exercises are done on prepared devices and systems
Exam literature	Obavezna: 1. N. Perić, Automatsko upravljanje, Zavod za APR FER-a, Zagreb, 1998. 2. N. Pašalić, Osnovi regulacione tehnike, Zavod za elektrostrojarstvo, ETF Zagreb, 1977. 3. P.Crnošija, T.Bjažić: Osnove automatike I. Dio, Element, Zagreb, 2011. Additional literature: 1. T. Šurina, Automatska regulacija, Školska knjiga, Zagreb, 1981. 2. Lj. Kuljača, Z. Vukić, Sistemi automatskog upravljanja Školska knjiga, Zagreb, 1985. 3. D'Azzo,Houpis, Feedback Control System Analysis and Synthesis, McGraw-Hill Book,Tokyo,1966.
Students obligations	Attend 70 percent of classes and auditory exercises and 100 percent performed labaratory exercises and passed preliminary exam of labaratory exercises
Knowledge evaluation during semester	3 exams with theoretical and numerical tasks Terms: Each exam at least 30 percent solved and the total percentage of the combined three exams at least 50 percent
Knowledge evaluation after semester	Written and oral exam To pass at least 50 percent
Student activities:	Aktivnost — ECTS (Practical work) — 1 (Constantly tested knowledge) — 1 (Written exam) — 2 (Oral exam) — 2
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
Proposal made by	Senior lecturer. Mato Fruk, dipl.ing.

Code WEB/ISVU	22858/22268	**ECTS**	6.0	**Academic year**	2018/2019
Name	Automatic Control				
Status	4th semester - Control and computer engineering in automation (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				45+30 (15+15+0+0) 105
Teachers	Lectures:1. v.pred. Mato Fruk dipl.ing. Lectures: Tomislav Špoljarić d. i. e., v. pred. Lectures: Goran Vujisić Auditory exercises:v.pred. Mato Fruk dipl.ing. Auditory exercises: Tomislav Špoljarić d. i. e., v. pred. Auditory exercises: Ivan Šulekić dipl.ing.el. Auditory exercises: Goran Vujisić Laboratory exercises:v.pred. Mato Fruk dipl.ing. Laboratory exercises: Tomislav Špoljarić d. i. e., v. pred. Laboratory exercises: Ivan Šulekić dipl.ing.el. Laboratory exercises: Goran Vujisić				
Course objectives	Students will learn to describe, analyze and design continuous controllers				
Learning outcomes:	1.categorize control systems. Level:6 2.solve differential equations. Level:6 3.relate time and Laplace domain. Level:6,7 4.ability to analyze the control system. Level:6 5.ability to analyze the process. Level:6 6.anlyze control element. Level:6 7.ability to calculate the controller parameters. Level:6 8.ability to integrate the selected type of controller into the system . Level:6,7 9.ability to analyze the oerfirmances of the closed loop system. Level:6 10.ability to test the closed loop system. Level:6				
Involvement of learning outcomes of the course in study programme:	5.1.EE Razumjeti princip rada električnih rotacijskih strojeva, transformatora, dalekovoda i sklopnih aparata: 5h in 180h				
Methods of carrying out lectures	Ex cathedra teaching Case studies Simulations Discussion The mater is presented by mathematical models, tables and diagrams using illustrative examples in practice.				
Methods of carrying out auditory exercises	Group problem solving Computer simulations Examples are discussed and solved on the blackboard for every topic with student participation				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Laboratory exercises, computer simulations Group problem solving Computer simulations Exercises are done on prepared devices and systems				
Course content lectures	1.Introduction, 3h, Learning outcomes:1 2.One stage amplifiers. Common emitter amplifier, 3h, Learning outcomes:2 3.One stage amplifiers. Common emitter amplifier, 3h, Learning outcomes:3 4.One stage amplifiers. Common emitter amplifier, 3h, Learning outcomes:4,5 5.One stage amplifiers. Common collector amplifier, 1h, Learning outcomes:4,5 , 2h, Learning outcomes:5 6.Transistor series voltage regulator, 2h, Learning outcomes:5 Common source amplifier, 1h, Learning outcomes:6 7.Common source amplifier, 3h, Learning outcomes:6 8.Common drain amplifier, 3h, Learning outcomes:6 9.Multistage amplifiers, 3h, Learning outcomes:6 10.Amplitude and phase frequency response, 3h, Learning outcomes:6 11.Amplitude and phase frequency response, 3h, Learning outcomes:7,8,9 12.Differential amplifier, 3h, Learning outcomes:7,8,9 13.Power amplifiers, 2h, Learning outcomes:9,10 , 1h, Learning outcomes:7,8,9,10 14.Feedback, 2h, Learning outcomes:7,8,9,10 , 1h, Learning outcomes:7,8,9,10 15.Oscillators, 2h, Learning outcomes:7,8,9,10 , 1h, Learning outcomes:5				
Course content auditory	1.No class. 2.No class. 3.No class. 4.Laplace transforms of differential equations and transfer functions., 2h, Learning outcomes:2 5.Determination of time response using inverse L-transformation., 2h, Learning outcomes:3 6.Determination of time response using inverse L-transformation., 2h, Learning outcomes:2 7.Block diagram algebra., 2h, Learning outcomes:1,4 8.No class. 9.Examples of time and frequency responses of various control elements (PT1,PT2,PT2S,PI,PDT1), 2h, Learning outcomes:5,6 10.Examples of time and frequency responses of various control elements (PT1,PT2,PT2S,PI,PDT1), 2h, Learning				

	outcomes:5,6 11.No class. 12.No class. 13.Bode stability criteria and determination of controller gain for system., 2h, Learning outcomes:7,8,9,10 14.Bode stability criteria and determination of controller gain for system., 2h, Learning outcomes:7,8,9,10 15.No class.
Course content laboratory	1.No class. 2.No class. 3.No class. 4.No class. 5.No class. 6.No class. 7.Transient response and Bode plot of passive and active PT1 and PDT1 controllers., 2h, Learning outcomes:6 8.Transient response and Bode plot of I and PI controllers., 2h, Learning outcomes:6 9.Transient response and Bode plot of passive PT2 and PT2S controllers., 2h, Learning outcomes:6 10.Determining of DC motor transfer function from the response., 2h, Learning outcomes:4,5 11.Determination of transfer functions using System Identification Toolbox., 2h, Learning outcomes:5,6 12.Positioning servo system., 2h, Learning outcomes:9,10 13.Experimental adjustment of the closed loop of PI controller of DC motor rotational speed with regard to the reference and disturbance value, 3h, Learning outcomes:5,6,7,8,9,10 14.No class. 15.No class.
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory Special purpose computer laboratory Overhead projector Video equipment Operating supplies Special equipment Modern measurment devices. Electrical and mechanical elementsi for designing labaratory models. Matlab with Simulink-om and System identification toolbox.
Exam literature	Basic literature: 1. N. Perić, Automatsko upravljanje, Zavod za APR FER-a, Zagreb, 1998. 2. P. Crnošija, Osnove automatike I.dio , Element, Zagreb, 2011. 3. N. Pašalić, Osnovi regulacione tehnike, Zavod za elektrostrojarstvo, ETF Zagreb, 1977. Additional literature: 1. T. Šurina, Automatska regulacija, Školska knjiga, Zagreb, 1981. 2. Lj. Kuljača, Z. Vukić, Automatsko upravljanje, Kigen, Zagreb, 2005. 3. D'Azzo,Houpis, Feedback Control System Analysis and Synthesis,McGraw-Hill Book,Tokyo,1966.
Students obligations	Attend 70 percent of classes and auditory exercises and 100 percent performed laboratory exercises and passed preliminary exam of labaratory exercises
Knowledge evaluation during semester	3 exams with theoretical and numerical tasks Terms: Each exam at least 30 percent solved and the total percentage of the combined three exams at least 50 percent
Knowledge evaluation after semester	Written and oral test To pass 50 percent
Student activities:	Aktivnost — ECTS (Practical work) — 1 (Constantly tested knowledge) — 1 (Written exam) — 2 (Oral exam) — 2
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
Proposal made by	Senior lecturer. Mato Fruk, dipl.ing.

Code WEB/ISVU	22855/22264	**ECTS**	5.0	**Academic year**	2018/2019
Name	Automation Elements				
Status	3rd semester - Control and computer engineering in automation (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (0+30+0+0) 90
Teachers	Lectures:1. Tomislav Špoljarić d. i. e., v. pred. Lectures: Goran Vujisić Laboratory exercises: Tomislav Špoljarić d. i. e., v. pred. Laboratory exercises: Goran Vujisić				
Course objectives	students will be introduced to the elements of control systems and their properties				
Learning outcomes:	1.ability to analyze static and dynamic properties of the automated process elements. Level:6 2.ability to identify the element transfer function according to the differential equation descripion and response analysis. Level:6 3.ability to classify elements according to the order, the number of energy storage devices. Level:6 4.ability to calculate the element response to step change in excitation. Level:6 5.ability to inspect the properties of voltage converters and choppers. Level:6,7 6.ability to inspect the dynamic and static characteristics of DCand synchronous generator. Level:6 7.ability to identify control and regulating characteristics of DC and asynchronous motor. Level:6 8.ability to draw the characteristics of simple non-linear elements. Level:6				
Methods of carrying out lectures	Ex cathedra teaching Case studies Demonstration Discussion Questions and answers				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment				
Course content lectures	1.Introduction, 2h, Learning outcomes:1,2 2.One stage amplifiers. Common emitter amplifier, 2h, Learning outcomes:1,2,3 3.One stage amplifiers. Common emitter amplifier, 2h, Learning outcomes:2,3 4.One stage amplifiers. Common emitter amplifier, 2h, Learning outcomes:2,3,4 5.One stage amplifiers. Common collector amplifier, 2h, Learning outcomes:3,4,5 6.Transistor series voltage regulator, 2h, Learning outcomes:3,4,5 7.Common source amplifier, 2h 8.Common drain amplifier, 2h, Learning outcomes:4 9.Multistage amplifiers, 2h, Learning outcomes:4,5 10.Amplitude and phase frequency response, 2h, Learning outcomes:4,5 11.Amplitude and phase frequency response, 2h, Learning outcomes:5,6 12.Differential amplifier, 2h 13.Power amplifiers, 2h, Learning outcomes:5,6,7 14.Feedback, 2h, Learning outcomes:6,7 15.Oscillators, 2h, Learning outcomes:1				
Course content laboratory	1.No ex 2.Introduction to lab exercise, 2h, Learning outcomes:1,2,3 3.First order electrical circuits - First order thermal system, 3h, Learning outcomes:1,2,3 4.DC generator, 3h, Learning outcomes:4,5 5.No exercise 6.Synchronous generator , 3h, Learning outcomes:3,4,5 7.No exercise, 2h 8. Thyristor rectifier , 3h, Learning outcomes:5,6 9.Chopper, 3h, Learning outcomes:6 10.DC motor - motor control characteristics , 2h, Learning outcomes:6 11.DC motor - transfer function, 3h, Learning outcomes:6,7 12.No ex. 13.Induction motor , 3h, Learning outcomes:7,8 14.Frequency controlled induction motor, 3h, Learning outcomes:8 15.Final test, 2h, Learning outcomes:1,2,3,4,5,6,7,8				
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory Overhead projector Maquette				
Exam literature	Basic literature: 1.Pašalić: Osnove regulacijske tehnike; FER- ZESA, Zagreb 1980. 2. M. Puzak: Upute i pripreme za vježbe radni materijali, web TVZ-ELO 3. M. Puzak: Sažeci predavanja; web TVZ-ELO Additional literature: 1. P. Crnošija: Elementi slijednih sustava, Skripta, Sveučilište u Zagrebu, 1984.				
Students obligations	regular class attendance, final exam on laboratory exercise				
Knowledge evaluation during	Redovitost pohaa#5#10#5; Prakti laboratorijski rad#10#30#20$; Kolokvij, numeri zadaci#3#30#15$;Kolokvij, teorijska pitanja#3#30#15$				

semester		
Knowledge evaluation after semester	Redovitost pohaa#5#10#5$Kolokvij, numeri zadaci#3#30#15$Kolokvij, teorijska pitanja#3#30#15$Prakti rad#10#30#20$	
Student activities:	Aktivnost	ECTS
	(Constantly tested knowledge)	1
	(Written exam)	2
	(Practical work)	1
	(Oral exam)	1
Remark	This course can be used for final thesis theme	
Prerequisites:	No prerequisites.	
Proposal made by	Mr. sc. Milivoj Puzak, viši predavač	

Code WEB/ISVU	23413/155818	**ECTS**	6.0	**Academic year**	2018/2019
Name	Automation of Plants				
Status	6th semester - Control and computer engineering in automation (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (0+30+0+0) 120
Teachers	Lectures:1. mr.sc. Davor Gadže Lectures:2. Tomislav Špoljarić d. i. e., v. pred. Laboratory exercises:mr.sc. Davor Gadže Laboratory exercises: Mario Ličanin Laboratory exercises: Boris Peša Laboratory exercises: Tomislav Špoljarić d. i. e., v. pred. Laboratory exercises: Ivan Šulekić dipl.ing.el.				
Course objectives	students will acquire knowledge necessary to develop the plant automation				
Learning outcomes:	1.ability to recognize the need for automation of a simple technical process. Level:6 2.ability to allocate sensors and actuators for automation of a simple technical process. Level:6 3.ability to extract PLC components for automation of a simple technical process. Level:6 4.ability to write a PLC program for automation of a simple technical process. Level:6,7 5.ability to examine the operation of PLC for automation of a simple technical process. Level:6				
Methods of carrying out lectures	Ex cathedra teaching Discussion Questions and answers				
Methods of carrying out laboratory exercises	Development and validation of the PLC software on a laboratory model				
Course content lectures	1.Control system and process connection, 2h, Learning outcomes:1,2,3 2.Hierarchy structure of process control, 2h, Learning outcomes:1,2,3 3.Elements of process control equipment (PLC and consisting parts), 2h, Learning outcomes:3 4.Elements of process control equipment (digital and analog inputs), 2h, Learning outcomes:3 5.Elements of process control equipment (digital and analog outputs), 2h, Learning outcomes:3 6.Elements of process control equipment (processing units possibilities and limitations), 2h, Learning outcomes:3 7.Control peripherals: sensor, actors and converters, 2h, Learning outcomes:2 8.Setting for reliable operating protection against disturbance, 2h, Learning outcomes:3 9.Program functions and blocks in PLC logic function, timers, counters, PWM regulators, 2h, Learning outcomes:1,3,4 10.PLC programming (Ladder and STL, graph), 2h, Learning outcomes:1,4 11.Communication networks, 2h, Learning outcomes:1,5 12.Process visualization - communications, 2h, Learning outcomes:1,4,5 13.Process visualization - tags, 2h, Learning outcomes:1,4,5 14.Process visualization - screen elements, 2h, Learning outcomes:1,4,5 15.Process visualization - archive, 2h, Learning outcomes:1,4,5				
Course content laboratory	1.no classes, 2h 2.no classes, 2h 3.no classes, 2h 4.no classes, 2h 5.no classes, 2h 6.no classes, 2h 7.Examples of simple systems based on PLC process controllers, developing a control program, 4h, Learning outcomes:1 8.testing on process simulator and laboratory process models, 4h, Learning outcomes:1 9.Positioner control, 4h, Learning outcomes:1,2,3,4,5 10.Velocity and direction measurement applying pulse encoder, 4h, Learning outcomes:1,2,3,4,5 11.Reversible electric motor drive control, 4h, Learning outcomes:1,2,3,4,5 12.Frequency regulated drive control, 4h, Learning outcomes:1,2,3,4,5 13.Adjustment of industrial communication lines, 4h, Learning outcomes:1,2,3,4,5 14.Review of the process elements (SCADA), 4h, Learning outcomes:1,2,3,4,5 15.Access to PLC via the Internet communications, 4h, Learning outcomes:1,2,3,4,5				
Required materials	Special purpose laboratory Special purpose computer laboratory Overhead projector Maquette Tools Development and validation of the PLC software on a laboratory model				
Exam literature	Basic literature: 1. H. Berger, Automatisieren mit SIMATIC, Siemens, Mnchen, 1990. 2. G. Malčić: Upute i radni materijali za laboratorijske vježbe, TVZ - ELO Additional literature: 1. www.rockwellautomation.com - MicroLOGIC 1500 PLC programming 2. S7-TIA1 - upute za tečaj, Siemens				
Students obligations	laboratory exercises presence				
Knowledge evaluation during semester	oral exam on laboratory classes 100				

Knowledge evaluation after semester	oral laboratory exam 90 pressence classes 10	
Student activities:	Aktivnost (Constantly tested knowledge)	ECTS 6
Remark	This course can be used for final thesis theme	
Prerequisites:	No prerequisites.	
ISVU equivalents:	22271;	
Proposal made by	Mr. sc. Davor Gadže, viši predavač	

Code WEB/ISVU	23487/156000	**ECTS**	6.0	**Academic year**	2018/2019
Name	Automation Systems				
Status	5th semester - Control and computer engineering in automation (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+45 (15+30+0+0) 105
Teachers	Lectures:1. mr.sc. Davor Gadže Lectures:2. mr. sc. Ivan Mišković dipl. ing. pred. Auditory exercises:mr.sc. Davor Gadže Auditory exercises:mr. sc. Ivan Mišković dipl. ing. pred. Laboratory exercises:mr.sc. Davor Gadže Laboratory exercises:mr. sc. Ivan Mišković dipl. ing. pred. Laboratory exercises: Ivan Šulekić dipl.ing.el.				
Course objectives	students will acquire knowledge necessary to establish automation system of technical processes				
Learning outcomes:	1.ability to standardize different technical processes according to their equivalent properties and parameters. Level:6,7 2.ability to predict the impact of control solutions on safety and reliability of the system. Level:6,7 3.ability to propose a method to determine the process model by analysis or experiment. Level:6,7 4.ability to analyze the fluid flow control processes . Level:6 5.ability to distinguish between the properties of thermal processes according to heat transfer and their purpose. Level:6 6.ability to distinguish between a multiple-input-multiple-output (MIMO) system and the ways of decoupling their interaction . Level:6 7.ability to estimate conditions for applying discrete digital controller in continuous processes. Level:6,7				
Methods of carrying out lectures	Ex cathedra teaching Case studies Discussion				
Methods of carrying out laboratory exercises	Laboratory exercises, computer simulations				
Course content lectures	1.Role, level and structure of automation system. Reliability and safety of controlled system as a technical requirement, 2h, Learning outcomes:1,2 2.Automation tasks setting, 2h, Learning outcomes:3 3.Examination of process model by analysis and measurement - mathematical models , 2h, Learning outcomes:3 4.Thermal processes, 2h, Learning outcomes:5 5.Fluid flow process, 2h, Learning outcomes:3 6.HVAC systems, 2h, Learning outcomes:3,4 7.Energy savingd by pump and fan speed control, 2h, Learning outcomes:5 8.Material transport and shaping, 2h, Learning outcomes:4 9.Mechanical mechanism behavior - vibration and oscilating, 2h, Learning outcomes:5 10.MIMO systems, 2h, Learning outcomes:5,6 11.Process and control limiting in automated system, 2h, Learning outcomes:6,7 12.Analog and digital controller design, 2h, Learning outcomes:7 13.Conditions for application of digital discrete controllers in continuous processes. Paramaters of A/D and D/A converters , 2h, Learning outcomes:7 14.Influence of controller limits and signal filtering on the system, 2h, Learning outcomes:7 15.Controller parameters settings, Feed forward control signal, 2h, Learning outcomes:7				
Course content auditory	1.mechnical process description, 1h, Learning outcomes:1 2.Description of a substitution model of complex technical process from response , 1h, Learning outcomes:1 3.Description of a substitution model of complex technical process from response , 1h, Learning outcomes:2 4.Description: thermal systems , 1h, Learning outcomes:2,3 5.thermal systems , 1h, Learning outcomes:3 6.systems with fluides, 1h, Learning outcomes:4 7.systems with fluides, 2h, Learning outcomes:4 8.characteristics of actuators of pumps and fans , 1h, Learning outcomes:4 9.characteristics of actuators of pumps and fans , 1h, Learning outcomes:4,5 10.mechanical process, 1h, Learning outcomes:5 11.mechanical process, 1h, Learning outcomes:4,5 12.Economic criteria in selecting the actuators in automation system , 1h, Learning outcomes:4,6 13.Economic criteria in selecting the actuators in automation system , 1h, Learning outcomes:5,7 14.Selection and setting of controllers , 1h, Learning outcomes:6,7 15.Selection and setting of controllers , 1h, Learning outcomes:6,7				
Course content laboratory	1.No ex 2.Analysis of the system behaviour of the Mathlab/Simulink models. Basic elements of the model, 3h, Learning outcomes:2 3.Thermal system , 3h, Learning outcomes:3 4. Mechanical system , 3h, Learning outcomes:3,4 5.No exercise 6.Process of the fluids, 3h, Learning outcomes:3,4 7.Electromechanical oscillations in the system, 3h, Learning outcomes:4,5 8.Multiple-input-multiple-output system, 3h, Learning outcomes:5 9.Test , 2h 10.System with physical and regulatory constrains, 2h, Learning outcomes:6 11.Elevator system example, 3h, Learning outcomes:7 12.heating and cooling system, 2h, Learning outcomes:7				

	13.pump system control, 2h, Learning outcomes:4 14.Test 2, 2h 15.No ex
Required materials	Basic: classroom, blackboard, chalk... General purpose computer laboratory Overhead projector Maquette
Exam literature	Basic literature: 1. Perić, Petrović: Osnove automatizacije postrojenja i procesa; Skripta; FER- ZAPR, Zagreb 2001. Additional literature: 2. ***: Tehnička dokumentacija i upute procesne opreme i regulatora: ABB, Siemens; A. Bradley, Schneider
Students obligations	25% of lecture attendance, performed all laboratory exercises and passed preliminary exams in the lab exercises
Knowledge evaluation during semester	Redovitost pohaa#5#10#5$Kolokvij, numeri zadaci#3#30#15$Kolokvij, teorijska pitanja#3#30#15$Prakti rad#10#30#20$
Knowledge evaluation after semester	Pismeni ispit#1#50#30$Usmeni ispit#1#50#30$
Student activities:	Aktivnost ECTS (Constantly tested knowledge) 6
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
ISVU equivalents:	22276;

Code WEB/ISVU	23479/155989	**ECTS**	4.0	**Academic year**	2018/2019
Name	Computers and Computer Systems				
Status	5th semester - Control and computer engineering in automation (Redovni elektrotehnika) - elective course5th semester - Communication and computer technology (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				45+20 (0+20+0+0) 55
Teachers	Lectures:1. Marko Miletić Laboratory exercises: Siniša Lacković struč.spec.ing.el. Laboratory exercises: Marko Miletić				
Course objectives	students will be introduced to the operating modes of digital microcomputers and computer equipment based on microcontrollers with the basics of their designing and programming				
Learning outcomes:	1.ability to classify computer systems according to their structure and purpose. Level:6,7 2.ability to design interfaces for connecting sensors and control elements to embedded systems. Level:6 3.ability to identify software and hardware components of embedded systems. Level:6 4.ability to integrate a microcomputer or a microcontroller and peripherals uniits into a whole performing a given task. Level:6,7 5.ability to design an embedded system using a microcontroller. Level:6,7 6.ability to write drivers and applications for a microcontroller-based embedded systems using C programming language. Level:6,7 7.ability to test the operating of embedded system using modelling and simulation program. Level:6				
Methods of carrying out lectures	Ex cathedra teaching Case studies Demonstration Simulations Questions and answers Classical lectures with overhead slides and blackboard. The students are motivated to participate in discussions.				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Laboratory exercises, computer simulations Computer simulations Workshop Lab excercises are done alone or in pairs, with the intent of independant svrha work on course subject. Lab exercises involve work in microntroller simulator and on 8-bit and 32-bit microcontroller evaluation boards.				
Course content lectures	1.History of microprocessors and microcontroller, 3h, Learning outcomes:1,3 2.definition and recognition of embedded systems , 3h, Learning outcomes:1,3,4,5 3.characteristics and techniques of development and testing of embedded systems, 3h, Learning outcomes:1,3,4,5,6,7 4.explanation of the operating mode of microprocessor on minimal architecture, 3h, Learning outcomes:1,3 5.explanation of the operating mode of microprocessor on minimal architecture, 3h, Learning outcomes:1,3 6.memory models, 3h, Learning outcomes:1,2,3 7.architecture of standard 8-bit microcontroller, 3h, Learning outcomes:1,3,4,5 8.architecture of standard 8-bit microcontroller, 3h, Learning outcomes:1,3,4,5 9.components necessary for construction of a device , 3h, Learning outcomes:1,2,3,4,5,7 10.digital inputs and outputs, 3h, Learning outcomes:2,3,5 11.analog inputs and outputs, 3h, Learning outcomes:2,3,5 12.characteristics and techniques of microcontroller programming, 3h, Learning outcomes:2,5,6,7 13. interrupts and interrupt service routine (ISR) of microcontroller and processing in the C programming language , 3h, Learning outcomes:4,5,6 14. interrupts and interrupt service routine (ISR) of microcontroller and processing in the C programming language , 3h, Learning outcomes:4,5,6 15.no class, 3h				
Course content laboratory	1.no class, 2h 2.no class, 2h 3.no class, 2h 4.introduction to development system - I group, 3h, Learning outcomes:2,3,4,5,6,7 5.introduction to development system - II group, 3h, Learning outcomes:2,3,4,5,6,7 6.usage of digital inputs and outputs for control of outside components - I group, 3h, Learning outcomes:2,3,4,5,6,7 7.usage of digital inputs and outputs for control of outside components - II group, 3h, Learning outcomes:2,3,4,5,6,7 8.usage of digital inputs and outputs over auxiliary components (buffers) - I group, 3h, Learning outcomes:2,3,4,5,6,7 9.usage of digital inputs and outputs over auxiliary components (buffers) - II group, 3h, Learning outcomes:2,3,4,5,6,7 10.midterm, 1h, Learning outcomes:1,2,3,4,5,6,7 11.Debouncing and non blocking coding - I group, 3h, Learning outcomes:2,3,4,5,6,7 12.Key debouncing and non blocking coding - II group, 3h, Learning outcomes:2,3,4,5,6,7 13.Interrupts - I group, 3h, Learning outcomes:2,3,4,5,6,7 14.Interrupts - II group, 3h, Learning outcomes:2,3,4,5,6,7 15.Final exam, 1h, Learning outcomes:1,2,3,4,5,6,7				
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory Special purpose computer laboratory Whiteboard with markers Overhead projector Maquette Special equipment Embedded development boards, electronic components, NI MyDAQ				
Exam literature	Basic literature: 1. S. Predanić: nastavni materijali i projekti dostupni u sustavu za udaljeno učenje				

	2. D. Ćika: nastavni materijali i projekti dostupni u sustavu za udaljeno učenje 3. BUDIN, LEO: Mikroračunala i mikroupravljači. Element, Zagreb, ISBN 953-6098-69-5, 2001., 328 str. Dodatna: 1. PETRINOVIĆ, DAVOR, VUČIĆ, MLADEN: Osnove projektiranja računalnih sustava. Skripta FER - Fakultet elektrotehnike i računarstva, Zagreb, 2007., 120 str. 2. VUČIĆ, MLADEN: Upotreba mikrokontrolera u ugrađenim računalnim sustavima. Skripta FER - Fakultet elektrotehnike i računarstva, Zagreb, 2007., 124 str. 3. VUČIĆ, MLADEN, PETRINOVIĆ, DAVORKA: Projektiranje ugrađenih računalnih sustava - laboratorijske vježbe. Skripta FER - Fakultet elektrotehnike i računarstva, Zagreb, 2007., 193 str.
Students obligations	All lab exercises done and minimum of 50% from laboratory work
Knowledge evaluation during semester	Midterm and final term, question about theory and practice - minimum of 50%
Knowledge evaluation after semester	Written exam - 50% of final mark Oral exam - 50% of final mark
Student activities:	Aktivnost — ECTS (Written exam) — 1 (Oral exam) — 1 (Constantly tested knowledge) — 1 (Activity in class) — 1
Remark	This course can be used for final thesis theme
Prerequisites:	Students cannot enroll in this course unless they have completed Digitalni sklopovi E
ISVU equivalents:	22279;22305;83429;85699;
Proposal made by	mr. sc. Dražen Ćika and Stipe Predanić 4.2.2014

Code WEB/ISVU	22874/22315	**ECTS**	5.0	**Academic year**	2018/2019
Name	Control Devices and Systems				
Status	5th semester - Communication and computer technology (Redovni elektrotehnika) - elective course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (15+15+0+0) 90
Teachers	Lectures:1. v.pred. Mato Fruk dipl.ing. Auditory exercises:v.pred. Mato Fruk dipl.ing. Laboratory exercises: Tomislav Špoljarić d. i. e., v. pred.				
Course objectives	Students will learn to describe, analyze and design continuous controllers				
Learning outcomes:	1.ability to analyze the control system. Level:6 2.ability to analyze the process. Level:6 3.ability to calculate the controller parameters . Level:6 4.ability to integrate the selected type of controller into the system. Level:6,7 5.ability to analyze the closed-loop system. Level:6 6.sketch open and closed control loop. Level:6 7.write a linear differential equation. Level:6,7 8.calculate analytical response of prime elements. Level:6 9.calculate the system transfer function . Level:6 10.draw frequency response plots. Level:6 11.write a discrete transfer function. Level:6,7 12.create mathematical model. Level:6,7				
Methods of carrying out lectures	Ex cathedra teaching Case studies Simulations Modelling The matter is presented by mathematical models, tables and diagrams using illustrative examples in practice.				
Methods of carrying out auditory exercises	Group problem solving Examples are discussed and solved on the board for every topic with students participation.				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Laboratory exercises, computer simulations Group problem solving Exercises are done on prepared devices and systems.				
Course content lectures	1.Introduction, 2h, Learning outcomes:6 2.One stage amplifiers. Common emitter amplifier, 1h, Learning outcomes:6 , 1h, Learning outcomes:8 3.One stage amplifiers. Common emitter amplifier, 2h, Learning outcomes:8 4.One stage amplifiers. Common emitter amplifier, 2h, Learning outcomes:9 5.One stage amplifiers. Common collector amplifier, 2h, Learning outcomes:10 6.Transistor series voltage regulator, 2h, Learning outcomes:7,8,10 7.Common source amplifier, 2h, Learning outcomes:7,8,10 8.Common drain amplifier, 2h, Learning outcomes:7,8,10 9.Multistage amplifiers, 2h, Learning outcomes:1,2,5,10 10.Amplitude and phase frequency response, 2h, Learning outcomes:1,2,5,10 11.Amplitude and phase frequency response, 2h, Learning outcomes:1,2,3,4,5,9,10 12.Differential amplifier, 2h, Learning outcomes:6 13.Power amplifiers, 2h, Learning outcomes:6 14.Feedback, 2h, Learning outcomes:11 15.Oscillators, 2h, Learning outcomes:1,2,6				
Course content auditory	1.No class. 2.No class. 3.No class. 4.Laplace transform and response determination., 2h, Learning outcomes:6,8 5.Transfer functions and frequency characteristics of basic dynamic elements., 2h, Learning outcomes:7,8,9,10 6.Transfer functions and frequency characteristics of basic dynamic elements., 2h, Learning outcomes:7,8,9,10 7.Examples of the analysis and synthesis of continuous systems for static control systems., 2h, Learning outcomes:1,2,3,4,5 8.Examples of the analysis and synthesis of continuous systems for astatic control systems., 2h, Learning outcomes:1,2,3,4,5 9.Analysis of feedback control system in time and frequency domain., 2h, Learning outcomes:2,3,5,10 10.Example of a discrete system analysis and synthesis., 2h, Learning outcomes:11 11.Example of a discrete system analysis and synthesis., 1h, Learning outcomes:11 12.No class. 13.No class. 14.No class. 15.No class.				
Course content laboratory	1.No class. 2.No class. 3.No class. 4.No class. 5.No class. 6.No class. 7.Transfer function of passive and active elements in the control of the first order systems., 3h, Learning outcomes:10 8.Transfer function of passive and active elements in the control of the second order systems., 2h, Learning				

	outcomes:10 9.Transfer functiones of dead time elements, 2h, Learning outcomes:10 10.Basics of Simulink., 2h, Learning outcomes:12 11.Examples of simulation and analysis of elements using Simulink program., 2h, Learning outcomes:2,3,4,5,10 12.Examples of simulation and analysis of closed loop systems using Simulink program., 2h, Learning outcomes:2,3,4,5,10 13.Examples of simulation and analysis of closed loop systems using Simulink program., 2h, Learning outcomes:2,3,4,5,10 14.No class. 15.No class.
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory General purpose computer laboratory Overhead projector Maquette Exercises are done on prepared devices and systems.
Exam literature	Basic literature: 1. N.Perić, Automatsko upravljanje, Zavod za APR FER-a, Zagreb, Interna skripta. Additional literature: 1. T.Šurina, Automatska regulacija, Školska knjiga, Zagreb, 1981. 2. Lj.Kuljača, Z.Vukić, Automatsko upravljanje,Kigen, Zagreb, 2005. 3. P.Katz, Digital Control Using Microprocessors, Prentice-Hall In
Students obligations	Attend 70 percent of lectures Attend 70 percent of auditory lectures Performed laboratory exercises and passed preliminary tests in the lab exercises
Knowledge evaluation during semester	Preliminary exams: 2 exams with numerical problems at least 50 percent to pass 1 exam with theoreticl problems at least 50 percent to pass
Knowledge evaluation after semester	Preliminary examination on laboratory exercises Written and oral examination
Student activities:	Aktivnost — ECTS (Practical work) — 1 (Written exam) — 2 (Oral exam) — 2
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
Proposal made by	Senior lecturer Mato Fruk,dipl.ing

Code WEB/ISVU	23015/63208	**ECTS**	5.0	**Academic year**	2018/2019
Name	Digital Circuits				
Status	4th semester - Control and computer engineering in automation (Redovni elektrotehnika) - obligatory course4th semester - Communication and computer technology (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				45+30 (15+15+0+0) 75
Teachers	Lectures:1. dr. sc. Mladen Sokele predavač Auditory exercises:dr. sc. Mladen Sokele predavač Laboratory exercises: Siniša Lacković struč.spec.ing.el. Laboratory exercises:dr. sc. Mladen Sokele predavač				
Course objectives	students will learn how to describe, analyze and design digital circuits				
Learning outcomes:	1.ability to predict behaviour of simple and complex logic circuits. Level:6,7 2.ability to calculate complex logic circuits on the basis of the desired behaviour. Level:6 3.ability to distinguish between simple logic circuits in real electronic circuits and systems. Level:6 4.ability to distinguish between description methods of electronic circuits and of the systems. Level:6 5.ability to determine the causes of chaotic behaviour in logical circuits. Level:6,7 6.ability to suggest correction in logic circuits to remove chaotic behaviour. Level:6,7				
Methods of carrying out lectures	Ex cathedra teaching Case studies Modelling The subject matter is taught by presenting a great number of real examples, in order to reach ahigh level of understanding.				
Methods of carrying out auditory exercises	Group problem solving Traditional literature analysis Interactive problem solving Problems are analysed and solved with the full participation of students.				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Group problem solving Interactive problem solving The exercises are done in a laboratory by using scale models specially prepared for the work with digital				
Course content lectures	1.Fundamentals of digital technology.Logical algebra and logical functions, 3h, Learning outcomes:1,3 2. Logical algebra and logical functions.Numeric systems and codes, 3h, Learning outcomes:1,2,3 3.Groups of integrated logical circuits, 3h, Learning outcomes:1,2,4 4.Complex combination logical circuits (coder, multiplexer), 3h, Learning outcomes:1,3,4 5.Complex combination logical circuits (comparator, arithmetic circuits), 3h, Learning outcomes:1,3,4 6.Midterm, 3h, Learning outcomes:5,6 7.Detecting flaws in combination logical circuits , 3h, Learning outcomes:1,2,3,4,5,6 8.Synchronous and asynchronous circuits, 3h, Learning outcomes:1,3,4 9. Types of flip flops., 3h, Learning outcomes:3,4 10.II Midterm, 3h, Learning outcomes:1,3,4 11.Complex digital circuit synthesis. Registers and counters , 3h, Learning outcomes:1,2,3,4 12.Monostable and astable multivibrators, 3h, Learning outcomes:1,2,3,4 13.Detecting flaws in sequential logical circuits. RAM , 3h, Learning outcomes:1,3,5,6 14.final exam, 3h, Learning outcomes:1,2,3,4,5,6 15.no class				
Course content auditory	1.AD/DA conversion, number systems, 2h, Learning outcomes:1,2 2.number systems, simple logical algebra and logical functions, 2h, Learning outcomes:1,2,3 3. logical functions, 2h, Learning outcomes:1,2,3 4.complex logical functions, 2h, Learning outcomes:1,2,3,4 5.coder, decoder, 2h, Learning outcomes:1,2,3,4 6.multiplexer, 2h, Learning outcomes:1,2,3,4 7.adder, comparator, 2h, Learning outcomes:1,2,3,4 8.preparation for the lab. exercise - working with circuits of different families, 2h, Learning outcomes:1,2,3,4 9.detecting flaws in combination logical circuits , 2h, Learning outcomes:1,2,5,6 10.Synchronous and asynchronous sequential circuits, 2h, Learning outcomes:1,2,3,4 11.using synchronous sequential circuits for automata, 2h, Learning outcomes:1,2,3,4 12.counters - synchronous sequential circuits, 2h, Learning outcomes:1,2,3,4 13.counters - asynchronous sequential circuits (ripple counter etc.), 2h, Learning outcomes:1,2,3,4 14.Detecting flaws in sequential logical circuits, 2h, Learning outcomes:1,2,5,6 15.no class, 2h				
Course content laboratory	1.no class 2.no class 3.no class 4.no class 5.no class 6.no class 7.no class 8.no class 9.basic logic circuits - similarities of families of integrated logical circuits, 3h, Learning outcomes:1,2,3,4 10.basic logic circuits - usage in complex circuits and diagnostic, 3h, Learning outcomes:1,2,3,4,5,6 11.no class 12.flip flops - similarities and differences, 3h, Learning outcomes:1,2,3,4 13.registers and counters, 3h, Learning outcomes:1,2,3,4 14.astabile and monostable multivibrators, flip flops, 3h, Learning outcomes:1,2,3,4				

	15.no class
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory Maquette
Exam literature	Basic literature: 1. U. Peruško, Digitalna elektronika, Školska knjiga, Zagreb 1996. 2. U. Peruško, V. Glavinić; Digitalni sustavu, Školska knjiga, Zagreb, 2005. Additional literature: 1. A. Szabo, Impulsna i digitalna elektronika, skripta Sveučilista u Zagrebu 2. H. Taub; D.Schilling, Digital Integrated Electronics, McGraw-Hill, 1977.
Students obligations	50% of maximum points on element: * quick test on lecturestest na predavanjima (blic) * midterm * homework * validation of work on lab exercises
Knowledge evaluation during semester	Curve grading on minimum requirements is used.
Knowledge evaluation after semester	Students who passed the midterms have oral exam. Others: written exam 50%, oral exam 50%
Student activities:	Aktivnost — ECTS (Classes attendance) — 1 (Practical work) — 2 (Written exam) — 1 (Oral exam) — 1
Remark	This course can be used for final thesis theme
Prerequisites:	Students cannot enroll in this course unless they have passed Osnove elektrotehnike II Students cannot enroll in this course unless they have completed Analogni sklopovi E
ISVU equivalents:	22269;
Proposal made by	Stipe Predanić, dipl.ing, 4.2.2014

Code WEB/ISVU	23640/158578	**ECTS**	5.0	**Academic year**	2018/2019
Name	Digital Control				
Status	5th semester - Control and computer engineering in automation (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (10+20+0+0) 90
Teachers	Lectures:1. v.pred. Mato Fruk dipl.ing. Lectures: Goran Vujisić Auditory exercises:v.pred. Mato Fruk dipl.ing. Auditory exercises: Goran Vujisić Laboratory exercises:v.pred. Mato Fruk dipl.ing. Laboratory exercises: Goran Vujisić				
Course objectives	students will learn to describe, analyze and design control systems employing digital controllers				
Learning outcomes:	1.ability to analyze continuous control system. Level:6 2.ability to create mathematical model of the system in Simulink. Level:6,7 3.ability to calculate parameters of standard types of digital controllers. Level:6 4.ability to integrate a selected type of digital controller into the system. Level:6,7 5.ability to verify the system perfromances with incorporated digital controller on Simulink model. Level:6 6.associate analog and digital systems. Level:6,7 7.ability to calculate parameters of standard types of analog controllers. Level:6 8.solve difference equation. Level:6 9.write discrete transfer functions of elements. Level:6,7				
Methods of carrying out lectures	Ex cathedra teaching Case studies Simulations Modelling Discussion The matter is presented by mathematical models, tables and diagrams using illustrative examples in practice.				
Methods of carrying out auditory exercises	Group problem solving Computer simulations Examples are discussed and solved on the blackboard for every topic with students participation.				
Methods of carrying out laboratory exercises	Laboratory exercises, computer simulations Group problem solving Computer simulations Exercises are performed in PC laboratory by using Matlab programs.				
Course content lectures	1.Introduction, 1h, Learning outcomes:1,6 , 1h, Learning outcomes:1,6 2.One stage amplifiers. Common emitter amplifier, 2h, Learning outcomes:6 3.One stage amplifiers. Common emitter amplifier, 2h, Learning outcomes:6 4.One stage amplifiers. Common emitter amplifier, 2h, Learning outcomes:1 5.One stage amplifiers. Common collector amplifier, 1h, Learning outcomes:5 , 1h, Learning outcomes:5 6.Transistor series voltage regulator, 1h, Learning outcomes:5 Common source amplifier, 1h, Learning outcomes:9 7.Common source amplifier, 1h, Learning outcomes:9 Common drain amplifier, 1h, Learning outcomes:7 8.Common drain amplifier, 2h, Learning outcomes:7 9.Multistage amplifiers, 1h, Learning outcomes:7 Amplitude and phase frequency response, 1h, Learning outcomes:6,9 10.Amplitude and phase frequency response, 2h, Learning outcomes:6,9 11.Amplitude and phase frequency response, 1h, Learning outcomes:6,9 Differential amplifier, 1h, Learning outcomes:4 12.Differential amplifier, 2h, Learning outcomes:2,3,4,5,6,7,8,9 13.Power amplifiers, 2h, Learning outcomes:2,3,4,5,6,7,8,9 14.Feedback, 2h, Learning outcomes:1,2,3,4,5,6,7,8,9 15.Oscillators, 2h, Learning outcomes:1,2,3,4,5,6,7,8,9				
Course content auditory	1.No class. 2.No class. 3.Examples of synthesis of PI controller by magnitude optimum., 1h, Learning outcomes:7 4.Examples of synthesis of PI controller by magnitude optimum., 1h, Learning outcomes:7 5.No class. 6.No class. 7.Discrete Laplace transform and step response of discrete elements., 1h, Learning outcomes:8 8.Discrete Laplace transform and step response of discrete elements., 1h, Learning outcomes:8 9.Discrete Laplace transform and step response of discrete elements., 1h, Learning outcomes:8 10.Discrete Laplace transform and step response of discrete elements., 1h, Learning outcomes:8 11.Block diagram algebra of discrete systems., 1h, Learning outcomes:6,9 12.Block diagram algebra of discrete systems., 1h, Learning outcomes:6,9 13.Analysis and synthesis of feedback discrete control system., 1h, Learning outcomes:1,2,3,4,5,6,7,8,9 14.Analysis and synthesis of feedback discrete control system., 1h, Learning outcomes:1,2,3,4,5,6,7,8,9 15.No class.				
Course content laboratory	1.No class. 2.No class. 3.No class. 4.No class.				

	5.Introduction to Matlab and Simulink programming systems., 2h, Learning outcomes:2 6.Responses and Bode plot with setting the continuous controller by magnitude optimum., 2h, Learning outcomes:2,3 7.Responses and Bode plot with setting the continuous controller by magnitude optimum., 2h, Learning outcomes:2,3 8.Responses and Bode plot with setting the continuous controller by symmetric frequency characteristics., 2h, Learning outcomes:2,3 9.Responses and Bode plot with setting the continuous controller by symmetric frequency characteristics., 2h, Learning outcomes:2,3 10.Responses and Bode plots of discrete PT1, PDT1, PI, PID controllers., 2h, Learning outcomes:2,3,4,9 11.Responses and Bode plots of discrete PT1, PDT1, PI, PID controllers., 2h, Learning outcomes:2,3,4,9 12.Responses and Bode plot of the systems with discrete controllers., 2h, Learning outcomes:1,2,3,4,5,6,7,8,9 13.Responses and Bode plot of the systems with discrete controllers., 2h, Learning outcomes:1,2,3,4,5,6,7,8,9 14.Responses and Bode plot of the systems with discrete controllers., 2h, Learning outcomes:1,2,3,4,5,6,7,8,9 15.No class.
Required materials	Basic: classroom, blackboard, chalk... General purpose computer laboratory Special purpose computer laboratory Overhead projector Special equipment Program package Matlab 2013a with Simulink 8.1. and Control System Toolbox
Exam literature	Basic literature: 1. N. Perić, O. Bego: Digitalni sustavi upravljanja, FESB, Split 2002. Additional literature: 1. T. Šurina, Automatska regulacija, Školska knjiga, Zagreb, 1981. 2. Lj. Kuljača, Z. Vukić: Automatsko upravljanje, Kigen, Zagreb, 2005. 3. P. Katz, Digital Control Using Microprocessors, Prentice-Hall International, 1981.
Students obligations	Attend 66 percent of classes Attend 70 percent of auditory exercises Attend 100 percent of labaratory exercises
Knowledge evaluation during semester	Preliminary exams: 2 exams with numerical problems at least 50 percent to pass 1 exam with theoreticl problems at least 50 percent to pass
Knowledge evaluation after semester	Preliminary examination on laboratory exercises Written and oral examination
Student activities:	Aktivnost — ECTS (Practical work) — 1 (Constantly tested knowledge) — 1 (Written exam) — 2 (Oral exam) — 1
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
ISVU equivalents:	22272;
Proposal made by	Senior lecturer Mato Fruk,dipl.ing.

Code WEB/ISVU	22875/22316	**ECTS**	5.0	**Academic year**	2018/2019
Name	Digital Signal Processing				
Status	5th semester - Communication and computer technology (Redovni elektrotehnika) - elective 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. Predrag Valožić prof. vis. šk. Laboratory exercises:dr.sc. Predrag Valožić prof. vis. šk.				
Course objectives	students will be familiar with theoretical principles and basic algorithms of digital signal processing				
Learning outcomes:	1.ability to generate harmonic, periodic and random signal with defined properties, off-line generated. Level:6,7 2.ability to compose a complex algorithm of linear and non-linear processing of a communication signals. Level:6,7 3.ability to inspect the properties of digital system model. Level:6 4.ability to design digital filters. Level:6 5.ability to integrate several digital signal procedures into a single, complex one. Level:6,7 6.ability to analyze the system of digital signal processing (DSP). Level:6 7.ability to calculate optimal parameters for a block of the complex DSP system. Level:6 8.ability to predict the characteristics of output signal of a part and of a complex DSP system. Level:6,7				
Methods of carrying out lectures	Ex cathedra teaching Case studies Simulations Modelling Discussion Lectures are incorporated in laboratory work (workshop). Teaching and learning are in a multimedia computer laboratory. Work is individual, collaboration and ad-hoc groups are welcomed. Educator performs lecturing sequences (on-line introductions for laboratory work) as a coach directs student				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Laboratory exercises, computer simulations Group problem solving Discussion, brainstorming Computer simulations Workshop Integrated with lecturing. Exercises to be finished at home.				
Course content lectures	1.Introduction. System, information and signal., 3h, Learning outcomes:6 2.Signals, presentation and analysis, 3h, Learning outcomes:1 3.Signals, A / D conversion, 3h, Learning outcomes:1 4.A / D conversion: - Sampling, aliasing - Quantization, quantization noise, 3h, Learning outcomes:3 5.DFT and FFT; Algorithm: Excel, MatLab, properties, 2h, Learning outcomes:1,3 6.Z transform - The concept and application of Z-transform in the analysis of discrete systems., 2h, Learning outcomes:3 7.A discrete, time-invariant, linear systems - application of Z-transform in the analysis of linear discrete systems, 2h, Learning outcomes:2 8.FIR digital filters - The process of designing FIR digital filters, 2h, Learning outcomes:4 9.FIR digital filters - Examples of design FIR digital filters, 2h, Learning outcomes:4 10.IIR digital filters - The process of designing FIR digital filters, 2h, Learning outcomes:4 11.IIR digital filters - Examples of design FIR digital filters, 2h, Learning outcomes:4 12.Modulation - Generate AM, SSB and PSK signal., 2h, Learning outcomes:2,5,6,8 13.Demodulation - AM, SSB and PSK receiver simulation, 2h, Learning outcomes:2,5,6,8 14.No lectures 15.No lectures				
Course content laboratory	1.Signal presentation repetitorium, 1h, Learning outcomes:1 2.Signals, presentation and analysis, 2h, Learning outcomes:1 3.A / D conversion: - Sampling, aliasing - Quantization, quantization noise, 2h, Learning outcomes:3 4.A / D conversion: - Sampling, aliasing - Quantization, quantization noise, 2h, Learning outcomes:3 5.DFT and FFT; Algorithm: Excel, MatLab, properties, 2h, Learning outcomes:2 6.DFT and FFT; Algorithm: Excel, MatLab, properties, 2h, Learning outcomes:3 7.A discrete, time-invariant, linear systems - application of Z-transform in the analysis of linear discrete systems, 2h, Learning outcomes:2 8.FIR digital filters - The process of designing FIR digital filters, 3h, Learning outcomes:4 9.FIR digital filters - The process of designing FIR digital filters, 3h, Learning outcomes:4 10.IIR digital filters - The process of designing FIR digital filters, 3h, Learning outcomes:4 11.The modulation and demodulation of AM, SSB and PSK, 3h, Learning outcomes:5,7 12.The modulation and demodulation of AM, SSB and PSK, 3h, Learning outcomes:5,7 13.Standalone project work, Learning outcomes:2 14.Standalone project work, Learning outcomes:2 15.Presentation and discussion of projects, 2h, Learning outcomes:6				
Required materials	Special purpose laboratory Special purpose computer laboratory Overhead projector Special equipment mbed LPC 1768; Analog System Lab Kit PRO				
Exam literature	Basic literature: 1. Steven W. Smith, The Scientist and Engineer's Guide to Digital Signal Processing na www.DSPguide.com 2. P. Valošić, Digitalna obrada signala - izravni pristup, MM e-skripta s predlošcima za vježbe, objavljena na web-u. Additional literature: 1. Sanjit K. Mitra, Digital Signal Processing, A Computer Based Approach, The McGraw-Hill Companies, Inc. 1998				

	2. Samuel D. Stearns, Ruth A. David, Signal Processing Algorithms in Matlab, Prentice-Hall, Inc. 1996. 3. A.V.Oppenheim R.W.Schafer, Discrete Time Signal Processing, Prentice-Hall, 1992. 4. D.F.Elliott: Handbook of Digital Signal Processing, Academic, 1987. 5. P. Valožić, Harmonijski titraji i njihov prikaz, recenzirani nastavni materijal, TVZ, 2004.
Students obligations	Regular attendance and completed exercises.
Knowledge evaluation during semester	Regular attendance Preparation and laboratory work Made all the exercises and projects The appearance of reports and projects 90 100 = 5 (A) 80 89 = 4 (B) 65 79 = 3 (C) 60 64 = 2 (D) 50 59 = 2 (E) 49 and less, insufficient
Knowledge evaluation after semester	Submission and presentation of the project 90 100 = 5 (A) 80 89 = 4 (B) 65 79 = 3 (C) 60 64 = 2 (D) 50 59 = 2 (E) 49 and less, insufficient
Student activities:	Aktivnost — ECTS (Classes attendance) — 1 (Activity in class) — 1 (Constantly tested knowledge) — 2 (Report) — 1
Remark	This course can be used for final thesis theme
Prerequisites:	Students cannot enroll in this course unless they have passed Signali i procesi
Proposal made by	Dr.sc.Predrag Valožić, prof.vis.šk.

Code WEB/ISVU	23089/85715	**ECTS**	5.0	**Academic year**	2018/2019
Name	Digital Signal Processors				
Status	6th semester - Communication and computer technology (Redovni elektrotehnika) - elective course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (30+0+0+0) 90
Teachers	Lectures:dr.sc. Predrag Valožić prof. vis. šk. Auditory exercises:dr.sc. Predrag Valožić prof. vis. šk.				
Course objectives	students will understand architecture and the DSP operating principle; practise building software for selected examples				
Learning outcomes:	1.ability to generate harmonic, periodic and random signal with defined properties in real time. Level:6,7 2.ability to compose a complex algorithm of linear and non-linear real-time processing of a communication signal. Level:6,7 3.ability to inspect the properties of modeled digital system. Level:6 4.ability to design digital filters. Level:6 5.ability to integrate a single signal processing procedure into a complex one. Level:6,7 6.ability to sketch a digital signal processing system. Level:6,7 7.ability to suggest optimal parameters of a complex system for digital and hybrid signal processing . Level:6,7 8.ability to define characteristics of the output signal of the parts of a complex digital signal processing system. Level:6,7 9.ability to verify designed and obtained performances of the parts of a digital signal processing system. Level:6				
Methods of carrying out lectures	Ex cathedra teaching Case studies Simulations Modelling Discussion Workshop				
Methods of carrying out auditory 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 Interactive problem solving Workshop				
Course content lectures	1.Applications of digital signal processing, 2h, Learning outcomes:9 2.Real time generation of harmonic signals with desired properties, 2h, Learning outcomes:1 3.Checking of the modeled digital system to operate in real time, 2h, Learning outcomes:3 4.Real time generation of periodic and random signals with desired properties, 2h, Learning outcomes:1 5.FIR digital filters, design, programming, testing and implementation, 2h, Learning outcomes:3,4 6.IIR digital filters, design, programming, testing and implementation, 2h, Learning outcomes:3,4 7.The digital version of analog modulation system, 2h, Learning outcomes:2,5,6,7 8.Communication channel: BP filter and Gaussian noise, 2h, Learning outcomes:2,3,6,7,8,9 9.Analog transmission in baseband, 2h, Learning outcomes:5,6,8,9 10.Digital transmission in baseband, 2h, Learning outcomes:5,6,8,9 11.Spectrum inversion of the speech signal, 2h, Learning outcomes:6,7,8,9 12.Analog transmission with modulation, 2h, Learning outcomes:1,2,3,4,5,6,7,8,9 13.Digital transmission with modulation, 2h, Learning outcomes:1,2,3,4,5,6,7,8,9 14.Project presentation with discussion, 2h, Learning outcomes:9 15.Project presentation with discussion, 2h, Learning outcomes:9				
Course content auditory	1.Applications of digital signal processing, 2h, Learning outcomes:9 2.Real time generation of harmonic signals with desired properties, 2h, Learning outcomes:1 3.Checking of the modeled digital system to operate in real time, 2h, Learning outcomes:3 4.Real time generation of periodic and random signals with desired properties, 2h, Learning outcomes:1 5.FIR digital filters, design, programming, testing and implementation, 2h, Learning outcomes:4,5 6.IIR digital filters, design, programming, testing and implementation, 2h, Learning outcomes:4,5 7.The digital version of analog modulation system, 2h, Learning outcomes:2,5,6,7 8.Communication channel: BP filter and Gaussian noise, 2h, Learning outcomes:2,3,6,7,8,9 9.Analog transmission in baseband, 2h, Learning outcomes:5,6,8,9 10.Digital transmission in baseband, 2h, Learning outcomes:5,6,8,9 11.Spectrum inversion of the speech signal, 2h, Learning outcomes:6,7,8,9 12.Analog transmission with modulation, 2h, Learning outcomes:1,2,3,4,5,6,7,8,9 13.Digital transmission with modulation, 2h, Learning outcomes:1,2,3,4,5,6,7,8 14.Project presentation with discussion, 2h, Learning outcomes:9 15.Project presentation with discussion, 2h, Learning outcomes:9				
Required materials	Special purpose computer laboratory Video equipment Special equipment mbed LPC 1768				
Exam literature	Steven W. Smith: The Scientist and Engineer's Guide to Digital Signal Processing; www.dspguide.com/ Rob Toulson, Tim Wilmshurst: Fast and Effective Embedded Systems Design: Applying the ARM mbed				
Students obligations	presence in lectures and exercises				
Knowledge evaluation during	Regular attendance 10 percent Programming example 70 percent				

semester	Practical work 20 percent 90 100 = 5 (A) 80 89 = 4 (B) 65 79 = 3 (C) 60 64 = 2 (D) 50 59 = 2 (E) 49 and less, insufficient
Knowledge evaluation after semester	Regular attendance 10 percent Programming example 70 percent Practical work 20 percent 90 100 = 5 (A) 80 89 = 4 (B) 65 79 = 3 (C) 60 64 = 2 (D) 50 59 = 2 (E) 49 and less, insufficient
Student activities:	Aktivnost — ECTS (Classes attendance) — 1 (Activity in class) — 1 (Constantly tested knowledge) — 2 (Report) — 1
Remark	This course can be used for final thesis theme
Prerequisites:	Students cannot enroll in this course unless they have passed Signali i procesi Students cannot enroll in this course unless they have completed Digitalna obradba signala
Proposal made by	PhD Predrag Valožić prof. May, 31, 2013

Code WEB/ISVU	24043/189957	**ECTS**	6.0	**Academic year**	2018/2019
Name	Electrical Engineering				
Status	6th semester - Electrical power engineering (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				45+45 (45+0+0+0) 90
Teachers	Lectures:1. Davor Šterc Auditory exercises: Davor Šterc				
Course objectives	students will understand modern power generation technologies and energy relations and be able to calculate and accept forthcoming energy processes in electrical engineering of the 21st century				
Learning outcomes:	1.ability to get insight and explain the importance of energy and energy supply, energy constraints, describe and classiffy energy and energy sources. Level:6 2.ability to describe and explain energy conversion in thermal power plants. Level:6 3.ability to introduce and exploit the properties of ideal gas in energy processes in both open and closed systems describe, solve and draw corresponding diagrams for relevant cyclic processes. Level:6 4.ability to understand the limitations in transformationsof various energy forms into energy (mechanical work), formulate and apply both the first and the second law of thermodynamics . Level:6 5.knowledge of procedures of increasing thermal efficiency in power plants with steam turbines, knowledge of basics of conversion of chemical into thermal energy . Level:6 6.ability to describe and explain energy processes in hydro electric power plants. Level:6 7.awareness of controversies of nuclear engineering, knowledge of the basics of energy transformation and processes in nuclear power plants and their risks and reliability. Level:6				
Methods of carrying out lectures	Ex cathedra teaching Case studies Modelling Discussion Questions and answers Seminar, students presentation and discussion Other Lectures are delivered with emphasis on basic problems illustrated with examples and applications. Recitations involve exercise solving with the participation of students and the monitoring of their progress. Rationale. Here, the energy processes and transformations of the most varied forms of energy into mechanical work and electrical energy are viewed and studied as one dimensional stationary processes. Furthermore, in open systemscontrary to the closed onesthese processes include the flow of fluids; so they are streaming processes whichin the first approximationconstitute a sound description of electrical power plants and equipment. The analysis of these processes leans heavily on the principles of conservation of mass and energy, the equation of state for an ideal fluid, and the principle of entropy increase in fluids which absorb energy for the environment, store this energy in a system, transport it and transform and deliver it, in the end, back to the environment. This cycle enables us to modelboth imagined and demandedprocesses which convert energy into electrical energy.				
Methods of carrying out auditory exercises	Traditional literature analysis Data mining and knowledge discovery on the Web Discussion, brainstorming Other Lectures are delivered with emphasis on basic problems illustrated with examples and applications. Recitations involve exercise solving with the participation of students and the monitoring of their progress. Rationale. Here, the energy processes and transformations of the most varied forms of energy into mechanical work and electrical energy are viewed and studied as one dimensional stationary processes. Furthermore, in open systemscontrary to the closed onesthese processes include the flow of fluids; so they are streaming processes whichin the first approximationconstitute a sound description of electrical power plants and equipment. The analysis of these processes leans heavily on the principles of conservation of mass and energy, the equation of state for an ideal fluid, and the principle of entropy increase in fluids which absorb energy for the environment, store this energy in a system, transport it and transform and deliver it, in the end, back to the environment. This cycle enables us to modelboth imagined and demandedprocesses which convert energy into electrical energy.				
Course content lectures	1. Introductory considerations: importance of energy, energy supply. Energy in the modern world, energy constraints., 3h, Learning outcomes:1 2. Energy classification and supply: primary (conventional and non-conventional), useful, stored, and transitional energy; energy, exergy and anergy., 3h, Learning outcomes:1,7 3. Basic energy conversions. Conversion of chemical and nuclear energy to internal thermal energy., 3h, Learning outcomes:1,7 4. Conversion of internal (thermal) energy to mechanical energy, conversion of gravitational (potential) energy of water to mechanical energy, conversion of mechanical energy to electrical energy., 3h, Learning outcomes:1,2,3 5.Direct energy conversions to electrical energy (thermoelectric, thermionic, photoelectric transformation, fuel cells, magneto-hydrodynamics generators). Conversion of electrical energy to other forms of energy., 3h, Learning outcomes:1 6. Power plants for production of electrical energy., 3h, Learning outcomes:2,3,4,7 7.Production, transmission, distribution, and consumption of electrical energy, 3h, Learning outcomes:4,7 8. Energy for transportation. Transport and delivery energy that is not electrical, 3h, Learning outcomes:1,3,4 9. Energy balance., 3h, Learning outcomes:1,4,6,7 10. Efficiency of energy conversions., 3h, Learning outcomes:2,4,5 11.Energy balance., 3h, Learning outcomes:6,7 12. Environmental impact of utilization, conversion and consumption of energy. Pollution and climate change., 3h, Learning outcomes:1,4,6,7 13. Sustainable development and energy., 3h, Learning outcomes:1,4,6,7 14. Energy storage., 3h, Learning outcomes:1,4,6,7 15. Energy efficiency and alternatives., 3h, Learning outcomes:1,2,4,6,7				

Course content auditory	1. Introductory considerations: importance of energy, energy supply. Energy in the modern world, energy constraints., 3h, Learning outcomes:1 2. Energy classification and supply: primary (conventional and non-conventional), useful, stored, and transitional energy; energy, exergy and anergy., 3h, Learning outcomes:1,7 3. Basic energy conversions. Conversion of chemical and nuclear energy to internal thermal energy., 3h, Learning outcomes:1,7 4. Conversion of internal (thermal) energy to mechanical energy, conversion of gravitational (potential) energy of water to mechanical energy, conversion of mechanical energy to electrical energy., 3h, Learning outcomes:1,2,3 5.Direct energy conversions to electrical energy (thermoelectric, thermionic, photoelectric transformation, fuel cells, magneto-hydrodynamics generators). Conversion of electrical energy to other forms of energy., 3h, Learning outcomes:1 6. Power plants for production of electrical energy., 3h, Learning outcomes:3,4,7 7.Production, transmission, distribution, and consumption of electrical energy, 3h, Learning outcomes:4,7 8. Energy for transportation. Transport and delivery energy that is not electrical, 3h, Learning outcomes:1,3,4 9. Energy balance., 3h, Learning outcomes:1,4,6,7 10.Efficiency of energy conversions., 3h, Learning outcomes:2,4,5 11. Energy balance., 3h, Learning outcomes:6,7 12. Environmental impact of utilization, conversion and consumption of energy. Pollution and climate change., 3h, Learning outcomes:1,4,6,7 13. Sustainable development and energy., 3h, Learning outcomes:1,4,6,7 14. Energy storage., 3h, Learning outcomes:1,4,6,7 15. Energy efficiency and alternatives., 3h, Learning outcomes:1,2,4,6,7
Required materials	Basic: classroom, blackboard, chalk... Overhead projector
Exam literature	Udžbenik: Vladimir Mikuličić, Davor Šterc (2012) Energetske pretvorbe i procesi u elektroenergetici. ISBN 978-953-7048-24-2. Dopunska literatura: pregledni članci (i poglavlja knjiga), npr: Nathan S. Lewis (2007) Powering the Planet. Engineering Science. Vol. 70, Phillip F. Schewe (2006) The Grid. ISBN 9780309102605, John R. Fanchi (2010) Energy in the 21st Century. ISBN 981432454X. Dodatna literatura: Vladimir Mikuličić et al. (2011) Energijske pretvorbe. ISBN [u pripremi], Vladimir Knapp (1993) Novi izvori energije. ISBN 953-0-30633-4. Referentna strana literatura: John R. Fanchi (2004) Energy: Technology and Directions for the Future. ISBN 980122482915, Hadi Sadaat (2010) Power System Analysis. ISBN 0-98-454380-5, T. K. Nagsarkar M. S. Sukhija (2007) Power System Analysis. ISBN 0-19-568451-6.
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
ISVU equivalents:	22293;
Proposal made by	Davor Šterc, MSc (April 2011)

Code WEB/ISVU	22977/26091	**ECTS**	5.0	**Academic year**	2018/2019
Name	Electrical Machines I				
Status	3rd semester - Electrical power engineering (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (30+0+0+0) 90
Teachers	Lectures:1. mr.sc. Veselko Tomljenović viši predavač Auditory exercises: Tomislav Đuran , dipl. ing. Auditory exercises:mr.sc. Veselko Tomljenović viši predavač				
Course objectives	students will acquire basic knowledge and understand operating principles of electromechanical conversion of energy				
Learning outcomes:	1.ability to calculate required energy conversions. Level:6 2.ability to sketch construction of windings . Level:6 3.ability to solve magnetic circle of an electric machine. Level:6 4.ability to propose a scheme of polyphase winding . Level:6,7 5.ability to calculate MMF of monophase and polyphase excitation. Level:6				
Involvement of learning outcomes of the course in study programme:	5.1.EE Razumjeti princip rada električnih rotacijskih strojeva, transformatora, dalekovoda i sklopnih aparata: 20h in 150h				
Methods of carrying out lectures	Ex cathedra teaching Discussion Questions and answers Lecturing is performed with the help of PowerPoint presentations.				
Methods of carrying out auditory exercises	Group problem solving Discussion, brainstorming Examples with active participation of students				
Course content lectures	1.Fundamentals of electromechanical energy conversion., 2h, Learning outcomes:1 2.Construction of a conversion machine., 2h, Learning outcomes:1 3.Construction of a conversion machine., 2h, Learning outcomes:1 4.Magnetic circuit., 2h, Learning outcomes:3 5.Magnetic circuit., 2h, Learning outcomes:3 6.Model of a DC machine., 2h, Learning outcomes:2 7.Model of an AC machine., 2h, Learning outcomes:2 8.Model of an AC machine., 2h, Learning outcomes:2 9.Current and MMF diagrams., 2h, Learning outcomes:5 10.Alternating current MMF diagrams., 2h, Learning outcomes:5 11.Polyphase winding MMF diagrams., 2h, Learning outcomes:5 12.Torque., 2h, Learning outcomes:1 13.Induced voltage., 2h, Learning outcomes:1 14.Factory tour., 2h, Learning outcomes:1 15.Final examination., 2h, Learning outcomes:1				
Course content auditory	1.Numerical examples of electromechanical energy conversion , 2h, Learning outcomes:1 2.Numerical examples of electromechanical energy conversion , 2h, Learning outcomes:1 3.Numerical examples of electromechanical energy conversion , 2h, Learning outcomes:1 4.Magnetic circuit calculations., 2h, Learning outcomes:3 5.Magnetic circuit calculations., 2h, Learning outcomes:3 6.Magnetic circuit calculations., 2h, Learning outcomes:3 7.Calculation of magnetic core losses., 2h, Learning outcomes:3 8.Calculation of magnetic core losses., 2h, Learning outcomes:3 9.Current and magneto motive force diagrams., 2h, Learning outcomes:5 10.Current and magneto motive force diagrams., 2h, Learning outcomes:5 11.Current and magneto motive force diagrams., 2h, Learning outcomes:5 12.Current and magneto motive force diagrams., 2h, Learning outcomes:5 13.Torque and induced voltage calculation., 2h, Learning outcomes:1 14.Torque and induced voltage calculation., 2h, Learning outcomes:1 15.Torque and induced voltage calculation., 2h, Learning outcomes:1				
Required materials	Basic: classroom, blackboard, chalk... Overhead projector				
Exam literature	Basic literature: 1. R. Wolf, Osnove električnih strojeva, Školska knjiga, Zagreb, 1991. 2. L. M. Piotrovskij, Električni strojevi, Tehnička knjiga, Zagreb, 1974. Additional literature: 1. D. Ban, V. Štivčević, I. Gašparac, Osnove elekromehaničke pretvorbe energije i električnih strojeva, Zbirka zadataka i ispitnih pitanja, Element, 1996. 2. I. Mandić: Električni strojevi I, Bilješke s predavanja (PowerPoint format)				
Students obligations	Successfully performed exercises.				
Knowledge evaluation during semester	Mid-term, numerical tasks#3#50#40$Mid-term, theoretical questions#3#50#50$				
Knowledge evaluation after semester	Written examination#1#50#40$Oral examination#1#50#50$				

Student activities:	Aktivnost	ECTS
	(Constantly tested knowledge)	1
	(Written exam)	2
	(Oral exam)	2
Remark	This course can be used for final thesis theme	
Prerequisites:	No prerequisites.	
Proposal made by	Mr.sc. Veselko Tomljenović, v.pred.	

Code WEB/ISVU	23414/155820	**ECTS**	6.0	**Academic year**	2018/2019
Name	Electrical Machines II				
Status	4th semester - Electrical power engineering (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				45+45 (30+15+0+0) 90
Teachers	Lectures:1. mr.sc. Veselko Tomljenović viši predavač Auditory exercises: Tomislav Đuran , dipl. ing. Laboratory exercises: Tomislav Đuran , dipl. ing. Laboratory exercises: Ivor Marković , mag. ing. Laboratory exercises: Alan Miletić				
Course objectives	students will acquire basic knowledge in the field of construction, properties and use of electrical rotating machines				
Learning outcomes:	1.ability to test the operating of synchronous generator . Level:6 2.ability to present synchronous motor operating on infinite busbar. Level:6,7 3.ability to distinguish between the operating of salient pole synchronous generator and cylindrical rotor synchronous generator . Level:6 4.ability to differentiate the types of asynchronous motors. Level:6 5.ability to calculate the impact of resistance on the properties of asynchronous motor . Level:6 6.ability to propose a type of a multipurpose commutator. Level:6,7 7.distinguish small electrical machines. Level:6				
Involvement of learning outcomes of the course in study programme:	5.1.EE Razumjeti princip rada električnih rotacijskih strojeva, transformatora, dalekovoda i sklopnih aparata: 40h in 180h				
Methods of carrying out lectures	Ex cathedra teaching Discussion Questions and answers Lecturing is performed with the help of PowerPoint presentations.				
Methods of carrying out auditory exercises	Group problem solving Discussion, brainstorming Examples with active participation of the students.				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Group problem solving Discussion, brainstorming Test of student readiness for the excercise, exercises in small groups, individual preparation of the report, test of the acquired knowledge.				
Course content lectures	1.Physical processes in a synchronous machine., 3h, Learning outcomes:1 2.Synchronous machine on an infinite busbar., 3h, Learning outcomes:2 3.Construction and parameters of synchronous machines., 3h, Learning outcomes:3 4.Basics of a synchronous machine testing., 3h, Learning outcomes:1 5.Physical processes in an induction machine., 3h, Learning outcomes:4 6.Construction and properties of induction machines., 3h, Learning outcomes:4 7.Starting, reversing and braking., 3h, Learning outcomes:5 8.Basics of induction machine testing., 3h, Learning outcomes:4 9.Physical processes in DC machines., 3h, Learning outcomes:6 10.Design and properties of DC machines., 3h, Learning outcomes:6 11.Basics of DC machine regulation., 3h, Learning outcomes:6 12.Output curves of DC machines., 3h, Learning outcomes:6 13.Basics of DC machine testing., 3h, Learning outcomes:6 14.Small electrical machines: construction, parameters and use., 3h, Learning outcomes:7 15.Small electrical machines: construction, parameters and use., 3h, Learning outcomes:7				
Course content auditory	1.Physical processes in a synchronous machine., 2h, Learning outcomes:1 2.Synchronous machine on an infinite busbar., 2h, Learning outcomes:2 3.Construction and parameters of synchronous machines., 2h, Learning outcomes:3 4.Construction and parameters of synchronous machines., 2h, Learning outcomes:3 5.Physical processes in an induction machine., 2h, Learning outcomes:4 6.Construction and properties of induction machines., 2h, Learning outcomes:4 7.Starting, reversing and braking., 2h, Learning outcomes:5 8.Starting, reversing and braking., 2h, Learning outcomes:5 9.Physical processes in DC machines., 2h, Learning outcomes:6 10.Design and properties of DC machines., 2h, Learning outcomes:6 11.Basics of DC machine regulation., 2h, Learning outcomes:6 12.Output curves of DC machines., 2h, Learning outcomes:6 13.Output curves of DC machines., 2h, Learning outcomes:6 14.Small electrical machines: construction, parameters and use., 2h, Learning outcomes:7 15.Small electrical machines: construction, parameters and use., 2h, Learning outcomes:7				
Course content laboratory	1.No-load characteristics of synchronous machine., 1h, Learning outcomes:1 2.Short circuit characteristics of synchronous machine , 1h, Learning outcomes:1 3.Synchronization., 1h, Learning outcomes:1 4.Regulation characteristics of synchronous machine., 1h, Learning outcomes:1 5.Regulation characteristics of synchronous machine., 1h, Learning outcomes:1 6.No-load characteristics of induction motor., 1h, Learning outcomes:4 7.No-load characteristics of induction motor., 1h, Learning outcomes:4 8.Torque characteristics of induction motor., 1h, Learning outcomes:4				

	9.Torque characteristics of induction motor., 1h, Learning outcomes:4 10.Load and external characteristics of a DC motor., 1h, Learning outcomes:6 11.Load and external characteristics of a DC motor., 1h, Learning outcomes:6 12.Regulation of a DC motor., 1h, Learning outcomes:6 13.Regulation of a DC motor., 1h, Learning outcomes:6 14.Introduction to specialized test laboratories for rotating electrical machinery., 1h, Learning outcomes:1 15.Introduction to specialized test laboratories for rotating electrical machinery., 1h, Learning outcomes:1
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory Overhead projector
Exam literature	Basic literature: 1. R.Wolf: Osnove električnih strojeva, Školska knjga, Zagreb, 1991. 2. I. Mandić, V. Tomljenović, M. Pužar: Sinkroni i asinkroni električni strojevi, Tehničko veleučilište u Zagrebu, 2012., http://nastava.tvz.hr/el-strojeviII/SinAsink.pdf 3. B.Jurković, Z.Smolčić: Kolektorski strojevi, Školska knjiga, Zagreb, 1986. 4. R.Wolf: Ispitivanje električnih strojeva II i III, Elektrotehnički fakultet u Zagrebu, 1972. Additional literature: 1. I. Mandić: Električni strojevi II, Bilješke s predavanja (PowerPoint format) 2. V. Tomljenović: Električni strojevi 2, Zbirka rješenja, Tehničko veleučilište u Zagrebu, 2012. 3. A.Dolenc: Asinhroni strojevi, Elektrotehnički fakultet u Zagrebu, 1970. 4. D. Ban, V. Štivčević, I. Gašparac: Osnove elelekromehaničke pretvorbe energije i električnih strojeva, Zbirka zadataka i ispitnih pitanja, Element, Zagreb, 1996. 5. Z. Sirotić, Z. Maljković: Sinhroni strojevi, Fakultet elektrotehnike i računarstva, Element, Zagreb, 1996.
Students obligations	Successfully performed exercises.
Knowledge evaluation during semester	Mid-term, numerical tasks#3#50#40$Mid-term, theoretical questions#3#50#50$
Knowledge evaluation after semester	Written examination#1#50#40$Oral examination#1#50#50$
Student activities:	Aktivnost — ECTS (Constantly tested knowledge) — 1 (Experimental work) — 1 (Written exam) — 2 (Oral exam) — 2
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
ISVU equivalents:	26092;
Proposal made by	Mr. sc. Veselko Tomljenović, v.pred.

Code WEB/ISVU	23484/155994	**ECTS**	6.0	**Academic year**	2018/2019
Name	Electrical Measurements				
Status	3rd semester - Electrical power engineering (Redovni elektrotehnika) - obligatory course3rd semester - Communication and computer technology (Redovni elektrotehnika) - obligatory course3rd semester - Control and computer engineering in automation (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+45 (15+30+0+0) 105
Teachers	Lectures:1. mr.sc. Darko Lukša dipl.ing Auditory exercises:mr.sc. Darko Lukša dipl.ing Laboratory exercises: Želimir Ivanović Laboratory exercises:mr.sc. Darko Lukša dipl.ing				
Course objectives	Students will acquire basic knowledge of measurements in engineering particularly in electrical engineering; be introduced to the basic electrical measuring instruments, measuring procedures and methods; give a proper interpretation of the obtained measurement results.				
Learning outcomes:	1.ability to identify the measurement results according to the source . Level:6 2.ability to differentiate measurement results according to the value of readings. Level:6 3.ability to classify the measurement reults by statistical methods . Level:6,7 4.ability to follow precaution and safety procedure in measurements . Level:6,7 5.ability to relate the measurement results obtained by different methods and procedures. Level:6,7 6.ability to estimate accuracy and errors of the obtained measurement resuls. Level:6,7 7.ability to distinguish between different measurement methods used for measurement of the same electrical values. Level:6 8.ability to test components and DC and AC circuit using a universal instrument . Level:6 9.ability to make a report on measurement results. Level:6,7				
Methods of carrying out lectures	Ex cathedra teaching Case studies Discussion Presentations including pictures, photos, diagrams and tables.				
Methods of carrying out auditory exercises	Group problem solving Discussion, brainstorming Presentations including pictures, photos, diagrams and tables.				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment The new knowledge from lectures is demonstrated and supplemented. Students acquire necessary skills for connecting instruments, their readings and proper interpretation of measurement results.				
Course content lectures	1.Measurement, measures and measurement units, standards. , 1h, Learning outcomes:9 Measurement error, error limits, statistical data processing. , 1h, Learning outcomes:3,6 2.Measurement error, error limits, statistical data processing. , 2h, Learning outcomes:3,6 3.Measurement parameters and waveform values., 2h, Learning outcomes:1,2 4.Presentation of measurement results (analog and digital and combination of the two, graphs, tables, functions, computer display of the results)., 2h, Learning outcomes:1,2,8,9 5.Measuring resistors, capacitors and coils, laboratory supplies, attenuators, dividers, amplifiers, filters., 2h, Learning outcomes:7 6.Principles of electrical quantity conversion according to the effects: magnetic, electrostatic, thermal, chamical, electronic (digital instrument)., 1h, Learning outcomes:7 Magnetic principle of conversion: a moving coil instrument with permanent magnet (as a universal instrument, Darsonval)., 1h, Learning outcomes:7 7.Magnetic principle of conversion: a moving coil instrument with permanent magnet (as a universal instrument, Darsonval)., 1h, Learning outcomes:7 Measurement methods based on instruments with coil in permanent magnetic field: universal voltmeter, ampermeter, ohmmeter., 1h, Learning outcomes:7 8.Measurement methods based on instruments with coil in permanent magnetic field: universal voltmeter, ampermeter, ohmmeter., 1h, Learning outcomes:6 Written exams., 1h 9.Electric power consumption measurement., 2h, Learning outcomes:5,7 10.Measuring bridges and compensators: DC and AC., 2h, Learning outcomes:5,7 11.Electronic instruments: oscilloscope., 2h, Learning outcomes:4,5,6,7 12.Electronic instruments: oscilloscope., 1h, Learning outcomes:4,5,6,7 Digital instruments with AD converter, voltage conversion in time or frequency with digital display., 1h, Learning outcomes:5,6,7 13.Digital instruments with AD converter, voltage conversion in time or frequency with digital display., 2h, Learning outcomes:5,6,7 14.Measurement procedure, choice of measurement method,choice of instruments and protection., 1h, Learning outcomes:5,6,7 Maintenace of instruments and equpment (handling, cleaning, calibrating, preserving and servicing)., 1h, Learning outcomes:2,5,7,9 15.Maintenace of instruments and equpment (handling, cleaning, calibrating, preserving and servicing)., 1h, Learning outcomes:2,5,7 Written exams., 1h				
Course content auditory	1.Measurement error, error limits, statistical data processing., 1h, Learning outcomes:2,5 2.Measurement error, error limits, statistical data processing., 1h, Learning outcomes:2,5 3.Measurement error, error limits, statistical data processing., 1h, Learning outcomes:2,5 4.Measurement parameters and waveform values., 1h, Learning outcomes:2,5 5.Measurement parameters and waveform values., 1h, Learning outcomes:2,5 6.Universal instrument. Magnetic principle of conversion, universal voltmetar, ampermetar, ommetar and vatmetar., 1h, Learning outcomes:2,5				

	7.Universal instrument. Magnetic principle of conversion, universal voltmetar, ampermetar, ommetar and vatmetar., 1h, Learning outcomes:2,5 8.Measuring bridges and compensators., 1h, Learning outcomes:2,5 9.Measuring bridges and compensators., 1h, Learning outcomes:2,5 10.Electric power consumption measurement., 1h, Learning outcomes:2,5 11.Electric power consumption measurement., 1h, Learning outcomes:2,5 12.Electronic instruments: function generator and oscilloscope., 1h, Learning outcomes:2,5 13.Electronic instruments: function generator and oscilloscope., 1h, Learning outcomes:2,5 14.Digital instruments with AD converter., 1h, Learning outcomes:2,5 15.Digital instruments with AD converter., 1h, Learning outcomes:2,5
Course content laboratory	1.No laboratory exercises. 2.No laboratory exercises. 3.No laboratory exercises. 4.No laboratory exercises. 5.Measurement error, error limits and statistical data processing., 3h, Learning outcomes:2,3,5 6.Extension and calibrate analog universal instrument., 3h, Learning outcomes:2,5 7.Measurement values parameters waveforms voltage and current., 3h, Learning outcomes:2,4 8.Measuring bridges and compensators., 3h, Learning outcomes:2,4 9.Measuring bridges and compensators., 3h, Learning outcomes:2,4,5 10.Measurement values parameters waveforms voltage and current on oscilloscope., 3h, Learning outcomes:2,4,5 11.Measurement in (X - Y) mode values parameters waveforms voltage and current on oscilloscope., 3h, Learning outcomes:2,4,6 12.Measurement in FFT mode values parameters waveforms., 3h, Learning outcomes:2,4,6 13.Compare analog and digital measurement methods., 3h, Learning outcomes:2,4,5 14.Written and oral exam., 3h 15.No laboratory exercises.
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory General purpose computer laboratory Special purpose computer laboratory Overhead projector Maquette Operating supplies The new knowledge from lectures is demonstrated and supplemented. Students acquire necessary skills for connecting instruments, their readings and proper interpretation of measurement results.
Exam literature	Basic literature: 1. D. Lukša; Bilješke sa predavanja. 2. V. Bego; Mjerenja u elektrotehnici, Tehnička knjiga, Zagreb, 1996. Dodatna: 1. France Mlakar: Opća električna mjerenja, Tehnička knjiga- Tehnička knjiga, Godina: 2003. 2. A. Šantić; Elektronička instrumentacija, Školska knjiga, Zagreb, 1998.
Students obligations	Attendance 80 % lectures and auditory exercises. All laboratory exercises.
Knowledge evaluation during semester	Preliminary exam in the subject matter of exercises; the written and the oral exam. Two written exams.
Knowledge evaluation after semester	Written and oral exam.
Remark	This course can not be used for final thesis theme
Prerequisites:	Students cannot enroll in this course unless they have passed Matematika I Students cannot enroll in this course unless they have passed Osnove elektrotehnike I Students cannot enroll in this course unless they have completed Matematika II Students cannot enroll in this course unless they have completed Osnove elektrotehnike II
ISVU equivalents:	22252;22277;85629;185689;
Proposal made by	Mr.sc. Darko Lukša dipl.ing.

Code WEB/ISVU	23998/185689	**ECTS**	6.0	**Academic year**	2018/2019
Name	Electrical Measurements				
Status	2nd semester - Undergraduate professional study in electrical engineering (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+45 (15+30+0+0) 105
Teachers	Lectures:1. pred. Ivan Lujo , dipl.ing. Lectures:2. Aleksandar Kiričenko Auditory exercises: Aleksandar Kiričenko Auditory exercises:pred. Ivan Lujo , dipl.ing. Laboratory exercises: Frane Brkić Laboratory exercises: Robert Herčeki Laboratory exercises: Želimir Ivanović Laboratory exercises: Aleksandar Kiričenko Laboratory exercises:pred. Ivan Lujo , dipl.ing.				
Course objectives					
Remark	This course can not be used for final thesis theme				
Prerequisites:	No prerequisites.				
ISVU equivalents:	22252;22277;85629;155994;				

Code WEB/ISVU	24041/189955	**ECTS**	6.0	**Academic year**	2018/2019
Name	Electrical Motor Drives				
Status	5th semester - Electrical power engineering (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+55 (30+10+0+15) 95
Teachers	Lectures:1. Ivor Marković , mag. ing. Auditory exercises: Ivor Marković , mag. ing. Laboratory exercises: Marko Babić Laboratory exercises: Tomislav Đuran , dipl. ing. Laboratory exercises: Ivor Marković , mag. ing. Construction exercises: Ivor Marković , mag. ing.				
Course objectives	students will quire knowledge to identify the process requirements, drive elements and to select motor drives				
Learning outcomes:	1.ability to analyze properties and requirements of working mechanisms in static and dynamic operating conditions . Level:6 2.ability to create a single-pole motor drive scheme with DC controlled speed motor . Level:6,7 3.ability to assess capacities of asynchronous motor fed from constant voltage network and via frequency converter . Level:6,7 4.ability to propose the choice of motor type and energy converter in accordance with the requirements of technical procedure. Level:6,7 5.ability to establish operating conditions of the motor (cooling and environmental protection) and motor protection requirements. Level:6,7 6.ability to plan construction, maintaining and modernizing of a motor drive. Level:6,7				
Methods of carrying out lectures	Ex cathedra teaching Case studies Questions and answers Oral and PowerPoint presentation				
Methods of carrying out auditory exercises	Traditional literature analysis Discussion, brainstorming				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Laboratory exercises, computer simulations				
How construction exercises are held	Group problem solving Discussion, brainstorming				
Course content lectures	1.lectric motor drive as an element of a technical or work process (1). Material, energy and information flow , 2h, Learning outcomes:1 2.motoring regime, braking, 2h, Learning outcomes:2 3.Power flow control in electrical drive system., 2h, Learning outcomes:2 4.Requirements for energy supply in static and dynamic conditions of a motor , 2h, Learning outcomes:3 5.DC motor drive control , 2h, Learning outcomes:3 6.Constant speed induction motor drive, 2h, Learning outcomes:3,4 7.Electric motor drive with asynchronous motor speed control. Scalar and vector control, 2h, Learning outcomes:3,4 8.Frequency converter for AC motor drive, 2h, Learning outcomes:3,4 9.Adjustment of motor and converter parameters , 2h, Learning outcomes:4 10.Design of electric motor drive controls according to static and dynamic load , 2h, Learning outcomes:5,6 11. Drive operating modes. Exvivalent mpotor torque and power. , 2h, Learning outcomes:5,6 12.Design of electric motor drive controls according to static and dynamic load . Motor and drive protection, 2h, Learning outcomes:2,3,4,5 13.Synchronous motor drive. Servo drive, 2h, Learning outcomes:5 14.Motor and converter selection - energy consumtion criteria, 2h, Learning outcomes:5 15.Testing and commissioning of electric motor drive. Maintenance an retrofit of a motor drive, 2h, Learning outcomes:6				
Course content auditory	1.nv 2.Machine mechanical needs torque speed power, 2h, Learning outcomes:1,2 3.Machine mechanical needs torque speed power, 2h, Learning outcomes:1,2 4.Calculations of properties and behaviour of: DC motor drive, 2h, Learning outcomes:2,3 5.Constant speed Induction motor drive supply from ac network, 2h, Learning outcomes:3,4 6.Induction motor start up current lowering , 2h, Learning outcomes:3,4 7.Induction motor speed control by voltage and frequency, 2h, Learning outcomes:4,5 8.- test, 2h 9.Design of variable speed induction motor drive - motor and converter selecting, 2h, Learning outcomes:2,3,4,5,6 10.Design of variable speed induction motor drive - motor and converter selecting, 2h, Learning outcomes:3,4,5 11.Motor lads during start up and speed reversal - efective torque, 2h, Learning outcomes:2,3,4 12.nv - test 2, 2h 13.Synchronous motor drive, 2h, Learning outcomes:4,5 14.Motor selection on energy consumption cruiteria, High efficiency motors, 2h, Learning outcomes:6 15.nv				
Course content laboratory	1.ne 2.ne 3.ne 4.ne 5.ne				

	6.ne 7.ne 8.DC motor drive properties, 2h, Learning outcomes:2 9.Mains supplied induction motor drive, 1h, Learning outcomes:3 10.Induction motor drive with reduced start current Y/D conection and soft start, 1h, Learning outcomes:3,4,5 11.Frequency control of induction motor, 2h, Learning outcomes:3,4,5,6 12.Frequency converter paramater setting, 2h, Learning outcomes:4,5 13.Servo drive, motor drive for elevator, 2h, Learning outcomes:4,5,6 14.Large drives with induction and SMPM motor - test laboratory visit, 1h, Learning outcomes:4,5,6 15.ne
Course content constructures	1.ne 2.ne 3.ne 4.ne 5.ne 6.ne 7.task sharing. Design rules, 1h, Learning outcomes:4,5,6 8.Solving exampe, 3h, Learning outcomes:6 9.Solving exampe, 3h, Learning outcomes:6 10.Individual task solving, 2h, Learning outcomes:6 11.Individual task solving, 2h, Learning outcomes:6 12.Solving review, 1h, Learning outcomes:4 13.Solving review, 1h, Learning outcomes:5 14.Solving review, 1h, Learning outcomes:5,6 15.Solve presentation , 2h, Learning outcomes:6
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory Whiteboard with markers Overhead projector Maquette Special equipment
Exam literature	Basic literature: 1. B.Jurković, Elektromotorni pogoni, Školska knjiga, Zagreb,1990. 2. G Erceg: Elektromotorni pogoni: Inženjerski priručnik 20. pp1017-1074 Školska knjiga 2002. Additional literature: 1. J. Bonal: Variable speed electric drives; Intercept , London, Paris , New York, 1999.
Students obligations	Individual project design of selected EMD elements for the given technical process (10)
Knowledge evaluation during semester	Redovitost pohaa#5#10#5$Kolokvij, numeri zadaci#3#50#30$Programski zadatak#1#30#20$Usmena provjera znanja#1#10#5$
Knowledge evaluation after semester	Pismeni ispit#1#40#25$Usmeni ispit#1#40#25$Project work 1#20#10$
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
ISVU equivalents:	22295;155987;
Proposal made by	Mr. sc. Milivoj Puzak, viši predavač

Code WEB/ISVU	23478/155988	**ECTS**	6.0	**Academic year**	2018/2019
Name	Electrical Motor Drives				
Status	5th semester - Control and computer engineering in automation (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+45 (20+10+0+15) 105
Teachers	Lectures:1. mr.sc. Davor Gadže Lectures:2. Tomislav Špoljarić d. i. e., v. pred. Auditory exercises:mr.sc. Davor Gadže Auditory exercises: Tomislav Špoljarić d. i. e., v. pred. Laboratory exercises:mr.sc. Davor Gadže Laboratory exercises: Tomislav Špoljarić d. i. e., v. pred. Construction exercises:mr.sc. Davor Gadže Construction exercises: Tomislav Špoljarić d. i. e., v. pred.				
Course objectives	students will acquire knowledge to recognize requirements of a motor drive and select the types and elements of electric motor drives				
Learning outcomes:	1.ability to create a single-pole motor drive scheme with DC controlled speed motor . Level:6 2.ability to assess possibilities of an asynchronous motor power supplied from constant voltage network via frequency converter. Level:6,7 3.ability to propose the choice of a motor type and energy converter according to the requirements of technical process. Level:6,7 4.ability to determine the motor operating conditions (cooling and environmental protection) and necessity of motor protection . Level:6,7 5.Be able to draw single line AC variable speed motor drive. Level:6 6.ability to plan construction, maintenance and modernization of a motor drive. Level:6 7.carry out the construction, maintenece and retrofit motor drive. Level:6,7				
Methods of carrying out lectures	Ex cathedra teaching Demonstration Oral and PowerPoint presentation				
Methods of carrying out auditory exercises	Traditional literature analysis				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment				
How construction exercises are held	project				
Course content lectures	1.Electric motor drive as an element of a technical or work process (1). Material, energy and information flow (1)., 2h, Learning outcomes:1 2.Material, energy and information flow, 2h, Learning outcomes:2 3.Basic principles of energy flow control in drives, 2h, Learning outcomes:1,2,3 4.Requirements for energy supply in static and dynamic conditions of a motor , 2h, Learning outcomes:2 5.DC motor drive control, 2h, Learning outcomes:3,4 6.Constant speed induction motor drive, 2h, Learning outcomes:4,5 7.Electric motor drive with asynchronous motor speed control. Scalar and vector control. , 2h, Learning outcomes:4,5 8.Frequency converter for AC motor drive, 2h, Learning outcomes:3,4,5 9.Adjustment of motor and converter parameters, 2h, Learning outcomes:4,5,6 10.Design of electric motor drive controls according to static and dynamic load, 2h, Learning outcomes:6,7 11.Mechanical construction of motors. Cooling systems. Drive operating modes, 2h, Learning outcomes:4,5 12.Protection of drive components., 2h, Learning outcomes:5,6 13. Synchronous motor drive. Servo drives, 2h, Learning outcomes:5,6 14.Testing and commissioning of electric motor drive , 2h, Learning outcomes:7 15.Maintenance of a motor drive.Motor drive design acording to energy consumption, 2h, Learning outcomes:6,7				
Course content auditory	1.NO ex 2.Task calculation power, torque speed, 2h, Learning outcomes:1,2 3.Task calculation power, torque speed, 2h, Learning outcomes:1,2 4.behavior of DC motor drive, 2h, Learning outcomes:2,3 5.Constant speed Induction motor drive supply from ac network, 2h, Learning outcomes:3,4 6.Startig current reduction of induction motor, 2h, Learning outcomes:6,7 7.Induction motor control by variable frequency and voltage, 2h, Learning outcomes:4,5,6,7 8.no ex 9.Design of variable speed induction motor drive - motor and converter selecting, 2h, Learning outcomes:4,5 10.Design of variable speed induction motor drive - motor and converter selecting, 2h, Learning outcomes:4,5,6 11.Motor loadig durig starting and speed reversal - efective torque, 2h, Learning outcomes:5,6,7 12.no ex 13.Synchronous drive, 1h, Learning outcomes:7 14.Motor selectig with low energy consumption - high efficiency drive, 1h, Learning outcomes:7 15.no ex				
Course content laboratory	1.No ex 2.No ex 3.No ex 4.No ex 5.No exercise 6.No ex				

	7.No exercise 8.DC motor drive properties, 2h, Learning outcomes:1,2 9.Induction motor drive supply from constant voltage network, 1h, Learning outcomes:3 10.Inductio motor drive with reduced start current Y/D and soft start, 1h, Learning outcomes:4 11.Frequency control of induction motor, 2h, Learning outcomes:3,4 12.Frequency converter paramater setting, 2h, Learning outcomes:3,4 13.Servo drive, motor drive for elevator , 1h, Learning outcomes:4,5 14.Large drives with induction and SMPM motor - test laboratory visit, 1h, Learning outcomes:5,6 15.No ex
Course content constructures	1.no ex 2.no exercise 3.no exercise 4.no exercise 5.no exercise 6.no exercise 7.Task sering, 1h 8.example 1, 3h, Learning outcomes:1,2,3 9.example 2, 3h, Learning outcomes:2,3 10.individual student work - support, 2h, Learning outcomes:2,4,5,6,7 11.ndividual student work - support, 2h, Learning outcomes:2,3,4,5,6,7 12.result control, 2h, Learning outcomes:7 13.result control, 1h, Learning outcomes:7 14.result control, 1h, Learning outcomes:7 15.result presentation, 2h, Learning outcomes:6
Required materials	Special purpose laboratory General purpose computer laboratory Overhead projector Maquette Special equipment project
Exam literature	Basic literature: 1. B.Jurković, Elektromotorni pogoni, Školska knjiga, Zagreb,1990. 2. J. Weidauer: Električna pogonska tehnika, Siemens, Graphis Zagreb 2013 3. G Erceg: Elektromotorni pogoni: Inženjerski priručnik 20. pp1017-1074 Školska knjiga 2002. Dodatna: 1.J. Bonal: Variable speed electric drives; Intercept , London, Paris , New York, 1999.
Students obligations	Individual project development of the selected electric motor drive (EMD) elements for the given technical process (10)
Knowledge evaluation during semester	Redovitost pohaa#5#10#5$Kolokvij, numeri zadaci#3#50#30$Programski zadatak#1#30#20$Usmena provjera znanja#1#10#5$
Knowledge evaluation after semester	Pismeni ispit#1#40#20$Usmeni ispit#1#40#30$Seminarski rad#1#20#10$
Student activities:	Aktivnost ECTS (Constantly tested knowledge) 6
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
ISVU equivalents:	22283;
Proposal made by	Mr. sc. Milivoj Puzak, viši predavač

Code WEB/ISVU	22866/22294	**ECTS**	5.0	**Academic year**	2018/2019
Name	Electrical Power Networks				
Status	5th semester - Electrical power engineering (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				45+30 (30+0+0+0) 75
Teachers	Lectures:1. Tomislav Špoljarić d. i. e., v. pred. Auditory exercises: Tomislav Špoljarić d. i. e., v. pred.				
Course objectives	Acquiring technical knowledge in the field of electrical power networks				
Learning outcomes:	1.ability to formulate calculations for certain types of electric power lines and electric transmission lines . Level:6,7 2.ability to identify required equipment for balanced construction of distribution power lines and transmission lines. Level:6 3.ability to analyze transients at switching on and interrupting voltage in power lines. Level:6 4.ability to identify schemes for cost-efficient power transmission. Level:6,7 5.ability to generate maintenance procedures for electric power lines and transmission lines . Level:6 6.ability to inspect cost effectiveness of solutions and operating principles of some parts of power network. Level:6 7.ability to formulate requirements for efficiency improvements in some parts of power network. Level:6				
Involvement of learning outcomes of the course in study programme:	5.1.EE Razumjeti princip rada električnih rotacijskih strojeva, transformatora, dalekovoda i sklopnih aparata: 20h in 150h				
Methods of carrying out lectures	Ex cathedra teaching Case studies Modelling Discussion Questions and answers Other Drawings, tables and diagrams are used to ease understanding. The specific examples are also shown through photographs, design, project and test documentation. All exposed materials are analyzed and discussed with students toachieve their active participation. It is necessary to a have blackboard, LCD projector and laptop.				
Methods of carrying out auditory exercises	Group problem solving Data mining and knowledge discovery on the Web Interactive problem solving Other Solving numerical examples that clarify particular topics of lectures, discussion on applied methods, solution quality and accuracy.				
Course content lectures	1.Network objective, main parts, types, load conditions, 3h, Learning outcomes:1 2.Constructional characteristics of overhead lines and cables, 3h, Learning outcomes:1,2 3.Quadruples and line parameters (1): resistance, inductance, geometric mean distance method, ground return, grounding conductor, bundle, impedance, 3h, Learning outcomes:1,2 4.Quadruples and line parameters (2): capacitance, ground return effect, partial capacitance, admittance, corona, 3h, Learning outcomes:1,2 5.Distributive network (1): calculation of voltage differences and power losses, transformer influence, 3h, Learning outcomes:1,2 6.Distributive network (2): Loaded line (at several points, at end, continuously and complex, both-sided fed line), cutting technique, 3h, Learning outcomes:1,2 7.Distributive network (3): Network transfiguration (star-polygon, delta-star, neutrals voltage, connecting and disconnecting of source- points, load displacement, unbalanced three phase load), 3h, Learning outcomes:1,2 8.Equivalent schematics of transmission lines: voltage calculations, quadruple chains, two-system transmission line, interlace, 3h, Learning outcomes:1,4,5 9.Line voltage regulation and compensation, compensator power calculations, 3h, Learning outcomes:1,4,5 10.Maximum currents, temperature dependence on external influences, 3h, Learning outcomes:1,4,5 11.Mechanical stresses of overhead lines, equilibrium equation, critical distance of towers, 3h, Learning outcomes:1,4,5 12.Direct and indirect touch protection, 3h, Learning outcomes:1,3 13.Protective grounding, lightning strike protection, 3h, Learning outcomes:1,3 14.Environmental impact, energy quality, 3h, Learning outcomes:1,5 15.Lecture not scheduled - ending exam, 3h, Learning outcomes:1,5,6,7				
Course content auditory	1.Transmission line parameters - examples in electrical network design and calculation (1): line inductance, resistance, geometric mean distance method, 2h, Learning outcomes:6,7 2.Transmission line parameters - examples in electrical network design and calculation (2): line capacity, partial capacitance, line admittance, 2h, Learning outcomes:6,7 3.Distributive networks - examples in electrical network design and calculation (1): direct current networks, one-side supplied transmission line with multiple loads, 2h, Learning outcomes:6,7 4.Distributive networks - examples in electrical network design and calculation (2): single and two phase load extensions in three phase networks, 2h, Learning outcomes:2,4,6,7 5.Distributive networks - examples in electrical network design and calculation (3): closed loop distributive networks, 2h, Learning outcomes:2,4 6.Network transfigurations (1) - network reduction and reconstruction, 2h, Learning outcomes:7 7.Network transfigurations (2) - reduction and reconstruction of radial networj with three phase loads, 2h, Learning outcomes:7 8.Lecture not scheduled - exam scheduled, 2h, Learning outcomes:2,4,6,7 9.Network calculation methods - branch voltages and currents, nod voltages, loop currents, 2h, Learning outcomes:2,4,6,7 10.Transmission line and transformer equivalents, 2h, Learning outcomes:2,4,6,7 11.Simple transmission network calculations, power flow calculation, 2h, Learning outcomes:2,4,6,7 12.Complex transmission networks: power flow calculations, 2h, Learning outcomes:2,4,6,7				

	13.Examples in mechanical network design and calculation (1): one material conductors (aluminium, copper), 2h, Learning outcomes:6,7 14.Examples in mechanical network design and calculation (2) - two material conductors (aluminium-steel), 2h, Learning outcomes:6,7 15.Examples of thermal calculations in electrical network design, 2h, Learning outcomes:6,7
Required materials	Whiteboard with markers Overhead projector Video equipment Special equipment Laptop with touch screen and digitizer pen
Exam literature	Basic literature: 1. M. Ožegović, K. Ožegović: Električne energetske mreže, I-V, FESB, Split, 2002. 2. S. Nikolovski: Elektroenergetske mreže I - Zbirka riješenih zadataka, ETF, Osijek, 1998. Dodatna: 1. Prijenos električne energije auditorne vježbe, FER, Zagreb, 2002. 2. M. Padelin: Zaštita od groma, Školska knjiga, Zagreb, 1987. 3. A. Pabla: Electric Power Distribution, McGraw-Hill, N.Y., USA, 2005.
Students obligations	Lecture attendance
Knowledge evaluation during semester	Lecture attendance 10% Preliminary exams (numerical problem solving) 90%
Knowledge evaluation after semester	Written exam 75% Verbal exam 25%
Student activities:	Aktivnost — ECTS (Constantly tested knowledge) — 5
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
Proposal made by	Tomislav Špoljarić, dipl. ing.

Code WEB/ISVU	24039/189953	**ECTS**	7.0	**Academic year**	2018/2019
Name	Electrical Power Plants				
Status	4th semester - Electrical power engineering (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				60+45 (30+0+0+15) 105
Teachers	Lectures:1. Prof.dr.sc. Krešimir Meštrović Auditory exercises: Ivor Marković , mag. ing. Construction exercises: Ivor Marković , mag. ing.				
Course objectives	students will acquire technical knowledge in the field of medium and high-voltage electric power plants				
Learning outcomes:	1.ability to formulate theoretical calculations of specific types of power plants. Level:6,7 2.ability to identify appropriate equipment for balanced operating of a power plant. Level:6 3.ability to analyze transients at switching on and off in a power plant. Level:6 4.ability to identify schemes of medium and high-voltage installations. Level:6,7 5.ability to generate maintenance procedure of power plants. Level:6 6.ability to test functionality of the plant operating. Level:6 7.ability to formulate requirements for improvement of efficiency in power plants . Level:6				
Methods of carrying out lectures	Ex cathedra teaching Modelling Discussion Questions and answers The material is exposed with previous preparedness of students and and maximizing the use of drawings, diagrams and tables to facilitate understanding. Showing concrete examples through photographs, constructional, project and test documentation. With students are discussed subject material to which they actively participated in teaching. It is necessary to have a notebook and overhead projector.				
Methods of carrying out auditory exercises	Group problem solving Other Solving numerical examples that illustrate particular themes of lectures, and discussion of the applied methodology and quality solutions.				
How construction exercises are held	Group problem solving Other Solving complex examples that follow the theme of lectures.				
Course content lectures	1.Introductory lecture. , 2h 2.Electrical Power Plants, 4h, Learning outcomes:1,2,3 3.Three-phase AC electrical system, 4h, Learning outcomes:1,2,3,4 4.Short circuit and modeling of elements of the EPS, 4h, Learning outcomes:1,2,3,4 5.Short circuit and modeling of elements of the EPS, 2h, Learning outcomes:1,2,3,4 Elements of power system - synchronous generators, 2h, Learning outcomes:2,3 6.Elements of power system - synchronous generators, 2h, Learning outcomes:2,3 Elements of power system - power transformers, 2h, Learning outcomes:2,3 7.Elements of power system - power transformers, 2h, Learning outcomes:2,3 Elements power system - circuit breakers and fuses, 2h, Learning outcomes:2,3 8.First interexams, 2h 9.Elements power system - circuit breakers and fuses, 4h, Learning outcomes:2,3 10.Elements of power system - instrument transformers and measuring, 4h, Learning outcomes:2,3 11.Elements of power system - surge arresters and stress of isolation, 4h, Learning outcomes:2,3 12.Elements of power system - busbars, insulators, disconnectors, 4h, Learning outcomes:2,3,4 13.Transformer substations, 4h, Learning outcomes:2,3,4 14.The secondary circuits - low voltage switchgears, protection and control, 2h, Learning outcomes:2,3,4 Earthing, 2h, Learning outcomes:2,3,4 15.Second interexams, 2h				
Course content auditory	1.Examples of electrical calculations in power system with balanced and unbalanced loads, 2h, Learning outcomes:6,7 2.Examples of electrical calculations in power system with balanced and unbalanced loads, 2h, Learning outcomes:6,7 3.Examples of electrical calculations in power system with balanced and unbalanced loads, 2h, Learning outcomes:6,7 4.Examples of determining the replacement scheme of electrical facilities in the network, 2h, Learning outcomes:6,7 5.Examples of determining the replacement scheme of electrical facilities in the network, 2h, Learning outcomes:6,7 6.Examples of determining the replacement scheme of electrical facilities in the network, 2h, Learning outcomes:6,7 7.First interexams, 1h 8.Calculation of short-circuit current relevant for sizing the plant, 2h, Learning outcomes:6,7 9.Calculation of short-circuit current relevant for sizing the plant, 2h, Learning outcomes:6,7 10.Calculation of short-circuit current relevant for sizing the plant, 2h, Learning outcomes:6,7 11.Calculation of short-circuit current relevant for sizing the plant, 2h, Learning outcomes:6,7 12.Solving problems in selected power systems design, 2h, Learning outcomes:6,7 13.Solving problems in selected power systems design, 2h, Learning outcomes:6,7 14.Second interexams, 1h 15.Repeat first or the second interexams, 2h				
Course content constructures	1.Display method of calculating the particular units of power plants , 1h, Learning outcomes:6,7 2.Display method of calculating the particular units of power plants , 1h, Learning outcomes:6,7 3.Display method of calculating the particular units of power plants , 1h, Learning outcomes:6,7 4.Display method of calculating the particular units of power plants , 1h, Learning outcomes:6,7 5.Display method of calculating the particular units of power plants , 1h, Learning outcomes:6,7 6.Display method of calculating the particular units of power plants , 1h, Learning outcomes:6,7 7.Display method of calculating the particular units of power plants , 1h, Learning outcomes:6,7 8.Making independent design solution of the plant with the necessary calculations and drawings, 1h, Learning outcomes:6,7				

	9.Making independent design solution of the plant with the necessary calculations and drawings, 1h, Learning outcomes:6,7 10.Making independent design solution of the plant with the necessary calculations and drawings, 1h, Learning outcomes:6,7 11.Making independent design solution of the plant with the necessary calculations and drawings, 1h, Learning outcomes:6,7 12.Making independent design solution of the plant with the necessary calculations and drawings, 1h, Learning outcomes:6,7 13.Making independent design solution of the plant with the necessary calculations and drawings, 1h, Learning outcomes:6,7 14.Making independent design solution of the plant with the necessary calculations and drawings, 1h, Learning outcomes:6,7 15.Making independent design solution of the plant with the necessary calculations and drawings, 1h, Learning outcomes:6,7
Required materials	Basic: classroom, blackboard, chalk... Whiteboard with markers Overhead projector Special equipment Notebook, overhead projector.
Exam literature	Basic literature: 1. H. Požar: Visokonaponska rasklopna postrojenja, Tehnička knjiga, Zagreb, 1980. 2. H. Požar: Osnove elektroenergetike I/II, Tehnička knjiga, Zagreb, 1972. Additional literature: 1. M.E. El-Hawayar: Electrical Power Systems, IEEE Press, 1983. 2. Electrical Power Engineering Handbook: Power Systems, CRC Press, 2007. 3. Electrical Power Engineering Handbook: Eledctric Power Generation, Transmission and Distribution,CRC Press, 2007. 4. Electrical Power Engineering Handbook: Electric Power Transformer Engineering, CRC Press, 2007. 5. Electrical Power Engineering Handbook: Electric Power Substations Engineering, CRC Press, 2007.
Students obligations	Attending lectures and exercises. Making a construction task.
Knowledge evaluation during semester	Written examination: First mid-term - four tasks, 12 points Second mid-term - four tasks, 12 points For passage should be #8805; 50% of both mid-term exams. Oral exam: First mid-term - 5 questions, 15 points Second mid-term - 5 questions, 15 points For passage should be #8805; 50% of both mid-term exams.
Knowledge evaluation after semester	Written exam (a prerequisite for the oral exam): 4 task, 12 points For passage should be #8805; 50% Constructional task (a prerequisite for the oral examination). Oral exam: 10 questions, 30 points. For passage should be #8805; 50%
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
ISVU equivalents:	26093;
Proposal made by	Prof.Ph.d. Krešimir Meštrović

Code WEB/ISVU	23959/184788	**ECTS**	8.0	**Academic year**	2018/2019
Name	Electricity and magnetism				
Status	2nd semester - Undergraduate professional study in electrical engineering (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				45+60 (45+15+0+0) 135
Teachers	Lectures:1. Davor Šterc Lectures:2. mr.sc. Veselko Tomljenović viši predavač Lectures: Vladimir Šimović Auditory exercises: Želimir Ivanović Auditory exercises: Vladimir Šimović Auditory exercises: Davor Šterc Auditory exercises:mr.sc. Veselko Tomljenović viši predavač Auditory exercises: Vatroslav Zuppa Bakša Laboratory exercises: Frane Brkić Laboratory exercises: Tomislav Đuran , dipl. ing. Laboratory exercises: Robert Herčeki Laboratory exercises: Želimir Ivanović Laboratory exercises: Aleksandar Kiričenko Laboratory exercises:mr.sc. Zoran Kovačević predavač Laboratory exercises:mr.sc. Krunoslav Martinčić Laboratory exercises: Vladimir Šimović Laboratory exercises: Petar Tomljanović				
Course objectives	students will acquire basic knowledge of electromagnetism				
Learning outcomes:	1.ability to solve problems in the field of electrostatics. Level:6 2.ability to calculate examples of DC circuits. Level:6 3.ability to find out solutions to the problems in the field of electromagnetism. Level:6,7 4.ability to experimentally verify (by measurements) some basic physical laws important in electrical engineering. Level:6 5.ability to analyze the given problem, calculate required values and estimate the physical aspect of calculated values . Level:6				
Methods of carrying out lectures	Ex cathedra teaching Case studies Discussion Questions and answers Lecturing is carried out with the help of PowerPoint presentations and continuous testing of acquired knowledge.				
Methods of carrying out auditory exercises	Group problem solving Discussion, brainstorming Examples with active participation of students and continuous testing of acquired skills.				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Group problem solving Test of student readiness for the exercise, exercises in small groups of students,10individual preparation of the report, and test of the acquired knowledge.				
Course content lectures	1.Basic ideas of electricity, Coulomb, 3h, Learning outcomes:1 2.Gauss law, Electric potential, energy of the electric field., 3h, Learning outcomes:1 3.Electrical dipole, conductor in the electrostatic field, Dielectrics in the electrostatic field, displacement vector., 3h, Learning outcomes:1 4.Electric capacitance., 3h, Learning outcomes:1 5.Prvi kolokvij., 3h, Learning outcomes:1 6.Motion of charges in conductor, electric resistance, Ohm, 3h, Learning outcomes:2 7.Work and power of electric energy of alternating voltage, simple current circuit, the maximum power transfer theorem, efficiency., 3h, Learning outcomes:2 8.Complex electric circuits, Kirchoff, 3h, Learning outcomes:2 9.Drugi kolokvij., 3h, Learning outcomes:2 10.Magnetic field, Biot-Savart, 2h, Learning outcomes:3 11.Forces in the magnetic field. Magnetic characteristics of matter., 3h, Learning outcomes:3 12.Magnetic circuit., 3h, Learning outcomes:3 13.Electromagnetic induction., 3h, Learning outcomes:3 14.Self-inductance and mutual inductance., 3h, Learning outcomes:3 15.Energy and forces in the magnetic field., 2h, Learning outcomes:3 Zavrni ispit., 1h, Learning outcomes:3				
Course content auditory	1.Vectors and operations with vectors, basic units of measurement., 3h, Learning outcomes:5 2.Basics of electricity, Coulomb, 3h, Learning outcomes:5 3.Gausss law, Electric potential, Energy of the electric field., 3h, Learning outcomes:5 4.Matter in the electric field., 3h, Learning outcomes:5 5.Electric capacitance., 3h, Learning outcomes:5 6.Motion of charges in the conductor, Electric resistance, Ohm, 3h, Learning outcomes:5 7.Simple current circuits, The maximum power transfer theorem, Efficiency., 3h, Learning outcomes:5 8.Complex electric circuits, Kirchoff, 3h, Learning outcomes:5 9.Complex electric circuits, Kirchoff, 3h, Learning outcomes:5 10.Magnetic field, Biot-Savart, 3h, Learning outcomes:5 11.Forces in the magnetic field, Magnetic characteristics of matter., 3h, Learning outcomes:5 12.Magnetic circuit., 3h, Learning outcomes:5 13.Electromagnetic induction., 3h, Learning outcomes:5 14.Self-inductance and mutual inductance,, 3h, Learning outcomes:5 15.Energy and forces in the magnetic field., 3h, Learning outcomes:5				

Course content laboratory	1.Measuring equipment., 1h, Learning outcomes:4 2.Measuring equipment., 1h, Learning outcomes:4 3.Measuring equipment., 1h, Learning outcomes:4 4.Electric charge and electric induction., 1h, Learning outcomes:4 5.Electric charge and electric induction., 1h, Learning outcomes:4 6.Electric charge and electric induction., 1h, Learning outcomes:4 7.Connections of capacitors., 1h, Learning outcomes:4 8.Connections of capacitors., 1h, Learning outcomes:4 9.Connections of capacitors., 1h, Learning outcomes:4 10.Magnetism and forces., 1h, Learning outcomes:4 11.Magnetism and forces., 1h, Learning outcomes:4 12.Magnetism and forces., 1h, Learning outcomes:4 13.Electromagnetic induction., 1h, Learning outcomes:4 14.Electromagnetic induction., 1h, Learning outcomes:4 15.Electromagnetic induction., 1h, Learning outcomes:4
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory Overhead projector
Exam literature	Basic literature: 1. B. Kuzmanović, Osnove elektrotehnike I, Element, Zagreb, 2004. 2. Branislav Kuzmanović: Osnove elektrotehnike I, Zbirka zadataka i pitanja, Element, Zagreb, 2005. Additional literature: 1. V. Pinter, Osnove elektrotehnike I, Tehnička knjiga, Zagreb, 1994. 2. Mandić: Osnove elektrotehnike 1, Bilješke s predavanja (PowerPoint format) 3. E. Šehović, M. Tkalić, I. Felja, Osnove elektrotehnike - zbirka primjera, I dio, Školska knjiga, Zagreb, 1984.
Students obligations	Attendance of all laboratory exercises and 70% of lectures
Knowledge evaluation during semester	Mid-term, numerical tasks#3#50#40$Mid-term, theoretical questions#3#50#40$
Knowledge evaluation after semester	Written examination#1#50#40$Oral examination#1#50#50$
Remark	This course can not be used for final thesis theme
Prerequisites:	No prerequisites.
ISVU equivalents:	22241;
Proposal made by	Dr. sc. Gordana Lukić, prof.v.šk., Mr.sc. Veselko Tomljenović, v. pred.

Code WEB/ISVU	22863/22287	**ECTS**	5.0	**Academic year**	2018/2019
Name	Electronic Circuits				
Status	3rd semester - Electrical power engineering (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (15+15+0+0) 90
Teachers	Lectures:1. mr.sc. Krunoslav Martinčić Lectures:2. Željko Stojanović Auditory exercises: Aleksandar Kiričenko Laboratory exercises: Aleksandar Kiričenko Laboratory exercises: Željko Stojanović				
Course objectives	students will acquire basic knowledge of analog, pulse and digital circuits and their properties and applications				
Learning outcomes:	1.Ability to analyze simple voltage regulators. Level:6 2.Ability to analyze simple bipolar and unipolar transistor amplifiers. Level:6 3.Ability to construct simple amplifiers. Level:6,7 4.Ability to find amplitude and phase frequency response. Level:6 5.Ability to classify types of electronic circuits. Level:6,7 6. Ability to solve power consumption of each component of simple analog circuits. Level:6 7.Ability to distinguish basic pulse and digital circuits. Level:6				
Methods of carrying out lectures	Ex cathedra teaching Case studies Discussion Questions and answers				
Methods of carrying out auditory exercises	Traditional literature analysis Discussion, brainstorming Other Problems solving				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Traditional literature analysis Discussion, brainstorming Mind mapping				
Course content lectures	1.Introduction, 2h, Learning outcomes:5 2.One stage amplifiers. Common emitter amplifier, 2h, Learning outcomes:2,3,5,6 3.Common emitter amplifier, 2h, Learning outcomes:2,3,5,6 4.Common emitter amplifier, 1h, Learning outcomes:2,3,5,6 Common collector amplifier, 1h, Learning outcomes:2,3,5,6 5.Common collector amplifier, 1h, Learning outcomes:2,3,5,6 Transistor series voltage regulator, 1h, Learning outcomes:1,6 6.Common source amplifier, 2h, Learning outcomes:2,3,5,6 7.Common drain amplifier, 2h, Learning outcomes:2,3,5,6 8.Amplitude and phase response, 2h, Learning outcomes:2,3,4,5,6 9.Amplitude and phase response, 2h, Learning outcomes:2,3,4,5,6 10.Amplitude and phase response, 1h, Learning outcomes:2,3,4,5,6 Pulse electronics - Comparators, 1h, Learning outcomes:5,7 11.Pulse electronics - Comparators, 1h, Learning outcomes:5,7 Pulse electronics - Multivibrators, 1h, Learning outcomes:5,7 12.Pulse electronics - Multivibrators, 1h, Learning outcomes:5,7 Logic circuits - Binary system and Boolean algebra, 1h, Learning outcomes:7 13.Logic circuits - Combinational circuits, 2h, Learning outcomes:5,7 14.Logic circuits - Sequentional circuits, 2h, Learning outcomes:5,7 15.AD and DA converters, 2h, Learning outcomes:5,7				
Course content auditory	1.Introduction, 1h, Learning outcomes:2,4,6 2.Introduction, 1h, Learning outcomes:2,4,6 3.One stage amplifiers. Common emitter amplifier, 1h, Learning outcomes:1,6 4.One stage amplifiers. Common emitter amplifier, 1h, Learning outcomes:2,3,5,6 5.Common collector amplifier, 1h, Learning outcomes:2,3,5,6 6.Transistor series voltage regulator, 1h, Learning outcomes:1,6 7.Common source amplifier, 1h, Learning outcomes:2,3,5,6 8.Common drain amplifier, 1h, Learning outcomes:2,3,5,6 9.Amplitude and phase frequency response, 1h, Learning outcomes:2,3,4,5,6 10.Amplitude and phase frequency response, 1h, Learning outcomes:2,3,4,5,6 11.Amplitude and phase frequency response, 1h, Learning outcomes:2,3,4,5,6 12.Pulse electronics, 1h, Learning outcomes:5,7 13.Pulse electronics and logic circuits, 1h, Learning outcomes:5,7 14.Logic circuits, 1h, Learning outcomes:5,7 15.Logic circuits and AD/DA converters, 1h, Learning outcomes:5,7				
Course content laboratory	1.There is no lessons 2.There is no lessons 3.There is no lessons 4.There is no lessons 5.Common emitter amplifier, 2h, Learning outcomes:2,3,5,6 6.There is no lessons 7.Common collector amplifier, 2h, Learning outcomes:2,3,5,6				

	8.Common source amplifier, 2h, Learning outcomes:2,3,5,6 9.There is no lessons 10.There is no lessons 11.Amplitude and phase response, 2h, Learning outcomes:2,3,4,5,6 12.There is no lessons 13.Pulse electronics, 2h, Learning outcomes:5,7 14.Logic circuits, 2h, Learning outcomes:5,7 15.There is no lessons
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory Whiteboard with markers Maquette Tools Operating supplies Special equipment The new knowledge from lectures is demonstrated with real life practical examples. The laboratoryexercises include measurements and recording of charactreristics that confirm the presented theory of operation. The excercises are conducted by teams of two students per team.
Exam literature	Basic literature: 1. P. Biljanović, Elektronički sklopovi, Školska knjiga, Zagreb, 1993 2. Ž. Butković, J.Divković-Pukšec, A.Barić, Elektronika II , FER, Zagreb, 2010 3. A. Szabo, Impulsna i digitalna elektronika I, II, COUO Ruđer Bošković, Zagreb 1988 4. Ž. Stojanović, Elektronički sklopovi - laboratorijske vježbe, TVZ, Zagreb, 2017 Dodatna: 1. R. Boylestad, L. Nashelsky, Electronic devices and circuit theory, Prentice-Hall, 1987 2. Ž. Butković, G. Zelić, Elektronički sklopovi-Zbirka zadataka, FER, Zagreb, 1995
Students obligations	Students have to earn 50% of total points in laboratory. Assesment: - Attendance - 1 point - Preparation for laboratory - 1 point - Measurement report - 1 point - Exam instead laboratory exercises - 3 points. The total number of points is 18.
Knowledge evaluation during semester	Conditions for passing the exam: - At least 9 points of 18 at laboratory exercises, - At least 43 points of 82 on two partial exams, each exam at least 35%, - Complete oral exam at first terms for exams. Maximum number of points is 40 at first exam and 42 at second exam. Overal scoring: a) - Laboratory exercises - at least 14 points of 18 - Partial exams - at least 56 points of 82, and each exam at least 50% Evaluation 90-100 points - 5 80-90 points - 4 70-80 points - 3 Students do not have to take oral exam. They passed the exam completely. b) - Laboratory exercises - at least 12 points of 18 - Partial exams - at least 43 points of 82, and each exam at least 35% Evaluation 69-76 points - 3 55-69 points - 2 Students have to take oral exam at the first term of exam.
Knowledge evaluation after semester	Written exam comprises 5 tasks. Value of each task is 10 points. Evaluation less then 50% points#8594;1 50% - 60% points#8594;2 61% - 74% points#8594;3 75% - 89% points#8594;4 More then 89% points#8594;5 Students who pass the written exam have to take oral exam.
Student activities:	Aktivnost — ECTS (Experimental work) — 1 (Constantly tested knowledge) — 4
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
Proposal made by	Željko Stojanović

Code WEB/ISVU	22852/22244	**ECTS**	6.0	**Academic year**	2018/2019
Name	Electronic Components				
Status	2nd semester - Undergraduate professional study in electrical engineering (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				45+30 (15+15+0+0) 105
Teachers	Lectures:1. mr.sc. Krunoslav Martinčić Lectures:2. Željko Stojanović Lectures: Aleksandar Kiričenko Auditory exercises: Robert Herčeki Auditory exercises: Aleksandar Kiričenko Auditory exercises:mr.sc. Krunoslav Martinčić Auditory exercises: Željko Stojanović Laboratory exercises: Aleksandar Kiričenko Laboratory exercises:mr.sc. Darko Lukša dipl.ing Laboratory exercises:mr.sc. Krunoslav Martinčić Laboratory exercises: Željko Stojanović				
Course objectives	students will acquire basic knowledge in the field of semiconductors and electronic components				
Learning outcomes:	1.ability to calculate electron-hole balance in a semiconductor. Level:6 2.ability to calculate contact potential and electric field in the PN barrier. Level:6 3.ability to construct simple rectifiers and voltage stabilizers. Level:6,7 4.ability to calculate the common emitter amplifier, draw static and dynamic characteristics. Level:6 5.ability to draw simple circuits with operational amplifier and describe its operating principle. Level:6 6.ability to calculate the values of elements in a basic thyristor circuit . Level:6 7.ability to draw symbols of semiconductor components and name the electrodes. Level:6				
Methods of carrying out lectures	Ex cathedra teaching Discussion Questions and answers Explanations include theory of operation, use of circuit diagrams, tables, and real life examples including the application notes from component manufacturers.				
Methods of carrying out auditory exercises	Specific examples are used to demonstrate principles of operation and reinforce the new30knowledge presented during lectures. The regularly required homework is used to stimulate independent student studies at home				
Methods of carrying out laboratory exercises	The new knowledge from lectures is demonstrated with real life practical examples. The10laboratory exercises include measurements and recording of characteristics that confirm the presented theory of operation. The exercises are conducted by teams of two students per team.				
Course content lectures	1.Semiconductors, 3h, Learning outcomes:1,2,3 2.PN Junction, I(V) Characteristics, Rectifier, 3h, Learning outcomes:1,2,3 3.Zener Diode, Varicap Diode, Voltage Regulator, 3h, Learning outcomes:1,2,3 4.LED, Solar Cells, 3h, Learning outcomes:1,2,3 5.BJT I(V) Characteristics, 3h, Learning outcomes:4 6.BJT, Active Mode, CE Amplifier, h-model, 3h, Learning outcomes:4 7.BJT, CC Amplifier, 3h, Learning outcomes:4 8.BJT as a Switch, 3h, Learning outcomes:4 9.Unipolar Transistor-FET, I(V) Characteristics, 3h, Learning outcomes:4,5 10.Unipolar Transistor-MOSFET, I(V) Characteristics, 3h, Learning outcomes:4,5 11.Unipolar Transistors Amplifiers, 3h, Learning outcomes:4,5 12.Operational Amplifier Basic Properties, 3h, Learning outcomes:5 13.Inverting and Noninverting Amplifier, 3h, Learning outcomes:5 14.OP-Amp: Adder, Comparator, Differentiator, Integrator, 3h, Learning outcomes:5 15.Thyristor, IGBT, 3h, Learning outcomes:6,7				
Course content auditory	1.Diode I(V) Characteristic, 1h, Learning outcomes:1,2,3 2.Rectifiers, 1h, Learning outcomes:1,2,3 3.Voltage Regulators, 1h, Learning outcomes:1,2,3 4.Limiters, 1h, Learning outcomes:1,2,3 5.BJT I(V) Characteristics, 1h, Learning outcomes:4 6.H-model, 1h, Learning outcomes:4 7.BJT-CE Circuit, 1h, Learning outcomes:4 8.BJT-CC Circuit, 1h, Learning outcomes:4 9.JFET I(V) Characteristics, 1h, Learning outcomes:4,5 10.JFET- CS Amplifier, 1h, Learning outcomes:4,5 11.MOSFET- CS Amplifier, 1h, Learning outcomes:4,5 12.Op-Amp, Inverting and Noninverting Amplifier, 1h, Learning outcomes:5 13.Op-Amp Adder Circuit, 1h, Learning outcomes:5 14.Op-Amp Differentiator Circuit, 1h, Learning outcomes:5 15.Thyristor and IGBT Circuits, 1h, Learning outcomes:6,7				
Course content laboratory	1.Diode I(V) Characteristics and Rectifier, 2.5h, Learning outcomes:1,2,3,7 2.Zener Diode I(V) Characteristics and Voltage Regulator, 2.5h, Learning outcomes:1,2,3,7 3.Bipolar Junction Transistor (BJT) Output Characteristics (CE), 2.5h, Learning outcomes:4,7 4.Common Emitter Amplifier, 2.5h, Learning outcomes:4,7 5.J-FET Output Characteristics (CS), 2.5h, Learning outcomes:5,7 6.Basic Operational Amplifier Circuits, 2.5h, Learning outcomes:5,6,7 7.- 8.- 9.-				

	10.- 11.- 12.- 13.- 14.- 15.-
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory Overhead projector
Exam literature	Basic literature: 1. P. Biljanović, Poluvodički elektronički elementi, Školska knjiga, Zagreb, 1996. 2. Ž.Butković, J.Divković-Pukšec, A.Barić: Elektronika I, 1., 2., 3. dio FER, Zagreb.2009 3. J. Šribar, J. Divković-Pukšec, Elektronički elementi, Zbirka zadataka, Element, 1996. 4. M. Dozet, Ž. Stojanović, K.Martinčić: Zbirka zadataka-u pripremi Dodatna: 1. Katalozi proizvođača elektroničkih komponenti.
Students obligations	maximum of 3 absences from exercises
Knowledge evaluation during semester	Redovitost pohaa#6#6#100$Kolokvij, numeri zadaci#2#70#35$Kolokvij, teorijska pitanja#2#12#35$Prakti rad#6#12#50$
Knowledge evaluation after semester	Written and oral examination.
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
Proposal made by	mr. sc. Krunoslav Martinčić, lecturer

Code WEB/ISVU	23040/75867	**ECTS**	5.0	**Academic year**	2018/2019
Name	Embedded Systems Design and Applications				
Status	6th semester - Communication and computer technology (Redovni elektrotehnika) - elective course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+45 (0+15+15+15) 75
Teachers	Lectures:1. Marko Miletić Laboratory exercises: Marko Miletić Seminar exercises: Marko Miletić Construction exercises: Marko Miletić				
Course objectives	students will be introduced to embedded systems, their designing and programming and the examples of their applications in which the microcontroller based embedded systems perform their operations within a more complex system				
Learning outcomes:	1.ability to analyze functional requirements when designing systems with embedded microcontroller. Level:6 2.ability to draw a circuit diagram of embedded system with microcontroller. Level:6 3.ability to design software and hardware interfaces of embedded system according to functional specifications. Level:6 4.ability to integrate their own solutions to sensors and controllers with evaluation board. Level:6,7 5.ability to inspect the operating of real time embedded system with microcontroller using debugger. Level:6 6.ability to compare 8-bit and 32-bit microcontrollers with regard to their properties and available resources. Level:6,7 7.ability to test the operating of embedded system circuits using the programs for simulating the circuit and modeling the operating system . Level:6 8.ability to prepare project documentation and a wiki project page . Level:6,7				
Involvement of learning outcomes of the course in study programme:	6.5.KIRT Izabrati transformatore, nadzemne vodove i sklopne aparate za prijenos i distribuciju električne energije: 10h in 150h				
Methods of carrying out lectures	Ex cathedra teaching Demonstration Simulations During lectures, examples will be shown to demonstrate practical work with development boards which students will use during lab exercises and/or independent project work (construction program).				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Laboratory exercises, computer simulations Computer simulations Laboratory exercises accompany lectures, but can also represent a rounded whole project (work in extensions that continues at home). Students work individually or at most in twos at one development board. Teams are formed depending on the project and an example for establishing communication between different boards. Preparations for the exercise are performed at home, in consultation and guidance in class before exercise.				
Methods of carrying out seminars	Traditional literature analysis Essay writing Discussion, brainstorming Computer simulations Other Seminar deals with a selected topic in the field of working with microcontrollers and embedded systems. Does not seek the practical realization of the project, the emphasis is on documentation and presentation. Student can pass the exam by defending seminars throughout the semester before the instructor and other students. Students who have only seminars and laboratory exercises without realization of project can not make final theses in this fiels. Seminar is made independently at home and can not be teamwork. Each students seminar is defended independently and graded paper represents written exam.				
How construction exercises are held	Laboratory exercises on laboratory equipment Laboratory exercises, computer simulations Computer simulations Other Construction program is the realization of the project tasks. The project is selected independently with the approval of teachers from the list of proposed projects. It implies work at home with consultation during the semester. It is possible to continue the project even after examination as preparation of the final paper. Only students who have chosen the construction task can choose the final theses in this course. It is possible to work in a team of more members. After successfully defending construction progran, members of the team will be assessed proportional to their contribution (points awarded by the team leader within given quota). Students who work construction program are not required to attend the lab. exercises, except for the consultation and the use of development boards and measurement equipment.				
Course content lectures	1.Application of embedded systems with microcontrollers in the industry and telecommunications. , 2h, Learning outcomes:1,2,3 2.Comparison of features of 8-bit and 32-bit microcontrollers (8051 and ARM). , 2h, Learning outcomes:3,4,6 3.Characteristic features of microcontroller programming in C programming language. , 2h, Learning outcomes:3,5 4.Analog and digital interfaces for environment and the user. , 2h, Learning outcomes:2,3,4 5.Communication interfaces and protocols that are often used in embedded applications., 2h, Learning outcomes:2,3,4 6.Character-based and graphical interfaces for embedded systems. , 2h, Learning outcomes:2,3,4,6 7.Detecting hardware and software faults and testing programs., 2h, Learning outcomes:3,5,7 8.Software tools for simulation of microcontroller and their environment., 2h, Learning outcomes:2,3,4,5,6,7 9.Software tools for documenting program., 2h, Learning outcomes:2,7,8 10. Maintenance programs and version control. , 2h, Learning outcomes:3,5,7,8 11.Linux in Embedded Systems., 2h, Learning outcomes:3,6 12. Operating systems and software tools are open source (Open Source)., 2h, Learning outcomes:3,7,8 13. Programming to work in real time (RTOS). , 2h, Learning outcomes:3,6,7 14.Distributed embedded systems., 2h, Learning outcomes:2,4 15.no class, 2h, Learning outcomes:3				

Course content laboratory	1.no class, 2h 2.no class, 2h 3.introductory exercise, 2h, Learning outcomes:7,8 4.work with 8 bit microcontroller for control of simple external devices and components, 2h, Learning outcomes:1,4 5.work with 8 bit microcontroller for control of complex external devices and components, 2h, Learning outcomes:1,3,4 6.work with 8 bit microcontroller with A/D conversion, 2h, Learning outcomes:1,3,4 7.work with 8 bit microcontroller (mix of previous exercises), 2h, Learning outcomes:1,2,3,4 8.work with 8 bit microcontroller (mix of previous exercises), 2h, Learning outcomes:1,2,3,4 9.work with character-based and graphical interfaces, 2h, Learning outcomes:1,2,3,4 10.work with software for documenting program., 2h, Learning outcomes:1,2,3,4,7,8 11.work with 32 bit microcontroller - introduction, 2h, Learning outcomes:1,2,3,4,5,6 12.work with 32 bit microcontroller - advanced, 2h, Learning outcomes:1,2,3,4,5,6 13.work on student project, 2h, Learning outcomes:1,2,3,4,5,6,7,8 14.work on student project, 2h, Learning outcomes:1,2,3,4,5,6,7,8 15.no class, 2h
Course content seminars	1.no class (work from home), 2h 2.no class (work from home), 2h 3.no class (work from home), 2h 4.no class (work from home), 2h 5.no class (work from home), 2h 6.no class (work from home), 2h 7.no class (work from home), 2h 8.no class (work from home), 2h 9.no class (work from home), 2h 10.no class (work from home), 2h 11.no class (work from home), 2h 12.no class (work from home), 2h 13.no class (work from home), 2h 14.no class (work from home), 2h 15.no class (work from home), 2h
Course content constructures	1.no class (work from home), 2h 2.no class (work from home), 2h 3.no class (work from home), 2h 4.no class (work from home), 2h 5.no class (work from home), 2h 6.no class (work from home), 2h 7.no class (work from home), 2h, Learning outcomes:1,2,3,4,5,6,7,8 8.no class (work from home), 2h, Learning outcomes:1,2,3,4,5,6,7,8 9.no class (work from home), 2h, Learning outcomes:1,2,3,4,5,6,7,8 10.no class (work from home), 2h, Learning outcomes:1,2,3,4,5,6,7,8 11.no class (work from home), 2h, Learning outcomes:1,2,3,4,5,6,7,8 12.no class (work from home), 2h, Learning outcomes:1,2,3,4,5,6,7,8 13.no class (work from home), 2h, Learning outcomes:1,2,3,4,5,6,7,8 14.no class (work from home), 2h, Learning outcomes:1,2,3,4,5,6,7,8 15.no class (work from home), 2h, Learning outcomes:1,2,3,4,5,6,7,8
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory Special purpose computer laboratory Whiteboard with markers Overhead projector Maquette Special equipment Construction program is the realization of the project tasks. The project is selected independently with the approval of teachers from the list of proposed projects. It implies work at home with consultation during the semester. It is possible to continue the project even after examination as preparation of the final paper. Only students who have chosen the construction task can choose the final theses in this course. It is possible to work in a team of more members. After successfully defending construction progran, members of the team will be assessed proportional to their contribution (points awarded by the team leader within given quota). Students who work construction program are not required to attend the lab. exercises, except for the consultation and the use of development boards and measurement equipment.
Exam literature	BUDIN, LEO: Mikroračunala i mikroupravljači. Element, Zagreb, ISBN 953-6098-69-5, 2001
Students obligations	While individually doing design exercise, students are faced with real problems in carrying out the project. Demonstration versions of development tool and simulators or the open code tools are used. It is possible to test the program on a real board using available licensing software tools or open source code during the laboratory exercises or consultations.
Knowledge evaluation during semester	Quizz (midterm, final term) 50% of the final mark Student project 50% of the final mark
Knowledge evaluation after semester	Written exam Oral exam
Student activities:	Aktivnost — ECTS (Written exam) — 1 (Oral exam) — 1 (Constantly tested knowledge) — 2

	(Practical work) 1
Remark	This course can be used for final thesis theme
Prerequisites:	Students cannot enroll in this course unless they have passed Digitalni sklopovi E Students cannot enroll in this course unless they have passed Programiranje
Proposal made by	mr. sc. Dražen Ćika, pred. and Stipe Predanić

Code WEB/ISVU	22857/22266	**ECTS**	4.0	**Academic year**	2018/2019
Name	Engineering Mechanics				
Status	3rd semester - Electrical power engineering (Redovni elektrotehnika) - obligatory course3rd semester - Control and computer engineering in automation (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (30+0+0+0) 60
Teachers	Lectures:1. Karmen Mott Bingula dipl.ing.stroj. Lectures: Vesna Alić-Kostešić dipl.ing.stroj. Auditory exercises: Karmen Mott Bingula dipl.ing.stroj.				
Course objectives	Students will broaden previously obtained knowledge in the module of Physics and be qualified to apply the knowledge in electrical engineering.				
Learning outcomes:	1.ability to calculate strength and deformation of mechanical constructions. Level:6 2.ability to construct electromotive force. Level:6,7 3.ability to analyze stress and strain in the given constructions. Level:6 4.ability to calculate the elements of electric drives. Level:6 5.ability to draw kinematic diagrams of electric drives and simple mechanical circuits. Level:6				
Methods of carrying out lectures	Ex cathedra teaching Case studies Simulations				
Methods of carrying out auditory exercises	Group problem solving Traditional literature analysis Data mining and knowledge discovery on the Web Discussion, brainstorming Interactive problem solving Auditory: Solving simpler problems which illustrate the topics covered by the lectures, in order to increase understanding and achieve a higher level of knowledge. Students are active and solve the problems on the blackboard.				
Course content lectures	1.Rigid body mechanics: Active forces and reactions., 2h, Learning outcomes:1 2.Adding forces, definition of resultant force. Moment of force and moment of couple., 2h, Learning outcomes:1 3.Reduction of forces to a given point. Statical equilibrium: coplanar forces, Statical equilibrium: forces in three dimensions, 2h, Learning outcomes:1 4.Components of internal forces: axial force, transverse force, bending moment, 2h, Learning outcomes:1 5.1st test, 2h, Learning outcomes:1 6.Mechanics of deformable bodies: Definition of stress and strain; Hooke, 2h, Learning outcomes:1 7.Stress and strain of axially loaded rod. Center of gravity, static moment of area, axial and polar moment of inertia., 2h, Learning outcomes:1 8.Torsion stress and strain; design for strength. Bending stress and strain; design for strength., 2h, Learning outcomes:1,3 9.Combined load: bending and torsion of transmission shafts., 2h, Learning outcomes:1,3 10.2nd test, 2h, Learning outcomes:1,3 11.Rigid body dynamics: translation and rotation of rigid body. Planar motion. Introduction to the particle and system dynamics., 2h, Learning outcomes:1,5 12.Force impulse, work and energy (potential, kinetic), power. Center of mass, rigid body moment of inertia., 2h, Learning outcomes:1,5 13.Kinetic energy of a system; mechanical energy conservation law., 2h, Learning outcomes:1 14.Basic dynamics of electromotive drives. Elements of the drive: working machine, clutches, transmission elements,engine., 2h, Learning outcomes:2,4,5 15.3rd test, 2h, Learning outcomes:1,2,3,4,5				
Course content auditory	1.Calculation of the resultant of coplanar forces., 2h, Learning outcomes:1 2.Application of the coplanar forces equilibrium equation., 2h, Learning outcomes:1 3.Equilibrium of forces in three dimensions., 2h, Learning outcomes:1 4.Internal forces components calculation: a beam on two supports., 2h, Learning outcomes:1,3 5.Calculation of stress and strain of axially loaded rods., 2h, Learning outcomes:1,3 6.Calculation of moment of inertia of composite area., 2h, Learning outcomes:1 7.Examples of design calculations for torsion loads; statically indeterminate cases., 2h, Learning outcomes:1 8.Design of shafts., 2h, Learning outcomes:1 9.Stress calculation in combined load cases., 2h, Learning outcomes:4,5 10.Examples of translational and rotational motion., 2h, Learning outcomes:5 11.Moments of inertia of solid rod, cylinder, ball., 2h, Learning outcomes:5 12.Kinematic diagram. Examples of translational and rotational motion., 2h, Learning outcomes:2,4 13.Transmission (belt, gear, friction). Transmission ratio., 2h, Learning outcomes:2,4 14.Conservation of mechanical energy, inertial force, friction, efficiency., 2h, Learning outcomes:4,5 15.Work and power in rotational motion Examples in dynamics of electromotive drives., 2h, Learning outcomes:4,5				
Required materials	Basic: classroom, blackboard, chalk... Whiteboard with markers Overhead projector Portable overhead projector Maquette				
Exam literature	Basic literature: B. Kunovac, Mehanika i elementi konstrukcija, bilješke s predavanja, 1997. Additional literature: O. Muftić, Mehanika,Tehnička knjiga,Zagreb, 1991. K.H. Decker, Elementi strojeva, Tehnička knjiga,Zagreb, 1987.				

	I. Alfirević, Nauka o čvrstoći I, Tehnička knjiga d.d., Zagreb, 1995. B. Kraut: Strojarski priručnik, 2012.
Students obligations	regular class attendance, minimal number of points in homework or seminar paper
Knowledge evaluation during semester	tests, numerical and theoretical questions; homework assignments
Knowledge evaluation after semester	Writen exam, Oral exam
Remark	This course can not be used for final thesis theme
Prerequisites:	No prerequisites.
Proposal made by	Čedomir Jurčec, lecturer

Code WEB/ISVU	23388/155632	**ECTS**	2.0	**Academic year**	2018/2019
Name	English Language				
Status	1st semester - Undergraduate professional study in electrical engineering (Redovni elektrotehnika) - elective course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				15+30 (30+0+0+0) 15
Teachers	Lectures:1. Marija Krstinić Lectures:2. Zoran Vulelija Auditory exercises: Marija Krstinić Auditory exercises: Zoran Vulelija				
Course objectives	students will acquire elementary competence in communication and knowledge of basic professional terminology necessary for translating easy texts in professional literature; systematize and broaden the knowledge of the English language structures with emphasis on professional language; develop the skill of writing messages and notes				
Learning outcomes:	1.ability to communicate at the standard basic level. Level:6,7 2.ability to write short personal letters, notes and messages using auxiliary literature (dictionaries and handbooks). Level:6,7 3.ability to integrate familiar language structures into a new context. Level:6,7 4.ability to identify and translate basic professional terminology. Level:6 5.ability to distinguish between established stereotypes and intercultural characteristics. Level:6 6.ability to integrate professional terminology into short written reports. Level:6,7 7.ability to establish similarities and differences between the language structures of Croatian and English. Level:6				
Methods of carrying out lectures	Ex cathedra teaching Case studies Questions and answers Seminar, students presentation and discussion Homework presentation Interactive lectures, i.e. continuous participation of students, using drills and exercises from text books, or by means of an over-head projector.				
Methods of carrying out auditory exercises	Laboratory exercises on laboratory equipment Laboratory exercises, computer simulations Group problem solving Discussion, brainstorming Grammar and vocabulary drills and exercises in class and in the computer laboratory(on-line learning).				
Course content lectures	1.Present Tenses, Word Order, 2h, Learning outcomes:1 2.Past Tenses, 2h, Learning outcomes:7 3.Sequence of tenses, 2h, Learning outcomes:1 4.Articles, Commands, 2h, Learning outcomes:1,3 5.Zero and 1st conditional, 2h, Learning outcomes:1,2,3,4 6.The Engineering Profession, 2h, Learning outcomes:1,3,4,6,7 7.The Bologna Process in the Department of Electrical Engineering, ECST, 2h, Learning outcomes:1 8.The Structure of Matter, 2h, Learning outcomes:4,6 9.The Electric Current, 2h, Learning outcomes:4,6,7 10.Electric Circuits, 2h, Learning outcomes:5,6 11.The Effects of an Electric Current, 2h, Learning outcomes:6,7 12.Conductors, Insulators, Semiconductors, 2h, Learning outcomes:4,5,6 13.Batteries and Capacitors, 2h, Learning outcomes:3,4,5 14.Your Career as an Electrical Engineer, 2h, Learning outcomes:1,2,3 15.What is Energy?, 2h, Learning outcomes:4,5,6				
Course content auditory	1.Present Tenses, Word Order, 2h, Learning outcomes:1,2,3 2.Past Tenses, 2h, Learning outcomes:1,2,3 3.Sequence of tenses, 2h, Learning outcomes:1,2,3 4.Articles, Commands, 2h, Learning outcomes:1,2,3 5.Zero and 1st conditional, 2h, Learning outcomes:1,2,3 6.The Engineering Profession, 2h, Learning outcomes:4,5,6,7 7.The Bologna Process in the Department of Electrical Engineering, ECTS, 2h, Learning outcomes:4,5,6,7 8.The Structure of Matter, 2h, Learning outcomes:4,5,6,7 9.The Electric Current, 2h, Learning outcomes:4,5,6,7 10.Electric Circuits, 2h, Learning outcomes:4,5,6,7 11.The Effects of an Electric Current, 2h, Learning outcomes:4,5,6,7 12.Conductors, Insulators, Semiconductors, 2h, Learning outcomes:4,5,6,7 13.Batteries and Capacitors, 2h, Learning outcomes:4,5,6,7 14.Your Career as an Electrical Engineer, 2h, Learning outcomes:4,5,6,7 15.What is Energy?, 2h, Learning outcomes:4,5,6				
Required materials	Basic: classroom, blackboard, chalk... General purpose computer laboratory Whiteboard with markers Overhead projector				
Exam literature	Basic literature: 1. Marija Krznarić : Electricity and Electronics, TVZ 2012. Additional literature: 1. Vladimir Muljević: Englesko-hrvatski elektrotehnički rječnik 2. Štambuk, Pervan, Pilković, Roje: Rječnik elektronike (hrvatsko-engleski i englesko-hrvatski) 3. Marija Slunjski: Englesko-hrvatski rječnik elektroenergetskog nazivlja				

Students obligations	none	
Knowledge evaluation during semester	Redovitost pohaa#10#0#100$Mini-test#2#5#60$Seminarski rad#1#30#100$Domazada5#5#100$Pisana provjera znanja#2#40#55$Usmena provjera znanja#1#20#60$	
Knowledge evaluation after semester	written and oral exam	
Student activities:	Aktivnost (Classes attendance) (Written exam)	ECTS 1 1
Remark	This course can not be used for final thesis theme	
Prerequisites:	No prerequisites.	
ISVU equivalents:	22153;46826;85612;	
Proposal made by	senior lecturer, Marija Krznarić, prof. (20.06.2013.)	

Code WEB/ISVU	23389/155633	**ECTS**	2.0	**Academic year**	2018/2019
Name	English Language 2				
Status	3rd semester - Electrical power engineering (Redovni elektrotehnika) - elective course3rd semester - Control and computer engineering in automation (Redovni elektrotehnika) - elective course3rd semester - Communication and computer technology (Redovni elektrotehnika) - elective course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				15+30 (30+0+0+0) 15
Teachers	Lectures:1. Marija Krstinić Lectures:2. Zoran Vulelija Auditory exercises: Marija Krstinić				
Course objectives	students will acquire competence in communication and good command of professional terminology in English required for translating more complex professional literature; broaden the knowledge of the English language structures with the emphasis on professional language; develop the skill of writing and integrating professional terminology in reports and presentations.				
Learning outcomes:	1.ability to integrate professional terminology into seminar papers and presentations. Level:6,7 2.ability to translate a more complex text in professional literature from English into Croatian using a dictionary. Level:6,7 3.ability to formulate and define basic terminology in electrical engineering . Level:6,7 4.ability to analyze similarities and differences in the professional language structures between Croatian and English . Level:6 5.ability to identify the language structures in professional literature. Level:6 6.ability to communicate and discuss professional topics. Level:6,7				
Methods of carrying out lectures	Ex cathedra teaching Case studies Discussion Questions and answers Seminar, students presentation and discussion Homework presentation Interactive lectures and students are continually encouraged for discussion and presentation of the new idea and achivements in electrical engineering and other related scientific fields. Particular attention is paid to their interests and affinity. During presentations all available electronic media are used. Intercultural themes are also included. Lectures are given interactivelly, i.e. continuous participation of students, using drills and exercises from text books, or by means of an over-head projector.				
Methods of carrying out auditory exercises	Laboratory exercises, computer simulations Group problem solving Discussion, brainstorming Grammar and vocabulary drills and exercises in class and in the computer laboratory (online learning), self-learning..				
Course content lectures	1.Active - revision, 2h, Learning outcomes:5,6 2.Passive, 2h, Learning outcomes:5,6 3.Defectives, Past Participle, professional language structures , 2h, Learning outcomes:4,5,6 4.Indirect Speech, 2h, Learning outcomes:2,3,4,5,6 5.CRT, 2h, Learning outcomes:1,2,3 6.Robots, 2h, Learning outcomes:1,2,3,4 7.Circuit Breakers, Fuses and Switches, 2h, Learning outcomes:1,2,3,4 8.Power Engineering, 2h, Learning outcomes:3,4,5 9.Energy Crisis, 2h, Learning outcomes:1,2,4 10.Machine Translation, 2h, Learning outcomes:1,2,6 11.Process Control System, 2h, Learning outcomes:1,3,6 12.Nanotechnology, 2h, Learning outcomes:4,5 13.Optical Fibers, 2h, Learning outcomes:4,5,6 14.Nikola Tesla, 2h, Learning outcomes:1,3,6 15.Telecommunications, 2h, Learning outcomes:1,3,6				
Course content auditory	1.Verbal forms in active, 2h, Learning outcomes:1,2,6 2.Active vs Passive , 2h, Learning outcomes:1,2,6 3.Professional glossary Exercises , 2h, Learning outcomes:1,2,3 4.Direct vs Indirect speech exercises, 2h, Learning outcomes:4 5.Comparison between CRT, LCD and plasma, 2h, Learning outcomes:1,2,3,4,5,6 6.Robots and Artificial Intelligence, 2h, Learning outcomes:1,4,6 7.Circuit Breakers, Fuses and Switches, 2h, Learning outcomes:4,5 8.Power Engineering and rennewable sources, 2h, Learning outcomes:2,3,4 9.Energy Crisis and possible solutions in the future, 2h, Learning outcomes:1,2,3 10.Machine Translation vs Google, 2h, Learning outcomes:3,4,6 11.Process Control System, 2h, Learning outcomes:5,6 12.Nanotechnology in everyday life, 2h, Learning outcomes:1,2,3 13.Optical Fibers vs Coaxial cables, 2h, Learning outcomes:3,5 14.Nikola Tesla and other outstanding Croatian Scientists, 2h, Learning outcomes:1,2,6 15.(Tele)communications, 2h, Learning outcomes:1,2,5				
Required materials	Basic: classroom, blackboard, chalk... General purpose computer laboratory Whiteboard with markers Overhead projector				
Exam literature	Basic literature: 1. Marija Krznarić : Electricity and Electronics, TVZ 2012.				

	Additional literature: Vladimir Muljević: Englesko-hrvatski elektrotehnički rječnik 2. Štambuk, Pervan, Pilković, Roje: Rječnik elektronike (hrvatsko-engleski i englesko-hrvatski) 3. Marija Slunjski: Englesko-hrvatski rječnik elektroenergetskog nazivlja Marija Slunjski: Englesko-hrvatski rječnik elektroenergetskog nazivlja
Students obligations	none
Knowledge evaluation during semester	Redovitost pohaa#10#0#100$Mini-test#2#5#60$Seminarski rad#1#30#100$Domazada5#5#100$Pisana provjera znanja#2#40#55$Usmena provjera znanja#1#20#60$
Knowledge evaluation after semester	Pismeni ispit#1#40#55$Usmeni ispit#50#60#60$
Remark	This course can not be used for final thesis theme
Prerequisites:	No prerequisites.
ISVU equivalents:	22245;85614;
Proposal made by	senior lecturer, Marija Krznarić, prof

Code WEB/ISVU	23390/155634	**ECTS**	2.0	**Academic year**	2018/2019
Name	English Language 3				
Status	4th semester - Electrical power engineering (Redovni elektrotehnika) - elective course4th semester - Control and computer engineering in automation (Redovni elektrotehnika) - elective course4th semester - Communication and computer technology (Redovni elektrotehnika) - elective course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				15+15 (15+0+0+0) 30
Teachers	Lectures:1. Zoran Vulelija Lectures:2. Marija Krstinić Auditory exercises: Marija Krstinić Auditory exercises: Zoran Vulelija				
Course objectives	Competence in communication and general and professional terminology.				
Learning outcomes:	1.ability to communicate and discuss. Level:6,7 2.ability to integrate professional terminology. Level:6,7 3.ability to translate. Level:6,7 4.ability to formulate and define. Level:6,7 5.ability to analyze similarities and differences. Level:6 6.ability to identify the language structure. 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				
Course content lectures	1.Job Search, 1h, Learning outcomes:1,2,4,5 2.Resume (CV), 1h, Learning outcomes:1,2,4 3.Resume (CV), 1h, Learning outcomes:1,2,4 4.Application and Cover Letter, 1h, Learning outcomes:1,2,4,6 5.Application and Cover Letter, 1h, Learning outcomes:1,2,4,6 6.Preparing for Job Interview, 1h, Learning outcomes:1,2,3,6 7.1. Kolokvij, 1h, Learning outcomes:4 8.Job Interview, 1h, Learning outcomes:1,2,3,4,5 9.Letters and E-Mails, 1h, Learning outcomes:1,2,4 10.Letters and E-Mails, 1h, Learning outcomes:1,2,4 11.Negotiations, 1h, Learning outcomes:1,2,6 12.Negotiations, 1h, Learning outcomes:1,2,6 13.Presentation, 1h, Learning outcomes:1,2,3,4 14.Presentation, 1h, Learning outcomes:1,2,3,4 15.2.Kolokvij, 1h, Learning outcomes:4				
Course content auditory	1.How to Start a Job Search, 1h, Learning outcomes:1,2,4,5 2.Internet of Things (EU and Privacy Rules), 1h, Learning outcomes:1,2,4,5 3.Internet of Things (Connected Cars), 1h, Learning outcomes:1,2,4,5 4.Wired and Weird (Cyborg Plants), 1h, Learning outcomes:1,2,4,6 5.Wired and Weird (Cyborg Plants), 1h, Learning outcomes:1,2,4,6 6.Microbes for Greener Electronics, 1h, Learning outcomes:1,2,3 7.1.Kolokvij, 1h, Learning outcomes:4 8.Job Interview, 1h, Learning outcomes:1,2,4,5,6 9.Hardware Emulation, 1h, Learning outcomes:2,4,6 10.Hardware Emulation, 1h, Learning outcomes:2,4,6 11.How to Write a Summary, 1h, Learning outcomes:1,2,4,5,6 12.Electric Trains and Wind Energy, 1h, Learning outcomes:1,2,3,5 13.ITER Project, 1h, Learning outcomes:1,2,4,6 14.ITER Project, 1h, Learning outcomes:1,2,4,6 15.2.Kolokvij, 1h, Learning outcomes:4				
Required materials	Basic: classroom, blackboard, chalk... General purpose computer laboratory Whiteboard with markers Video equipment				
Exam literature	Basic literature: 1. Marija Krznarić : Electricity and Electronics, TVZ 2012. Additional literature: Vladimir Muljević: Englesko-hrvatski elektrotehnički rječnik 2. Štambuk, Pervan, Pilković, Roje: Rječnik elektronike (hrvatsko-engleski i englesko-hrvatski)				

	3. Marija Slunjski: Englesko-hrvatski rječnik elektroenergetskog nazivlja Marija Slunjski: Englesko-hrvatski rječnik elektroenergetskog nazivlja
Students obligations	Attendance 80%
Knowledge evaluation during semester	Redovitost pohaa#10#0#100$Mini-test#2#5#60$Seminarski rad#1#30#100$Domazada5#5#100$Pisana provjera znanja#2#40#55$Usmena provjera znanja#1#20#60$
Knowledge evaluation after semester	Written and Oral Exam
Remark	This course can not be used for final thesis theme
Prerequisites:	No prerequisites.
ISVU equivalents:	22254;85618;
Proposal made by	lecturer, Marija Krstinić, prof.

Code WEB/ISVU	23493/156009	**ECTS**	8.0	**Academic year**	2018/2019
Name	Final Thesis				
Status	6th semester - Electrical power engineering (Redovni elektrotehnika) - elective course6th semester - Control and computer engineering in automation (Redovni elektrotehnika) - elective course6th semester - Communication and computer technology (Redovni elektrotehnika) - elective course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				15+0 (0+0+0+0) 225
Teachers	Lectures:1. Tomislav Novak mag. ing. inf. et comm. techn. Lectures: Trpimir Alajbeg Lectures: Marija Krstinić Lectures:mr.sc. Milivoj Puzak v. pred				
Course objectives	students will know how to apply the acquired knowledge when solving engineering problems				
Learning outcomes:	1.ability to identify the problem and development line of the field. Level:6 2.ability to analyze the existing achievements in the particular field. Level:6 3.ability to analyze the problem and development line of the field into its components. Level:6 4.ability to devise a proposal, i.e. a solution to the problem. Level:6,7 5.ability to work out a practical solution to the problem. Level:6,7 6.ability to make conclusion about the achievements and possibilities for generalization of the thesis. Level:6,7 7.ability to present the results of the thesis. Level:6,7				
Involvement of learning outcomes of the course in study programme:	5.1.EE Razumjeti princip rada električnih rotacijskih strojeva, transformatora, dalekovoda i sklopnih aparata: 30h in 240h 6.5.KIRT Izabrati transformatore, nadzemne vodove i sklopne aparate za prijenos i distribuciju električne energije: 30h in 240h				
Methods of carrying out lectures	Case studies Simulations Modelling Discussion Seminar, students presentation and discussion				
Course content lectures	1.An engineering problem The use of professional language and form in the presentation of work. Standards, 3h 2.Structuring the thesis: introduction, theoretical discussion, practical results, conclusion, abstract, 3h 3.Logical form of sections in the text. Literature referencing, picture, tables and formulas integration., 3h 4. planning of the thesis, relevant literature research., 3h 5.Preparation of presentation materials and the public presentation of results., 3h 6.Work coordinated with final thesis menthor, 2h 7.Work coordinated with final thesis menthor, 2h 8.Work coordinated with final thesis menthor, 2h 9.Work coordinated with final thesis menthor, 2h 10.Work coordinated with final thesis menthor, 2h 11.Work coordinated with final thesis menthor, 2h 12.Work coordinated with final thesis menthor, 2h 13.Work coordinated with final thesis menthor, 2h 14.Work coordinated with final thesis menthor, 2h 15.Work coordinated with final thesis menthor, 2h				
Required materials	Basic: classroom, blackboard, chalk... General purpose computer laboratory Special purpose computer laboratory Overhead projector Tools Operating supplies Thesis dependant				
Exam literature	Prema Zadatku i uputama mentora Puzak: Završni rad - inženjerski zadatak -web ELO Ćika: Završni rad - produktivna uporaba računala; web ELO Krznarić: Završni rad - pravopis, rječnik: web ELO				
Students obligations	A final thesis paper in accordance to the guidelines given in the "Final thesis instructions"				
Knowledge evaluation during semester	Regular attendance 10% Finished thesis 90%				
Knowledge evaluation after semester	Regular attendance 10% Finished thesis 90%				
Remark	This course can not be used for final thesis theme				
Prerequisites:	No prerequisites.				
ISVU equivalents:	83430;				
Proposal made by	Ivan Lujo, MSc, Lecturer				

Code WEB/ISVU	23963/184795	**ECTS**	9.0	**Academic year**	2018/2019
Name	Fundamentals of Electrical Engineering				
Status	1st semester - Undergraduate professional study in electrical engineering (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				45+60 (45+15+0+0) 165
Teachers	Lectures:2. Davor Šterc Lectures:2. mr.sc. Veselko Tomljenović viši predavač Lectures: Vladimir Šimović Auditory exercises: Mato Brizar Auditory exercises: Robert Herčeki Auditory exercises: Želimir Ivanović Auditory exercises:mr.sc. Zoran Kovačević predavač Auditory exercises: Vladimir Šimović Auditory exercises: Davor Šterc Auditory exercises:mr.sc. Veselko Tomljenović viši predavač Laboratory exercises: Trpimir Alajbeg Laboratory exercises: Mato Brizar Laboratory exercises: Tomislav Đuran , dipl. ing. Laboratory exercises: Želimir Ivanović Laboratory exercises: Aleksandar Kiričenko Laboratory exercises:mr.sc. Zoran Kovačević predavač Laboratory exercises: Siniša Lacković struč.spec.ing.el. Laboratory exercises:pred. Ivan Lujo , dipl.ing. Laboratory exercises:mr.sc. Darko Lukša dipl.ing Laboratory exercises:mr.sc. Krunoslav Martinčić Laboratory exercises: Vladimir Šimović Laboratory exercises: Petar Tomljanović				
Course objectives					
Learning outcomes:	1. . Level:6 2.ability to formulate, write and solve Kirchoff's law equations, understand and explain the existence and uniqueness of solution depending on the voltage-current relation for a particular branch. Level:6,7 3.ability to set and solve equation of charging and discharging of capacitors and inductor by real voltage or current source . Level:6,7 4.ability to ability to introduce and apply phasor method for solving alternating electric circuits, calculating and drawing diagrams using phasors, impedance/admittance. Level:6,7 5.ability to use instantenous, average, active, reactive, apparent and complex power and the power factor in characteristic examples and applications. Level:6 6.ability to use basic theorems and methods for solving electric networks: node and mesh analyses, the addition principle, i.e. the superposition principle, Thevenin and Norton theorem and the theorem of maximum power; to choose and apply the most suitable method for a particular problem . Level:6 7.ability to understand and use the basic principles of three-phase networks . Level:6				
Methods of carrying out lectures	Ex cathedra teaching Case studies Discussion Questions and answers				
Methods of carrying out auditory exercises	Group problem solving Discussion, brainstorming				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Group problem solving Discussion, brainstorming				
Course content lectures	1. , 3h, Learning outcomes:1,2 2. , 3h, Learning outcomes:1,2,6 3. , 3h, Learning outcomes:2,6 4. , 3h, Learning outcomes:6 5. , 3h, Learning outcomes:1,2,6 6. , 3h, Learning outcomes:1,2,3 7. , 3h, Learning outcomes:1 8. , 3h, Learning outcomes:1,3 9. , 3h, Learning outcomes:1,3 10. , 3h, Learning outcomes:1,2,3 11. , 3h, Learning outcomes:1,2,3 12. , 3h, Learning outcomes:4,5 13. , 3h, Learning outcomes:1,2,3,6 14. , 3h, Learning outcomes:1,2,3,6 15. , 3h, Learning outcomes:1,3				
Course content auditory	1. , 3h, Learning outcomes:1,2 2. , 3h, Learning outcomes:1,2 3. , 3h, Learning outcomes:1,2 4. , 3h, Learning outcomes:1,2 5. , 3h, Learning outcomes:1,2 6. , 3h, Learning outcomes:1,2 7. , 3h, Learning outcomes:1,2				

	8. , 3h, Learning outcomes:1,2,3 9. , 3h, Learning outcomes:1,2,4 10. , 3h, Learning outcomes:1,2,4 11. , 3h, Learning outcomes:1,2,4 12. , 3h, Learning outcomes:4,5,6 13. , 3h, Learning outcomes:1,2,4 14. , 3h, Learning outcomes:1,2,4,5,6 15. , 3h, Learning outcomes:1,4
Course content laboratory	1. 2. 3. 4. 5. 6. , 3h, Learning outcomes:1 7. , Learning outcomes:1,4,5 8. , 3h, Learning outcomes:1,2,4,5 9. 10. , 3h, Learning outcomes:2,4 11. 12. , 3h, Learning outcomes:2,4 13. , Learning outcomes:7 14. , 3h, Learning outcomes:2,4 15.
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory Whiteboard with markers Overhead projector Portable overhead projector Video equipment
Exam literature	Preporučena literatura: udžbenik: V. Pinter (1994) Osnove elektrotehnike, ISBN zbirka zadataka: istosmjerni električni krugovi -> E. Šehović, M. Tkalić, I. Felja (1989) Osnove elektrotehnike - zbirka primjera, ISBN izmjenični električni krugovi -> J. Edminster (1963, 2003) Electric circuits ISBN ili V. Tomljenović (2009) Osnove elektrotehnike 2 (zbirka rješenja) ISBN. Alternativna literatura: B. Kuzmanović (2002) Osnove elektrotehnike II ISBN. G. Lukić (2012) Zbirka zadataka iz osnova elektrotehnike ISBN. A. Pavić, I. Felja (1996.) Osnove elektrotehnike 1 (auditorne vježbe) ISBN. I Felja, D. Koračin (1987) Zbirka zadataka i riješenih primjera iz Osnova elektrotehnike, ISBN
Student activities:	Aktivnost — ECTS (Classes attendance) — 2 (Written exam) — 4 (Oral exam) — 3
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
ISVU equivalents:	22249;

Code WEB/ISVU	23391/155635	**ECTS**	2.0	**Academic year**	2018/2019
Name	German Language				
Status	1st semester - Undergraduate professional study in electrical engineering (Redovni elektrotehnika) - elective course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				15+30 (30+0+0+0) 15
Teachers	Lectures:1. Doc. dr. sc. Lidija Tepeš Golubić v. pred. Auditory exercises: Doc. dr. sc. Lidija Tepeš Golubić v. pred.				
Course objectives	Students will acquire competence in translating professional literature. By systematizing and broadening general knowledge of the German language structures and by practicing the language skills, they will achieve the A2 level (in some elements B1 level) according to the Common European Framework of Reference for Languages.				
Learning outcomes:	1.ability to communicate at the standard basic level. Level:6,7 2.ability to write short personal letters, notes and messages using auxiliary literature (dictionaries and handbooks). Level:6,7 3.ability to integrate familiar language structures into a new context. Level:6,7 4.ability to recognize and translate basic professional terminology. Level:6 5.ability to distinguish between established stereotypes and intercultural characteristics. Level:6 6.ability to integrate professional terminology into short written reports. Level:6,7 7.ability to analyze similarities and differences between the language structures of Croatian and German. Level:6				
Methods of carrying out lectures	Ex cathedra teaching Case studies Questions and answers Homework presentation The course is intercultural and interdisciplinary. Students are introduced to scientific and technical achievements of the people whose language they study (especially in the specialism area).				
Methods of carrying out auditory exercises	Group problem solving Interactive problem solving The student does various types of exercises in auditory recitations, being continuously warned of cognitive, metacognitive and social and affective learning strategies which make individual learning easier. The student is trained for using dictionaries (bilingual, unilingual) and other manuals (in a traditional form or those mediated by electronic media), in order to be able to use manuals, professional literature, documentation and other knowledge sources in German, all related to the profession they are trained for.The student is trained for using various reading techniques, to write short summaries and use the basic business correspondence and to communicate about everyday issues.				
Course content lectures	1.Introductory lecture, 2h, Learning outcomes:1 2.Importance of foreign language study, 2h, Learning outcomes:1,3,5 3.New media, 2h, Learning outcomes:2,3,4,5 4.Grammar of the German language - Nouns, 2h, Learning outcomes:1,3 5.Electrical Engineering Basics, 2h, Learning outcomes:3,4,6 6.Electrical Engineering Basics, 2h, Learning outcomes:3,4,6 7.Colloquium 1, 2h, Learning outcomes:1,2,3,4,5,6,7 8.Curriculum Vitae, 2h, Learning outcomes:2,3,6,7 9.Curriculum Vitae, 2h, Learning outcomes:2,3,6,7 10.Job interview, 2h, Learning outcomes:1,4 11.Electrical Engineering Jobs, 2h, Learning outcomes:2,4,7 12.Grammar of the German language - Verbs, 2h, Learning outcomes:2,7 13.Electrical Engineering Books in German, 2h, Learning outcomes:2,3,4 14.Dictionary and vocabulary, 2h, Learning outcomes:3,4,7 15.Colloquium 2, 2h, Learning outcomes:1,2,3,4,5,6,7				
Course content auditory	1.Introductory lecture, 2h, Learning outcomes:1 2.Importance of foreign language study, 2h, Learning outcomes:1,3,5 3.New media, 2h, Learning outcomes:2,3,4,5 4.Grammar of the German language - Nouns, 2h, Learning outcomes:1,3 5.Electrical Engineering Basics, 2h, Learning outcomes:3,4,6 6.Electrical Engineering Basics, 2h, Learning outcomes:3,4,6 7.Colloquium 1, 2h, Learning outcomes:1,2,3,4,5,6,7 8.Curriculum Vitae, 2h, Learning outcomes:2,3,6,7 9.Curriculum Vitae, 2h, Learning outcomes:2,3,6,7 10.Job interview, 2h, Learning outcomes:1,4 11.Job interview, 2h, Learning outcomes:1,4 12.Electrical Engineering Jobs, 2h, Learning outcomes:2,4,7 13.Grammar of the German language - Verbs, 2h, Learning outcomes:2,7 14.Dictionary and vocabulary, 2h, Learning outcomes:3,4,7 15.Colloquium 2, 2h, Learning outcomes:1,2,3,4,5,6,7				
Required materials	Basic: classroom, blackboard, chalk... Whiteboard with markers Overhead projector Operating supplies The student does various types of exercises in auditory recitations, being continuously warned of cognitive, metacognitive and social and affective learning strategies which make individual learning easier. The student is trained for using dictionaries (bilingual, unilingual) and other manuals (in a traditional form or those mediated by electronic media), in order to be able to use manuals, professional literature, documentation and other knowledge sources in German, all related to the profession they are trained for.The student is trained for using various reading techniques, to write short summaries and use the basic business correspondence and to communicate about everyday issues.				
Exam literature	Basic literature: 1. Izbor tekstova (na stranicama TVZa)				

	2. Rječnici (J. Kljajić, Njemačko-hrvatski praktični rječnik, Školska knjiga, Zagreb, 1998.; M. Uroić, A. Hurm, Hrvatsko-njemački rječnik, Školska knjiga, Zagreb, 1994.; V. Muljević: Elektrotehnički rječnik njemačko-hrvatski, Školska knjiga, Zagreb, 1996.; S. i J. Rittgasser, Njemačko-hrvatski računalni rječnik, Školska knjiga, Zagreb, 1996.) 3. 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; Stručni časopisi iz svih područja elektronike i elektrotehnike.
Students obligations	Attending classes and participation in the process
Knowledge evaluation during semester	preliminary exam 1 and 2; pp presentation
Knowledge evaluation after semester	written and/or oral exam
Student activities:	Aktivnost ECTS (Written exam) 1 (Report) 1
Remark	This course can not be used for final thesis theme
Prerequisites:	No prerequisites.
ISVU equivalents:	22238;46827;85613;
Proposal made by	Phd. Lidija Tepeš Golubić, senior lecturer, 18th of May 2016

Code WEB/ISVU	23392/155636	**ECTS**	2.0	**Academic year**	2018/2019
Name	German Language 2				
Status	3rd semester - Electrical power engineering (Redovni elektrotehnika) - elective course3rd semester - Control and computer engineering in automation (Redovni elektrotehnika) - elective course3rd semester - Communication and computer technology (Redovni elektrotehnika) - elective course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				15+30 (30+0+0+0) 15
Teachers	Lectures:1. Doc. dr. sc. Lidija Tepeš Golubić v. pred.				
Course objectives	Ability to successfully translate professional literature. By systematizing and broadening general knowledge of the German language structures and by practicing the language skills, they will achieve the A2 level (in some elements B1 level) according to the Common European Framework of Reference for Languages.				
Learning outcomes:	1.ability to integrate professional terminology into seminar papers and presentations. Level:6 2.ability to translate more complex professional literature from German into Croatian using a dictionary. Level:6,7 3.ability to formulate and define basic terminology in electrical engineering . Level:6 4.ability to analyze similarities and differences in the professional language structures between Croatian and German. Level:6,7 5.ability to identify language structures in professional literature. Level:6,7 6.ability to communicate and discuss professional topics. Level:6,7				
Methods of carrying out lectures	Ex cathedra teaching Case studies Questions and answers Homework presentation Other The course is intercultural and interdisciplinary. Students are introduced to scientific and technical achievements of the people whose language they study (especially in the specialism area).				
Methods of carrying out auditory exercises	Group problem solving Interactive problem solving Other The student does various types of exercises in auditory recitations, being continuously warned of cognitive, metacognitive and social and affective learning strategies which make individual learnig easier.The student is trained for using dictionaries (bilingual, unilingual) and other manuals (in a traditional form or those mediated by electronic media), in order to be able to use manuals, professional literature, documentation and other knowledge sources in German, all related to the profession they are trained for.The student is trained for using various reading techniques, to write short summaries and use the basic business correspondence and to communicate about everyday issues.				
Course content lectures	1.Wiederholen und Systematisieren, 2h, Learning outcomes:1,3,4 2.Lebenslauf zusammenfassen und Bewebung schreiben, 2h, Learning outcomes:1,3,4 3.Aktueller Text (Anlass): Physik - Nobelpreis 2013, 1h, Learning outcomes:1,2 4.CERN 1 (Text, Film), 1h, Learning outcomes:1,2 5.CERN 2 (Text, Film), 1h, Learning outcomes:1,2,5 6.Widerstand; Komparation, 1h, Learning outcomes:1,3,4 7.Elektronenrn, Passiversatz 1, 1h, Learning outcomes:1,3,4 8.Transistoren; Passiversatz 2, 1h, Learning outcomes:1,2,3,4 9.Integrierter Schaltkreis, 1h, Learning outcomes:1,3 10.Anweisungen: Recherchieren; Referate schreiben; Referieren, 1h, Learning outcomes:6 11.Mikroprozessor; Deklination der substantive 1, 1h, Learning outcomes:1,3,4 12.Eingabe- und Ausgabegeraete; Deklination der Substantive 2, 1h, Learning outcomes:1,3,4 13.Eine nette Geste 1, 1h, Learning outcomes:1,2,3 14.eine nette Geste 2, 1h, Learning outcomes:1,2,3 15.Briefe schreiben (Muster: Geschaeftsbrief, privatbrief), 1h, Learning outcomes:3,5				
Course content auditory	1.Wiederholen und Systematisieren, verschiedene ungen (schriftliche/muendliche), 2h, Learning outcomes:1,2,3 2.Lebenslauf zusammenfassen und Bewebung schreiben, 2h, Learning outcomes:1,2 3.Satzstellung (schriftliche und muendliche Uebungen); Arbeit mit dem Woerterbuch, 2h, Learning outcomes:1,2,5 4.Passiv (schriftliche Uebungen); Arbeit mit der Vokabelliste, 2h, Learning outcomes:1,2 5.1. Kolloquium; schriftliche Uebersetzung; Arbeit mir der Vokabelliste; Recherchieren im Internet (Aufgaben: Kroaten am CERN; Teilchenbeschleuniger an anderen Forschungsinstituten), 2h, Learning outcomes:1,2,5 6.Komparation (schriftliche und muendliche Uebungen); Fragestellung; Arbeit mit der VL, 2h, Learning outcomes:1,2,4 7.1. Kolloquium (Wiederholung); Fragestellung; Arbeit mit der VL; Passiversatz (schriftliche Uebungen), 2h, Learning outcomes:1,2,3,4 8. Fragestellung; Arbeit mit der VL; Passiversatz (schriftliche Uebungen); Kurzgespraeche: Tagesablauf, 2h, Learning outcomes:1,2,3 9.2. Kolloquium; Fragestellung; Arbeit mit der VL, 2h, Learning outcomes:1,2,4 10.Imperativ (schriftliche ungen); gezieltes Uebersetzen (Infinitivgruppen, Passiv, Passiversatz), 2h, Learning outcomes:1,2,3 11.2. Kolloquium (Wiederholung); Deklination der Substantive 1 (schriftliche Uebungen); Arbeit mit der VL, 2h, Learning outcomes:1,2,3,4 12.Deklination der Substantive 2; Kurzgespre: Im Buero, Familienfeier, 2h, Learning outcomes:1,2,3 13.Prsitionen (schriftliche Uebungen); Arbeit mit dem WB, 2h, Learning outcomes:1,2,3,4 14.3. Kolloquium; Arbeit mit dem WB, 2h, Learning outcomes:1,2,3,5 15.Arbeit mit dem WB; Kurzgespraeche: Im Beschsreise, 2h, Learning outcomes:1,2				
Required materials	Basic: classroom, blackboard, chalk... Whiteboard with markers Overhead projector Video equipment				

	Operating supplies dictionary
Exam literature	Izbor tekstova na njemačkom jeziku (repozitorij) Additional literature: 1. Tekstovi dostupni na stranicama Interneta. 2. Rječnici (J. Kljajić, Njemačko-hrvatski praktični rječnik, Školska knjiga, Zagreb, 1998.; M. Uroić, A. Hurm, Hrvatsko-njemački rječnik, Školska knjiga, Zagreb, 1994.; V. Muljević: Elektrotehnički rječnik njemačko-hrvatski, Školska knjiga, Zagreb, 1996.; S. i J. Rittgasser, Njemačko-hrvatski računalni rječnik, Školska knjiga, Zagreb, 1996.). 3. Gramatike (I. Medić, Deutsche Grammatik fuer jedermann, Školska knjiga, Zagreb, 2002.; T. Marčetić, Pregled gramatike njemačkog jezika, Školska knjiga, Zagreb, 2000.; 4. V. Grujoski, Deutsche Fachtexte aus der Elektrotechnik, Sveučilište u Zagrebu, 1993.
Students obligations	Attendance 80%, homework 100%.
Knowledge evaluation during semester	Attendance 80% Homwork: 3 - 5 checkups, value 10% Written exam: 5 checkups, value 90%
Knowledge evaluation after semester	Written exam: 2 checkups, value 40% Oral exam: 2 checkups, value 60%
Student activities:	Aktivnost ECTS (Constantly tested knowledge) 1 (Activity in class) 1
Remark	This course can not be used for final thesis theme
Prerequisites:	No prerequisites.
ISVU equivalents:	22248;85617;
Proposal made by	PhD. Lidija Tepeš Golubić, 04. of June 2018

Code WEB/ISVU	23393/155637	**ECTS**	2.0	**Academic year**	2018/2019
Name	German Language 3				
Status	4th semester - Electrical power engineering (Redovni elektrotehnika) - elective course4th semester - Control and computer engineering in automation (Redovni elektrotehnika) - elective course4th semester - Communication and computer technology (Redovni elektrotehnika) - elective course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				15+15 (15+0+0+0) 30
Teachers	Lectures:1. Doc. dr. sc. Lidija Tepeš Golubić v. pred.				
Course objectives					
Remark	This course can not be used for final thesis theme				
Prerequisites:	No prerequisites.				
ISVU equivalents:	22255;85619;				

Code WEB/ISVU	23134/128258	**ECTS**	5.0	**Academic year**	2018/2019
Name	Information, theory and coding				
Status	4th semester - Communication and computer technology (Redovni elektrotehnika) - 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. Mladen Sokele predavač Auditory exercises:dr. sc. Mladen Sokele predavač Laboratory exercises:dr.sc. Krešimir Osman , dipl.ing. Laboratory exercises:dr. sc. Mladen Sokele predavač				
Course objectives	students will understand the architecture of telecommunication systems, services and basic processes within the systems				
Learning outcomes:	1.ability to aalyze the structure and functionality of the communication system. Level:6 2.ability to calculate the amount of information emitted by the source of information . Level:6 3.ability to distinguish between different message encryption algorithms. Level:6 4.ability to calculate the information capacity of a communication channel. Level:6 5.ability to compare different encryption algorithms. Level:6,7 6.ability to analyze and apply complex procedures of digital modulations. Level:6 7.ability to configure digital data transmitter. Level:6,7 8.ability to evaluate the quality to cost-effectiveness ratio of the communication system. Level:6,7				
Involvement of learning outcomes of the course in study programme:	6.5.KIRT Izabrati transformatore, nadzemne vodove i sklopne aparate za prijenos i distribuciju električne energije: 10h in 150h				
Methods of carrying out lectures	Ex cathedra teaching Simulations Modelling Discussion Homework presentation Oral lecturing supported with a modern presentation technology. Theoretical explanation and equations derivation is followed by multimedia interactive demonstration. Discussion with students is frequent too.				
Methods of carrying out auditory exercises	Laboratory exercises on laboratory equipment Laboratory exercises, computer simulations Computer simulations Numerical problem solving on the blackboard and in notebooks is supported with a spreadsheet MS Excel and MatLab.				
Methods of carrying out laboratory exercises	Laboratory exercises, computer simulations Computer simulations Individual work in a PC laboratory				
Course content lectures	1.About subject, plan and conditions, 1h Communication system, definitions and examples, 1h, Learning outcomes:1 2.Communication and Information definition, 2h, Learning outcomes:2 3.The entropy of a discrete source of information, 2h, Learning outcomes:3 4.The amount of information, 2h, Learning outcomes:2 5.Evenly and unevenly coding, Shannon-Fano, 2h, Learning outcomes:3 6.Random Number Generators, 2h, Learning outcomes:3 7.The binary symmetric channel BSC, 2h, Learning outcomes:2 8.Checking the correctness of message transmission, 2h, Learning outcomes:3 9.Protecting the information from errors in transmission of messages, 2h, Learning outcomes:3 10.Analysis of the effectiveness of protection, 2h, Learning outcomes:3 11.BSC Simulation with Hamming code, enhancement exercises, 1h, Learning outcomes:4 Channel capacity, physical level, Co., 1h, Learning outcomes:4 12.Huffman code. Channel capacity Co., 2h, Learning outcomes:4 13.Information coding and signal modulation, 2h, Learning outcomes:6 14.Digital modulations, 2h, Learning outcomes:6,7 15.Transmission into a modulation band, 2h, Learning outcomes:8				
Course content auditory	1.Probability, 1h, Learning outcomes:2 2.Applied probability, 1h, Learning outcomes:2 3.Introduction to the lab, 1h, Learning outcomes:1 4.Applied statistics, 1h, Learning outcomes:2 5.Statistical analysis of signals and messages, Learning outcomes:1,2 6.Random Number Generators, 2h, Learning outcomes:3 7.Capacity of BSC, 1h, Learning outcomes:2 8.CRC, 1h, Learning outcomes:3 9.Hamming and Huffman coding, 1h, Learning outcomes:3 10.The first colloquium, 2h, Learning outcomes:1,2,3 11.Algorithms of the classical cryptography, 1h, Learning outcomes:5 12.Contemporary cryptography with public and secret key, 2h, Learning outcomes:4 13.DMT, 1h, Learning outcomes:6 14.Digital modulations, 1h, Learning outcomes:7 15.Transfer into a modulation band, 1h, Learning outcomes:8 The second colloquium, 1h, Learning outcomes:4,5,6,7,8				
Course content laboratory	1.Introducing mbed platform, 2h, Learning outcomes:1 2.Introducing mbed platform, 2h, Learning outcomes:1 3.Statistical analysis and probability in spreadsheets, 2h, Learning outcomes:2				

	4.Statistical analysis of real signals and messages , 2h, Learning outcomes:2 5.BSC channel simulation, 2h, Learning outcomes:4 6.BSC channel simulation, 2h, Learning outcomes:3,4 7.BSC with Hamming code simulation, 2h, Learning outcomes:5 8.BB channel analysis, 2h, Learning outcomes:5 9.Line codes, 2h, Learning outcomes:4 10.Digital modulations, 2h, Learning outcomes:6 11.Digital modulations, 2h, Learning outcomes:6 12.Presentation and analysis of digitally modulated signals, 2h, Learning outcomes:7 13.Demodulation of digitally modulated signals, 2h, Learning outcomes:8 14.Analysis of a digital channel, 2h, Learning outcomes:5,8 15.Exercises presentation, Learning outcomes:1,8
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory Special purpose computer laboratory Overhead projector Special equipment mbed LPC 1768
Exam literature	Obvezna 1.P. Valožić: Informacija i kodiranje, skripta TVZ, 2012. 2.P. Valožić: Informacija i kodiranje, zbirka riješenih zadataka, TVZ, 2012. 3.P. Valožić: Informacija i kodiranje, laboratorijske vježbe,TVZ, 2012. Dopunska 1.P. Valožić: Informacija i kodiranje, laboratorijske vježbe s uputama, TVZ, 2012. 2.Information Theory and Coding Technique http://g.csie.org/itct/ 3.Željko Pauše: Vjerojatnost, informacija, stohastički procesi, Školska knjiga, Zagreb, 2003. 4.Vjekoslav Sinković, Informacija, simbolika, semantika, Školska knjiga, Zagreb, 1997.
Students obligations	Attendance All the exercises completed Colloquium of the exercises
Knowledge evaluation during semester	Regular attendance 10 percent Colloquium, numerical tasks 40 percent Colloquium, theoretical issues 30 percent Oral examination 20 percent 90 100 = 5 (A) 80 89 = 4 (B) 65 79 = 3 (C) 60 64 = 2 (D) 50 59 = 2 (E) 49 and less, insufficient
Knowledge evaluation after semester	Written examination 60 percent Oral examination 40 percent 90 100 = 5 (A) 80 89 = 4 (B) 65 79 = 3 (C) 60 64 = 2 (D) 50 59 = 2 (E) 49 and less, insufficient
Student activities:	Aktivnost — ECTS (Classes attendance) — 1 (Written exam) — 1 (Oral exam) — 1 (Practical work) — 2
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
ISVU equivalents:	22307;85689;
Proposal made by	PhD Predrag Valožić, prof.

Code WEB/ISVU	23491/156006	**ECTS**	5.0	**Academic year**	2018/2019
Name	Introduction to networking technologies				
Status	3rd semester - Communication and computer technology (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (0+30+0+0) 90
Teachers	Lectures:1. mr.sc. Dubravko Žigman viši predavač Laboratory exercises: Nikolina Kasunić struč.spec.ing.techn.inf. Laboratory exercises: Tomislav Novak mag. ing. inf. et comm. techn. Laboratory exercises: Vedran Tadić struč.spec.ing.techn.inf.				
Course objectives	Acquiring basic knowledge in the area of networking technologies.				
Learning outcomes:	1.ability to analyze network communication. Level:6 2.ability to compare the ISO/OSI and TCP/IP network models. Level:6,7 3.ability to relate the ISO/OSI network models to real devices and applications in a network. Level:6,7 4.ability to plan the network address space. Level:6,7 5.ability to calculate the IP address space. Level:6 6.ability to analyze the network traffic. Level:6 7.ability to prepare default network equipment to connect a simple local area network. Level:6,7 8.ability to design a simple local area network. Level:6 9.ability to test the computer network operating. Level:6 10.ability to detect the problem of the interrupted communication in a simple local area network. Level:6				
Methods of carrying out lectures	Ex cathedra teaching Case studies Simulations Discussion Questions and answers In person lectures with practical experiences and examples presented using modern technologies. Multimedia materials are presented in classroom and are available on line.				
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 Mind mapping Computer simulations Interactive problem solving Introduction to network components and design. Launching a small network, signal measurements and traffic analysis.				
Course content lectures	1.Course introduction, 2h 2.Exlopring the Networks, 2h, Learning outcomes:1 3.Configuring a Network Operating System, 2h, Learning outcomes:3,7 4.Network protocols and communication, 2h, Learning outcomes:1,2,3,7 5.Network Acces, 2h, Learning outcomes:7,8 6.Ethernet, 2h, Learning outcomes:1,2,3 7.Network layer, 2h, Learning outcomes:6,7 8.Transport Layer, 2h, Learning outcomes:2,3 9.IP addressing, 2h, Learning outcomes:4,5 10.IP addressing, 2h, Learning outcomes:4,5 11.Subnetting IP Networks, 2h, Learning outcomes:4,5 12.Subnetting IP Networks, 2h, Learning outcomes:4,5 13.Application Layer, 2h, Learning outcomes:2,3,4,5 14.It is a Network, 2h, Learning outcomes:7,8,9,10 15.Course summary, 2h, Learning outcomes:1,2,3,4,5,6,7,8,9,10				
Course content laboratory	1.Introduction to course, 2h, Learning outcomes:1 2.Network Communication Tools research, 2h, Learning outcomes:1 3.Basic Networking Device configuration, 2h, Learning outcomes:7,8 4.Protocols and applications research, 2h, Learning outcomes:2,3,6 5.Methods and Technologies of Network Access, 2h, Learning outcomes:4,5 6.Ethernet Technologies and Protocols analasys, 2h, Learning outcomes:1,2,3,6 7.Observing Network Layer services, 2h, Learning outcomes:4,5 8.Observing Transport Layer services, 2h, Learning outcomes:4,5 9.IPv4 and IPv6 subnetting, 2h, Learning outcomes:4,5 10.IPv4 and IPv6 subnetting, 2h, Learning outcomes:4,5 11.Subnetting of IPv4, 2h, Learning outcomes:4,5 12.Advanced subnetting of IPv4, 2h, Learning outcomes:4,5 13.Network Services research, 2h, Learning outcomes:1,6 14.Connecting and configuring Networking Devices, 2h, Learning outcomes:4,5,7,8,9,10 15.Final skill and theoretical exam, 2h, Learning outcomes:1,2,3,4,5,6,7,8,9,10				
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory General purpose computer laboratory Special purpose computer laboratory Whiteboard with markers Overhead projector Tools Operating supplies				

	Special equipment Routers, Switches, Crimping Tool, RJ-45 Connectors, UTP cable
Exam literature	1.Interconnecting Cisco Network Devices, Part 1 (ICND1) Foundation Learning Guide, 4th Edition, by Anthony Sequeira, Jun 17, 2013, ISBN-10: 1-58714-376-3, ISBN-13: 978-1-58714-376-2, Cisco Press. 2. Cisco CCNA Routing and Switching 200-120 Foundation Learning Guide Library, by Anthony Sequeira and John Tiso, Oct 7, 2013, ISBN-10: 1-58714-378-X, ISBN-13: 978-1-58714-378-6, Cisco Press. 3. CCENT/CCNA ICND1 100-101 Official Cert Guide Premium Edition eBook and Practice Test, by Wendell Odom, Mar 26, 2013, ISBN-10: 0-13-336788-6, ISBN-13: 978-0-13-336788-1, Cisco Press. 4. CCNA Routing and Switching 200-120 Official Cert Guide Library, May 23, 2013, by Wendell Odom, ISBN-10: 1-58714-387-9, ISBN-13: 978-1-58714-387-8, Cisco Press. 5. CCENT/CCNA ICND1 100-101 Official Cert Guide, by Wendell Odom, Apr 25, 2013, ISBN-10: 1-58714-385-2, ISBN-13: 978-1-58714-385-4, Cisco Press 4. Internet Core Protocols by O'Reilly.
Students obligations	Minimum of 9 completed laboratory exercises.
Knowledge evaluation during semester	Attendance, Quick-test, Test, Homework, Practical Exam
Knowledge evaluation after semester	Written Exam, Oral Exam
Student activities:	Aktivnost — ECTS (Written exam) — 1 (Activity in class) — 1 (Constantly tested knowledge) — 3
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
ISVU equivalents:	26094;63008;
Proposal made by	Dubravko Zigman

Code WEB/ISVU	23272/143308	**ECTS**	1.0	**Academic year**	2018/2019
Name	Kinesiology Education I				
Status	1st semester - Undergraduate professional study in electrical engineering (Redovni elektrotehnika) - 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. Boris Metikoš ,prof.				
Course objectives	students will raise awareness of the importance of physical education				
Learning outcomes:	1.Demonstrate the proper execution of the technical elements of a specific kinesiologic activity. Level:6 2.Demonstrate the proper execution of the technical elements of a specific kinesiologic activity. Level:6 3.Explain the basic terms of a specific kinesiologic activity. Level:6 4.Explain the importance of warming-up in a specific kinesiologic activity. Level:6 5.Explain the importance of stretching in a particular kinesiologic activity. Level:6 6.Express the basic rules of a specific kinesiologic activity. Level:6 7.Identify auxiliary and elementary games in the learning process of a specific kinesiologic activity. Level:6 8.Describe the technical and tactical elements of a specific kinesiologic activity. Level:6 9.Give an example of how to organize a competition. Level:6 10.Identify and understand the necessity of regular exercise for health. Level:6 11.ability to describe organization of students' sport competitions. Level:6				
Methods of carrying out auditory exercises	Workshop				
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:8 12.Adoption of basic technical and tactical elements of a specific kinesiologic activity, 2h, Learning outcomes:8 13.Competition and Games, 2h, Learning outcomes:9 14.Competition and Games, 2h, Learning outcomes:9 15.Training and automation of injury prevention exercises, 2h, Learning outcomes:10				
Required materials	Methodological: Realized according to the elective programmes for which the students decide at the beginning of each semester: football, basketball, swimming, walking, general physical condition. Programmes are adapted to the level of technical and tactical knowledge of a certain group in the individual programme. In addition to the contents included in elective programmes, the students are obliged to climb Sljeme once in every semester and to test the knowledge of swimming in order to get an insight into the number of non swimmers. A course for non swimmers is organized. The competitions and technical-tactical preparations for competitions (football, basketball, water polo, archery and athletics).				
Exam literature	Basic literature: 1. I. Belan, Aerobik, Ivo Balen, Koprivnica, 1988. 2. I. Horvat, Pravila nogometne igre, Novinsko-izdavačko propagandno poduzeće, Zagreb, 1994. 3. 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	Regular attendance				
Knowledge evaluation after semester	The exam is not graded but the knowledge is checked at the beginning, in the preamble, the following semester.				
Student activities:	Aktivnost (Classes attendance)			ECTS 1	
Remark	This course can not be used for final thesis theme				
Prerequisites:	No prerequisites.				
ISVU equivalents:	22259;83784;				
Proposal made by	Boris Metikoš, profesor of kineziology				

Code WEB/ISVU	23273/143309	**ECTS**	1.0	**Academic year**	2018/2019
Name	Kinesiology Education II				
Status	2nd semester - Undergraduate professional study in electrical engineering (Redovni elektrotehnika) - 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. Boris Metikoš ,prof.				
Course objectives	students will raise awareness of the importance of physical education				
Learning outcomes:	1.Demonstrate the proper execution of the technical elements of a specific kinesiologic activity. Level:6 2.Demonstrate the proper execution of the technical elements of a specific kinesiologic activity. Level:6 3.Group together the exercises for each muscle group. Level:6 4.Express the basic rules of a specific kinesiologic activity. Level:6 5.Distinguish the way of training for specific motor and functional abilities. Level:6 6.Compare different physical activities and their impact on the anthropologic characteristics of the body. Level:6 7.Explain the basics of the impact of regular exercise on physical and mental health. Level:6 8.Describe the technical and tactical elements of a specific kinesiologic activity. Level:6 9.Give an example of how to organize a competition. Level:6 10.ability to explain basic relation between physical exercises and general body voluminosity. Level:6				
Methods of carrying out auditory exercises	Workshop				
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:2 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:5 9.Adopting different training methods , 2h, Learning outcomes:5 10.Implementation of the elements of various sporting activities, 2h, Learning outcomes:6 11.Training of injury prevention exercises , 2h, Learning outcomes:7 12.Adoption of basic technical and tactical elements of a specific kinesiologic activity, 2h, Learning outcomes:8 13.Adoption of basic technical and tactical elements of a specific kinesiologic activity, 2h, Learning outcomes:8 14.Competition and Games, 2h, Learning outcomes:9 15.Competition and Games, 2h, Learning outcomes:9				
Required materials	Methodological: Realized according to the elective programmes for which the students decide at the beginning of each semester: football, basketball, swimming, walking, general physical condition. Programmes are adapted to the level of technical and tactical knowledge of a certain group in the individual programme. In addition to the contents included in elective programmes, the students are obliged to climb Sljeme once in every semester and to test the knowledge of swimming in order to get an insight into the number of non swimmers. A course for non swimmers is organized. The competitions and technical-tactical preparations for competitions (football, basketball, water polo, archery and athletics).				
Exam literature	Basic literature: 1. I. Horvat, Pravila nogometne igre, Novinsko-izdavačko propagandno poduzeće, Zagreb, 1994. 2. 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	Regular attendance				
Knowledge evaluation after semester	The exam is not graded but the knowledge is checked at the beginning, in the preamble, the following semester.				
Student activities:	Aktivnost (Classes attendance)		ECTS 1		
Remark	This course can not be used for final thesis theme				
Prerequisites:	No prerequisites.				
ISVU equivalents:	22260;83785;				
Proposal made by	Boris Metikoš, profesor of kineziology				

Code WEB/ISVU	23274/143310	**ECTS**	1.0	**Academic year**	2018/2019
Name	Kinesiology Education III				
Status	3rd semester - Electrical power engineering (Redovni elektrotehnika) - obligatory course3rd semester - Control and computer engineering in automation (Redovni elektrotehnika) - obligatory course3rd semester - Communication and computer technology (Redovni elektrotehnika) - 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. Boris Metikoš ,prof.				
Course objectives	students will raise awareness of the importance of physical education				
Learning outcomes:	1.ability to properly perform technical elements of a particular sport activity. Level:6 2.ability to explain the purpose of performing tactical elements of a particular sport activity. Level:6 3.ability to give an example of organizing students' sport competitions. Level:6 4.ability to group basic kinesiology programs with regard to their influence on human organism. Level:6 5.ability to inform about possibilities of participating in recreational and sport activities in Croatia. Level:6 6.ability to create a personal exercise program for a week/month/year. Level:6 7.ability to describe how to give the first aid in case of sport injury. Level:6				
Methods of carrying out auditory exercises	Workshop				
Course content auditory	1.Improving the technical elements of a specific kinesiologic activity, 2h, Learning outcomes:1 2.Improving the technical elements of a specific kinesiologic activity, 2h, Learning outcomes:1 3.Establishing the rules of a specific kinesiologic activity, 2h, Learning outcomes:2 4.Establishing the rules of a specific kinesiologic activity, 2h, Learning outcomes:2 5.Improving the basic technical and tactical elements of a specific kinesiologic activity, 2h, Learning outcomes:3 6.Improving the basic technical and tactical elements of a specific kinesiologic activity, 2h, Learning outcomes:3 7.Game systems and tactics of a specific kinesiologic activity, 2h, Learning outcomes:4 8.Game systems and tactics of a specific kinesiologic activity, 2h, Learning outcomes:4 9.Team leadership, officiating, organization of competitions, 2h, Learning outcomes:5 10.Training structure (content and organization) of a specific kinesiologic activity, 2h, Learning outcomes:6 11.Learning and application of a specific kinesiologic activity for the purpose of independent regular exercise during free time., 2h, Learning outcomes:7 12.Learning and application of a specific kinesiologic activity for the purpose of independent regular exercise during free time., 2h, Learning outcomes:7 13.Adoption of exercises for each muscle group for the prevention of occupational injuries, 2h, Learning outcomes:6 14.Strength and mobility exercises for the prevention of injuries, First aid, 2h, Learning outcomes:5 15.Basic characteristics of different kinesiologic activities and their impact on anthropological characteristics, 2h, Learning outcomes:6				
Required materials	Methodological: Realized according to the elective programmes for which the students decide at thebeginning of each semester: football, basketball, swimming, walking, general physical condition.Programmes are adapted to the level of technical and tactical knowledge of a certain group in the individual programme. In addition to the contents included in elective programmes, the students are obliged to climb Sljeme once in every semester and to test the knowledge of swimming in order to get an insight into the number of non swimmers. A course for non swimmers is organized. The competitions and technical-tactical preparations for competitions (football, basketball, waterpolo, archery and athletics).				
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.				
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 work				
Knowledge evaluation after semester	The exam is not graded but the knowledge is checked at the beginning, in the preamble, the following semester.				
Student activities:	Aktivnost (Classes attendance)			ECTS 1	
Remark	This course can not be used for final thesis theme				
Prerequisites:	No prerequisites.				
ISVU equivalents:	22261;83787;				
Proposal made by	Boris Metikoš, profesor of kineziology				

Code WEB/ISVU	23275/143311	**ECTS**	1.0	**Academic year**	2018/2019
Name	Kinesiology Education IV				
Status	4th semester - Electrical power engineering (Redovni elektrotehnika) - obligatory course4th semester - Control and computer engineering in automation (Redovni elektrotehnika) - obligatory course4th semester - Communication and computer technology (Redovni elektrotehnika) - 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. Boris Metikoš ,prof.				
Course objectives	students will raise awareness of the importance of physical education				
Learning outcomes:	1.Apply the rules of a specific kinesiologic activity. Level:6 2.Demonstrate the technical and tactical elements of a specific kinesiologic activity. Level:6 3.Demonstrate the proper execution of the technical elements of a particular kinesiologic activity. Level:6 4.Choose the proper kinesiologic operators for learning and improving a specific sporting activity. Level:6 5.Design and present a personal exercise program for the week / month / year. Level:6 6.Envision the organization of student sports competitions and teamwork training. Level:6 7.Conduct a kinesiologic program with regard to its impact on the body. Level:6 8.Demonstrate strength and mobility exercises for the purposes of injury prevention . Level:6 9.Interpret the benefits of kinesiologic activities for the purpose of raising the level of skills and qualities. Level:6 10.ability to point out the importance of physical activity in prevention against occupational diseases of locomotive system. Level:6				
Methods of carrying out auditory exercises	Workshop				
Course content auditory	1.Adopting and improving the technical elements of a chosen kinesiologic activity, 2h, Learning outcomes:1 2.Adopting and improving the technical elements of a chosen kinesiologic activity, 2h, Learning outcomes:1 3.Improving the technical and tactical elements of a specific kinesiologic activity, 2h, Learning outcomes:2 4.Improving the technical and tactical elements of a specific kinesiologic activity, 2h, Learning outcomes:2 5.Establishing the rules of a specific kinesiologic activity, 2h, Learning outcomes:3 6.Establishing the rules of a specific kinesiologic activity, 2h, Learning outcomes:3 7.Analysis and methods of teaching a specific kinesiologic activity, 2h, Learning outcomes:4 8.Application of a specific kinesiologic activity for the purpose of independent regular exercise during free time., 2h, Learning outcomes:5 9.Application of a specific kinesiologic activity for the purpose of independent regular exercise during free time., 2h, Learning outcomes:5 10.Team leadership, officiating, organization of competitions, 2h, Learning outcomes:6 11.Training structure (content and organization) of a specific kinesiologic activity, 2h, Learning outcomes:7 12.Training structure (content and organization) of a specific kinesiologic activity, 2h, Learning outcomes:7 13.Selection of exercises for each muscle group for the prevention of occupational injuries, 2h, Learning outcomes:8 14.Basic characteristics of different kinesiologic activities and their impact on anthropological characteristics, 2h, Learning outcomes:9 15.Basic characteristics of different kinesiologic activities and their impact on anthropological characteristics, 2h, Learning outcomes:9				
Required materials	Methodological: Realized according to the elective programmes for which the students decide at the beginning of each semester: football, basketball, swimming, walking, general physical condition. Programmes are adapted to the level of technical and tactical knowledge of a certain group in theindividual programme. In addition to the contents included in elective programmes, the students are obliged to climb Sljeme once in every semester and to test the knowledge of swimming in order to get an insight into the number of non swimmers. A course for non swimmers is organized. The competitions and technical-tactical preparations for competitions (football, basketball, waterpolo, archery and athletics).				
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.				
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	Regular attendance				
Knowledge evaluation after semester	The exam is not graded but the knowledge is checked at the beginning, in the preamble, the following semester.				
Student activities:	Aktivnost (Classes attendance)		ECTS 1		
Remark	This course can not be used for final thesis theme				
Prerequisites:	No prerequisites.				
ISVU equivalents:	22262;83788;				
Proposal made by	Boris Metikoš, profesor of kineziology				

Code WEB/ISVU	23480/155990	**ECTS**	4.0	**Academic year**	2018/2019
Name	LabView graphic programming				
Status	5th semester - Electrical power engineering (Redovni elektrotehnika) - elective course5th semester - Control and computer engineering in automation (Redovni elektrotehnika) - elective course3rd semester - Communication and computer technology (Redovni elektrotehnika) - elective course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (6+24+0+0) 60
Teachers	Lectures:1. pred. Ivan Lujo , dipl.ing. Lectures:2. Tomislav Novak mag. ing. inf. et comm. techn. Auditory exercises:pred. Ivan Lujo , dipl.ing. Auditory exercises: Tomislav Novak mag. ing. inf. et comm. techn. Laboratory exercises:pred. Ivan Lujo , dipl.ing. Laboratory exercises: Tomislav Novak mag. ing. inf. et comm. techn.				
Course objectives	students will be familiar with basic graphic programming and the examples of the LabView programming tool applications				
Learning outcomes:	1.to recognize the difference between the graphical and textual (command line) programing approach. Level:6 2.ability to create virtual measuring instrument whose functions are performed by using a computer . Level:6,7 3.ability to integrate a computer and LabView software package into a measurement process and data display. Level:6,7 4.ability to design a software application for measurements using graphical programming language. Level:6 5.ability to recognize a possibility for using computer as a measuring instrument. Level:6 6.connecting the computer with other "outside" units (electronics, mechanics,...). Level:6,7				
Methods of carrying out lectures	Ex cathedra teaching Guest lecturer Case studies Demonstration Simulations Modelling Discussion Questions and answers				
Methods of carrying out auditory exercises	Laboratory exercises on laboratory equipment Group problem solving Discussion, brainstorming Computer simulations Interactive problem solving Workshop				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Laboratory exercises, computer simulations Group problem solving Discussion, brainstorming Computer simulations Workshop Other				
Course content lectures	1.Introduction to LabView environment, 2h, Learning outcomes:1 2.Basics of LabView environment , 2h, Learning outcomes:1 3.Elements of control flow of the LabView program execution, 2h, Learning outcomes:1,3 4.Elements of control flow of the LabView program execution, 2h, Learning outcomes:1,3 5.Fields and other complex data types , 2h, Learning outcomes:3,4 6.Fields and other complex data types , 2h, Learning outcomes:3,4 7.Graphical presentation of data, 2h, Learning outcomes:3,4 8.Graphical presentation of data, 2h, Learning outcomes:3,4 9.Creating text and files, 2h, Learning outcomes:1,3 10.Measurement and signal generating, 2h, Learning outcomes:1,3 11.Digital and analog inputs and outputs, 2h, Learning outcomes:2,3,4,6 12.Digital and analog inputs and outputs, 2h, Learning outcomes:2,3,4,6 13.Measuring instrument control, 2h, Learning outcomes:2,4,5,6 14. Advanced LabView structures and functions , 2h, Learning outcomes:2,4,5,6 15.Communication with other software and hardware equipment, 2h, Learning outcomes:4,5,6				
Course content auditory	1.No class, 2h 2.No class, 2h 3.Solving more difficult laboratory exercise assignments, 2h 4.No class, 2h 5.No class, 2h 6.No class, 2h 7.Solving more difficult laboratory exercise assignments, 2h 8.No class, 2h 9.No class, 2h 10.No class, 2h 11.No class, 2h 12.Solving more difficult laboratory exercise assignments, 2h 13.No class, 2h 14.No class, 2h				

	15.No class, 2h
Course content laboratory	1.Test 2.Test 3.Introduction and basic elements of LabView environment, variable types, 2h, Learning outcomes:1,3 4.LabVIEW execution control elements, 2h, Learning outcomes:1,3,4 5.Complex operations in LabVIEW, random number generation, 2h, Learning outcomes:1,3,4 6.Test, 2h 7.Text and textual manipulation (string operations), 2h, Learning outcomes:2,5,6 8.Complex data types, arrays, 2h, Learning outcomes:2,5,6 9.Clusters and State machine, 2h, Learning outcomes:2,5,6 10.Test, 2h 11.Data acquisition, 2h, Learning outcomes:2,3,5 12.7 segment display and acquired data manipulation, 2h, Learning outcomes:3,5,6 13.File data storage, 2h, Learning outcomes:3,5,6 14.Test, 2h 15.No class
Required materials	Basic: classroom, blackboard, chalk... Special purpose computer laboratory Whiteboard with markers Overhead projector Operating supplies Special equipment
Exam literature	J. Travis, J. Kring - LabVIEW for Everyone: Graphical Programming Made Easy and Fun, III izdanje, Prentice Hall, 2006 National Instruments web stranice: http://www.ni.com/academic/students/learnlabview/
Students obligations	50% of totally possible points covering lab attendance and knowledge checks
Knowledge evaluation during semester	Three knowledge checks during the semester 75% Lab attendance (beside tests) 25% Total of 50% needed for a passing grade
Knowledge evaluation after semester	Written test - 50% needed for a passing grade Oral examination - 50% needed for a passing grade
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
ISVU equivalents:	93491;
Proposal made by	Ivan Lujo, Msc. Lecturer

Code WEB/ISVU	22867/22296	**ECTS**	4.0	**Academic year**	2018/2019
Name	Lighting and Installations				
Status	5th semester - Electrical power engineering (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+15 (0+15+0+0) 75
Teachers	Lectures:1. dr.sc. Davor Petranović dipl.ing.el. Laboratory exercises:dr.sc. Davor Petranović dipl.ing.el.				
Course objectives	Students should be capable to solve problems in the field of electrical installations and lighting and produce project documentation.				
Learning outcomes:	1.ability to analyze requirements for lighting. Level:6 2.ability to identify the required type of lighting . Level:6 3.ability to identify the existence of such lighting in a similar space. Level:6 4.ability to examine the preliminary view of lighting after installment. Level:6 5.ability to classify the sources of light applied in project. Level:6 6.ability to comment on accepted solution. Level:6 7.analyze the type and the elements of the installation. Level:6 8.knowledge check. Level:6				
Involvement of learning outcomes of the course in study programme:	5.1.EE Razumjeti princip rada električnih rotacijskih strojeva, transformatora, dalekovoda i sklopnih aparata: 15h in 120h				
Methods of carrying out lectures	Ex cathedra teaching Discussion Questions and answers Drawings, tables and diagrams are used to ease understanding. The specific examples are also shown through photographs, design, project and test documentation. All exposed materials are analyzed and discussed with students to achieve their active participation. It is necessary to have blackboard and LCD projector.				
Methods of carrying out laboratory exercises	Laboratory exercises, computer simulations Computer simulations				
Course content lectures	1.Low-voltage networks and indoor and outdoor installations., 2h, Learning outcomes:7 2.Low-voltage networks and indoor and outdoor installations., 2h, Learning outcomes:7 3.Low- and medium-voltage power distribution: construction types, requirements, conductors, cables and accessories. , 2h, Learning outcomes:7 4.Low- and medium-voltage power distribution: construction types, requirements, conductors, cables and accessories., 2h, Learning outcomes:7 5.Conductor and load control and protection., 2h, Learning outcomes:6 6.Conductor and load control and protection. , 2h, Learning outcomes:6 7.Low-voltage installation equipment selection and design., 2h, Learning outcomes:7 8.Control and communication devices installations. , 2h, Learning outcomes:7 9.Lighting basics. Lighting sources: construction, colour, accessories, use and duration., 2h, Learning outcomes:1 10.Sources and luminaries characteristics., 2h, Learning outcomes:2 11.Indoor and outdoor lighting design. , 2h, Learning outcomes:5 12.Utility method, point method and glare limiting method., 2h, Learning outcomes:5 13.Reflecting surface influence and characteristics., 2h, Learning outcomes:4 14.Standardization., 2h, Learning outcomes:1 15.Computer program applications in low-voltage installations and lighting., 2h, Learning outcomes:5				
Course content laboratory	1.Indoor lighting design., 2h, Learning outcomes:1 2.Indoor lighting design., 1h, Learning outcomes:2 3.Indoor lighting design., 1h, Learning outcomes:5 4.Outdoor lighting design., 2h, Learning outcomes:1 5.Outdoor lighting design., 1h, Learning outcomes:2 6.Outdoor lighting design., 1h, Learning outcomes:5 7.colloquium, 2h, Learning outcomes:8 8.no teaching 9.Installation calculation, 2h, Learning outcomes:7 10.Installation calculation, 1h, Learning outcomes:7 11.Installation calculation, 1h, Learning outcomes:7 12.no teaching 13.no teaching 14.colloquium, 1h, Learning outcomes:8 15.no teaching				
Required materials	General purpose computer laboratory Whiteboard with markers Overhead projector				
Exam literature	Basic literature: 1. Tehnički priručnik, Končar Zagreb 2. RELUX On-line manual 3. Ecodial On-line manual Dodatna: 1. Električne instalacije u zgradama - Zbirka el.teh. propisa i pravila				
Students obligations	written professional paper in accordance with the contents and layout defined by Regulations on Final Thesis				

Knowledge evaluation during semester	Pisana provjera znanja#2#80#50$Usmena provjera znanja#1#20#50$	
Knowledge evaluation after semester	Paper test#1#80#50$verbal exam#1#20#50$	
Student activities:	Aktivnost (Written exam) (Oral exam)	ECTS 3 1
Remark	This course can be used for final thesis theme	
Prerequisites:	No prerequisites.	
Proposal made by	MSEE Davor Petranović, senior lecturer	

Code WEB/ISVU	22869/22301	**ECTS**	4.0	**Academic year**	2018/2019
Name	Linear and Nonlinear Networks				
Status	3rd semester - Communication and computer technology (Redovni elektrotehnika) - elective course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+15 (15+0+0+0) 75
Teachers	Lectures:1. Željko Stojanović Auditory exercises: Željko Stojanović				
Course objectives	Students will acquire knowledge in the field of electrical circuit analysis				
Learning outcomes:	1.ability to classify models of electrical components. Level:6,7 2.ability to predict basic properties of electrical circuits. Level:6,7 3.ability to analyze simple electrical circuits in a time interval. Level:6 4.ability to analyze simple electrical circuits in a frequency interval. Level:6 5.ability to compare the methods of analysis. Level:6,7				
Methods of carrying out lectures	Ex cathedra teaching Case studies Modelling Discussion Questions and answers Seminar, students presentation and discussion Homework presentation				
Methods of carrying out auditory exercises	Traditional literature analysis Discussion, brainstorming Mind mapping				
Course content lectures	1.Introduction, 2h, Learning outcomes:1,2,3 2.One-port resistors, 2h, Learning outcomes:1,2,3 3.One-port resistors, 1h, Learning outcomes:1,2,3 One-port reactive elements, 1h, Learning outcomes:1,2,3 4.One-port reactive elements, 2h, Learning outcomes:1,2,3 5.Multi-port resistors, 2h, Learning outcomes:1,2,3 6.Commutation laws, 2h, Learning outcomes:1,2,3 7.First-order circuits, 2h, Learning outcomes:1,2,3 8.Second-order circuits - free response, 2h, Learning outcomes:1,2,3 9.Second order circuits - complete response, 2h, Learning outcomes:1,2,3 10.Second order circuits - complete response, 1h, Learning outcomes:1,2,3 Basic properties of Laplace transforms, 1h, Learning outcomes:4,5 11.Basic properties of Laplace transforms, 2h, Learning outcomes:4,5 12.Circuit analysis using Laplace transform , 2h, Learning outcomes:1,2,4,5 13.Network functions, 2h, Learning outcomes:1,2,4,5 14.Reciprocity Theorem, 2h, Learning outcomes:1,2,4,5 15.Two-ports, 2h, Learning outcomes:1,2,4,5				
Course content auditory	1.Introduction, 1h, Learning outcomes:1,2,3 2.One-port resistors, 1h, Learning outcomes:1,2,3 3.One-port resistors, 1h, Learning outcomes:1,2,3 4.One-port reactive elements, 1h, Learning outcomes:1,2,3 5.One-port reactive elements, 1h, Learning outcomes:1,2,3 6.Multi-port resistors, 1h, Learning outcomes:1,2,3 7.Commutation laws, 1h, Learning outcomes:1,2,3 8.First order circuits, 1h, Learning outcomes:1,2,3 9.Second order circuits - free response, 1h, Learning outcomes:1,2,3 10.Second order circuits - forced response, 1h, Learning outcomes:1,2,3 11.Basic properties of Laplace transformation, 1h, Learning outcomes:4,5 12.Laplace Transformation Circuit Analysis, 1h, Learning outcomes:1,2,4,5 13.Network functions, 1h, Learning outcomes:1,2,4,5 14.Reciprocity Theorem, 1h, Learning outcomes:1,2,4,5 15.Two-port elements, 1h, Learning outcomes:1,2,4,5				
Required materials	Basic: classroom, blackboard, chalk... Whiteboard with markers Maquette				
Exam literature	Basic literature: 1. Flegar, Teorija mreža-Bilješke s predavanja, Sveučilište u Osijeku, Osijek, 2001 Additional literature: 1. Chua, Desoer, Kuh, Linear and Nonlinear Circuits, Mc. Graw Hill Comp. 1987 2. Nilsson, Riedel, Electric circuits, Reading, Massachusetts, Addison-Wesley Publ. Comp. 1996 3. Flegar, Teorija mreža-Zbirka zadataka, Sveučilište u Osijeku, Osijek, 1996 4. Flegar, Teorija mrežaIspitna pitanja, ETF Osijek, Osijek, 2001, Interna skripta 5. Željko Stojanović, Linearne i nelinearne mrežeDodatni zadaci i pitanja, http://nastava.tvz.hr/zstojanovic/predmeti/linem/linem.htm				
Students obligations	There are 10 small exams during the semester. Minimum condition is 20% overall.				
Knowledge	There are 10 small exams during the semester.				

evaluation during semester	Grades: - 0 - 20% #8594; the conditions for taking exams are not accomplished for the whole year - 20 - 50% #8594; 1 , not passed - 50 - 64% #8594; 2 , passed - 64 - 80% #8594; 3 , passed - 80 - 90% #8594; 4 , passed - 90 - 100% #8594; 5 , passed Another option is to pass seminary or consultations.
Knowledge evaluation after semester	The exam consists of 20 questions divided into two groups, both of 10 questions from announced list of questions (see additional literature number 4). Group A consists of questions from number 1 to 43, and 56 to 96. Group B consists of questions from number 199 to 231, 277 to 282 and 293 to 301. There are 120 minutes for solving the exam. Value of each question is 1 point. The condition for passing the written exam is at least 50$ correct answers from each group of question. Passing grades - 10 do 13 points #8594; 2 - 13 do 16 points #8594; 3 - 16 do 18 points #8594; 4 - 18 do 20 points #8594; 5 There is oral exam after written exam.
Student activities:	Aktivnost ECTS (Constantly tested knowledge) 4
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
Proposal made by	Željko Stojanović

Code WEB/ISVU	23492/156008	**ECTS**	5.0	**Academic year**	2018/2019
Name	Lines and Antennas				
Status	4th semester - Communication and computer technology (Redovni elektrotehnika) - 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 Sonja Zentner Pilinsky prof.v.š. Lectures:Prof.dr.sc. Slavica Ćosović Bajić Auditory exercises:dr.sc Sonja Zentner Pilinsky prof.v.š. Laboratory exercises: Antonio Krajinović mag.ing.inf. et comm.techn Laboratory exercises: Siniša Lacković struč.spec.ing.el. Laboratory exercises:dr.sc Sonja Zentner Pilinsky prof.v.š.				
Course objectives	students will acquire knowledge of types of transmission lines used in modern communication systems and of special features of high-frequency signal transmission				
Learning outcomes:	1.ability to design basic types of transmission lines (coaxial cable, microstrip line, rectangular waveguide) . Level:6 2.ability to calculate stub matching at microwave frequencies. Level:6 3.ability to calculate the input impedance correlated to load impendence, transmission line length and matching elements. Level:6 4.ability to analyze different causes of external losses in radio (wireless) communication system. Level:6 5.ability to distinguish between various antennas and their parameters (gain efficiency coefficient, polarization, frequency band). Level:6,7 6.ability to identify SM and MM fibers and various optical cables. Level:6 7.ability to calculate power budget in wireless communication system consisting of transmitter with antenna and receiver with antenna. Level:6 8.ability to predict a possibility of establishing a wireless communication system with available components. Level:6				
Methods of carrying out lectures	Ex cathedra teaching Guest lecturer Discussion Questions and answers The subject matter is taught by using a number of particular examples. Students are constantly motivated to take an active part in class.Teaching equipment: board, overhead projector and LCD projector.				
Methods of carrying out auditory exercises	Group problem solving Students solve practical examples.				
Methods of carrying out laboratory exercises	Laboratory exercises, computer simulations Students solve practical examples on computers. Lab excersises preparatin are obligatory homework.				
Course content lectures	1.Introduction - definition of communication system, coax cable and transmission line, lumped and distributred parameters , 2h, Learning outcomes:1,3 2.Coax cables and microstrip lines, 2h, Learning outcomes:1,3 3.Definition of lossless tramsmission line parameters - characteristic impedance, SWR, reflection coefficient , 2h, Learning outcomes:1,3 4. Smith chart - definition, impedance and admittance characterization along the transmission line , 2h, Learning outcomes:1,2,3 5.Stub matching in Smith chart , 2h, Learning outcomes:1,2,3 6.Stub matching in Smith chart , 2h, Learning outcomes:1,2,3 7.Fibers and optical cables - SM and MM fiber, number of modes, basic fiber and cable characteristics (, 2h, Learning outcomes:6 8.Rectangular waveguide definition, TE and TM modes, singlemode transmission frequency, waveguide excitation , 2h, Learning outcomes:1 9.Rectangular waveguide definition, TE and TM modes, singlemode transmission frequency, waveguide excitation , 2h, Learning outcomes:1 10.Capacity and inductivity in rectangualr waveguide, waveguide filters, waveguide resonator, dispersion in waveguides (, 2h, Learning outcomes:1 11.Antennas - definitions and antenna parameters , 2h, Learning outcomes:4,8 12.Elementary dipole and elementary surface, dipoles and monopoles , 2h, Learning outcomes:4 13.Linear antenna array - array factor, array calculations, 2h, Learning outcomes:7 14.Linear antenna array - array factor, array calculations, 2h, Learning outcomes:7 15.Different antennas and antenna arrays - reflectors, Yagi-Uda, horns, wideband antennas , 2h, Learning outcomes:5,8				
Course content auditory	1.coax characteristic impedance calculations and coax dimensioning; dimensioning of microstrip lines, 1h, Learning outcomes:1 2.calculations of impedance and admitance along transmission line (with Smith chart), 1h, Learning outcomes:3 3.calculations of impedance and admitance along transmission line (with Smith chart), 1h, Learning outcomes:3 4.stub matching, 1h, Learning outcomes:2 5.stub matching, 1h, Learning outcomes:2 6.matching with lambda quarter transformer, 1h, Learning outcomes:2 7.matching with lambda quarter transformer, 1h, Learning outcomes:2 8.NA and number of modes calculations in fiber, SM condition, 1h, Learning outcomes:6 9.waveguide modes calculations, single mode operation conditions, losses per length, 1h, Learning outcomes:1,3 10.waveguide modes calculations, single mode operation conditions, losses per length, 1h, Learning outcomes:1,3 11.Friis equation, 1h, Learning outcomes:4,5 12.Friis equation, 1h, Learning outcomes:4,5 13.Antenna array calculations, array diagram, feeder impedance, lambda/4 transformer in feeder lines , 1h, Learning outcomes:7,8 14.Antenna array calculations, array diagram, feeder impedance, lambda/4 transformer in feeder lines , 1h, Learning outcomes:7,8				

	15.Antenna array calculations, array diagram, feeder impedance, lambda/4 transformer in feeder lines , 1h, Learning outcomes:7,8
Course content laboratory	1.no lab exercises 2.no lab exercises 3.no lab exercises 4.Characteristic impedance of various transmission lines, 2h, Learning outcomes:1,3 5.Measurements of transmission line losses, 2h, Learning outcomes:2 6.SWR measurements, 2h, Learning outcomes:2 7.no lab exercises 8.no lab exercises 9.Stub matching, 1h, Learning outcomes:2 10.Folded dipole and monopole impedance, log-periodic antenna, 2h, Learning outcomes:3,4 11.Long wire antenna patters, 2h, Learning outcomes:5,8 12.no lab exercises 13.Measurements of free space losses and antenna pattern, 2h, Learning outcomes:1,4,5 14.Measurements of directional coupler characteristics, 2h, Learning outcomes:1,4,5 15.no lab exercises
Required materials	Basic: classroom, blackboard, chalk... General purpose computer laboratory Whiteboard with markers Overhead projector
Exam literature	Basic literature: 1. E. Zentner, Antene i radiosustavi ,Graphis, Zagreb, 2001 Additional literature:
Students obligations	regular class attendance
Knowledge evaluation during semester	Redovitost pohaa#5#10#50$Mini-test#2#30#40$Kolokvij, numeri zadaci#3#30#50$Kolokvij, teorijska pitanja#3#15#50$Prakti rad#6#15#50$
Knowledge evaluation after semester	written exam and after copletion of min. 50% oral exam
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
ISVU equivalents:	28962;
Proposal made by	professor Slavica Čosović-Bajić, Ph.D.; professor Sonja Zentner Pilinsky,Ph.D.

Code WEB/ISVU	23088/85714	**ECTS**	5.0	**Academic year**	2018/2019
Name	Maintenance				
Status	6th semester - Control and computer engineering in automation (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				45+45 (45+0+0+0) 60
Teachers	Lectures:1. mr.sc. Branimir Preprotić dipl. inž. stroj. Auditory exercises: Darko Mitrović Auditory exercises:mr.sc. Branimir Preprotić dipl. inž. stroj.				
Course objectives	Gain competences for plant or service maintenance management				
Learning outcomes:	1.Risks. Level:6 2.Time based acitivity plan. Level:6,7 3.Maintenance strategy . Level:6,7 4.Reliability, Availability, Overall Equipment Efectiveness. Level:6 5.Maintenance management. Level:6,7				
Methods of carrying out lectures	Ex cathedra teaching Guest lecturer Case studies Discussion Questions and answers Seminar, students presentation and discussion Homework presentation Company visit				
Methods of carrying out auditory exercises	Group problem solving Traditional literature analysis Data mining and knowledge discovery on the Web Discussion, brainstorming Workshop				
Course content lectures	1.Maintenance-Introduction, definitions and maintenance concepts, 6h, Learning outcomes:3,5 2.Types of maintenance, 6h, Learning outcomes:5 3.Defining of maintenance key performance indicators, 6h, Learning outcomes:1,4 4.No Lessons 5.No Lessons 6.Introduction to maintenance organizational models, 3h, Learning outcomes:5 7.Service workshop orgnization, 6h, Learning outcomes:1,3,5 8.Legal requirements in maintenance, 6h 9.No lessons 10.No lessons 11.No Lessons 12.Test-second part, 3h, Learning outcomes:2 13.Project management-theory, 6h, Learning outcomes:2 14.Project management-theory, 3h, Learning outcomes:2 15.Nema nastave				
Course content auditory	1.No lessons 2.No lessons 3.No lessons 4.Calculation of maintenance Key performance indicators, 6h, Learning outcomes:4 5.Maintenance diagnostic, 6h 6.Test ofacquired knowledge, 3h 7.No lessons 8.No lessons 9.Case Study: Organization of automatization maintenance Thermo power plant and specific requirements , 6h, Learning outcomes:5 10.Case Study: Organization of service network on entire area of Croatia, tools and SW implemented , 6h, Learning outcomes:1,2,3 11.Visit to plant with best in class maintenance organization, 3h, Learning outcomes:3,4,5 Analysis of Case studies and company visit-Lessons learned, 3h, Learning outcomes:1,2,3,4,5 12.Test-Second part, 3h 13.No Lessons 14.Project management Excercise, 3h, Learning outcomes:2 15.Test-third part, 3h Student prezentations, 3h, Learning outcomes:1,2,3,4,5				
Required materials	Basic: classroom, blackboard, chalk... Whiteboard with markers Overhead projector				
Exam literature	Materijali objavljeni na intranetu				
Students obligations	Attendance of lectures				
Knowledge evaluation during semester	3 tests				
Knowledge evaluation after	Exams-writen and oral				

semester		
Student activities:	Aktivnost	ECTS
	(Classes attendance)	1
	(Written exam)	3
	(Oral exam)	1
Remark	This course can be used for final thesis theme	
Prerequisites:	No prerequisites.	
ISVU equivalents:	32776;	
Proposal made by	mr.sc. Branimir Preprotić dipl. inž. stroj.,	

Code WEB/ISVU	23481/155991	**ECTS**	2.0	**Academic year**	2018/2019
Name	Mathematical Tools in Electrical Engineering				
Status	2nd semester - Undergraduate professional study in electrical engineering (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				0+30 (30+0+0+0) 30
Teachers	Auditory exercises:1. Luka Marohnić Auditory exercises:2. mr.sc. Bojan Kovačić , viši predavač Auditory exercises:3. Ivica Vuković Auditory exercises:4. dr. sc. Anđa Valent viši predavač Auditory exercises:Prof.dr.sc. Slavica Ćosović Bajić Auditory exercises:dr.sc. Mandi Orlić Bachler v.pred Auditory exercises: Goran Sirovatka				
Course objectives	Students will acquire basic knowledge and skills working with properly chosen mathematical software.				
Learning outcomes:	1.input mathematical expression. Level:6 2.combine possible problem solutions. Level:6,7 3.display function graphs . Level:6 4.write simple computer programs. Level:6,7 5.solve (non)algebraic equations. Level:6 6.solve ordinary differential equations. Level:6				
Methods of carrying out auditory exercises	Laboratory exercises, computer simulations Computer simulations a laptop				
Course content auditory	1.Introduction. Scientific notation., 2h, Learning outcomes:2 2.Computing values of elementary math functions., 2h, Learning outcomes:2 3.Matrix input and generating. Basic matrix operations., 2h, Learning outcomes:2 4.Changing matrix elements. Calculating matrix determinant and inverse matrix., 2h, Learning outcomes:2 5.Anonymous functions and applications. Displaying function graphs., 2h, Learning outcomes:4 6.Working with ordinary and function m-files. Creating primary functions., 2h, Learning outcomes:5 7.1. preliminary exam., 2h, Learning outcomes:2,4,5 8.Symbolic expressions., 2h, Learning outcomes:2 9.Computing limits and differentials., 2h, Learning outcomes:2 10.Computing integrals., 2h, Learning outcomes:1 11.Numeric series. , 2h, Learning outcomes:3,6 12.Function series. Taylor and Fourier series., 2h, Learning outcomes:3,6 13.Laplace transform. Solving ordinary differential equations.,, 2h, Learning outcomes:3 14.Overview of free mathematical software., 2h, Learning outcomes:2,5 15.2. preliminary exam., 2h, Learning outcomes:1,2,3,5,6				
Required materials	Basic: classroom, blackboard, chalk... General purpose computer laboratory Whiteboard with markers Overhead projector a laptop				
Exam literature	Obavezna: 1. Autorizirani radni materijal za auditorne vježbe 2. B. Kovačić: Matematički alati u elektrotehnici, elektronički udžbenik, Tehničko veleučilište u Zagrebu, Zagreb, 2013. Additional literature: 1. MATLAB Documentation-Version R0216a., The MathWorks Inc., Natick, 2016. 2. M. Vrdoljak: Uvod u MATLAB, (http://titan.fsb.hr/mvrdolja/matlab) 3. R. L. Spencer, M. Ware: Introduction to MATLAB, Brigham Young University, 2011. 4. Getting started with MATLAB , The Math Works, 2016.				
Students obligations	Performed all laboratory exercises.				
Knowledge evaluation during semester	1. preliminary exam: eliminatory; pass: 50% od total points; 2. preliminary exam: eliminatory; pass: 50% of total points; Final mark: 50% - 62% od total points at both preliminary exams = sufficient (2) 63% - 74% od total points at both preliminary exams = good (3) 75% - 89% od total points at both preliminary exams = very good (4) 90% - 100% od total points at both preliminary exams = excellent (5)				
Knowledge evaluation after semester	Practical exams 4 exam terms; pass: 50% od total points.				

	Ocjene: see final marks formed as the result of both preliminary exams.
Student activities:	Aktivnost ECTS (Constantly tested knowledge) 2
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
ISVU equivalents:	85622;
Proposal made by	Bojan Kovačić, M.Sc., senior lecturer, Luka Marohnić, B.Sc., lecturer (31.5.2018.)

Code WEB/ISVU	23482/155992	**ECTS**	7.0	**Academic year**	2018/2019
Name	Mathematics I				
Status	1st semester - Undergraduate professional study in electrical engineering (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				45+45 (45+0+0+0) 120
Teachers	Lectures:1. mr.sc. Bojan Kovačić , viši predavač Lectures:2. Luka Marohnić Lectures:3. dr. sc. Anđa Valent viši predavač Lectures:4. Ivica Vuković Auditory exercises:mr.sc. Bojan Kovačić , viši predavač Auditory exercises: Luka Marohnić Auditory exercises:dr. sc. Anđa Valent viši predavač Auditory exercises: Ivica Vuković				
Course objectives	Students will understand the teaching material and develop the skill required for solving the relevant problems.				
Learning outcomes:	1.ability to analyze the real function of a real variable. Level:6 2.ability to calculate sum, difference, product and quotient of complex numbers written in some of three standard forms. Level:6 3.ability to calculate dot, cross and scalar triple products of three vectors and give an interpretation of theobtained results. Level:6 4.ability to calculate derivations of the real function of a real variable . Level:6 5.calculate the limit of a sequence of real numbers and the limit of a real function of a real variable. Level:6 6.ability to plot the graph of the real real function of a real variable . Level:6 7.calculate sum, difference and product of two real matrices, and inverse of regular real matrix. Level:6				
Methods of carrying out lectures	Ex cathedra teaching Case studies Modelling Discussion Questions and answers Other The course material is being presented in the classroom with detailed explanations and comments.				
Methods of carrying out auditory exercises	Computer simulations Other The problems are being solved on the blackboard with detailed explanations.				
Course content lectures	1.Introduction to the module. Basic principles of mathematic logics. Mathematical induction, 3h 2.Complex numbers. Euler formula., 3h, Learning outcomes:2 3.Basic concept of matrix algebra., 2h, Learning outcomes:7 Determinants of order at most 3., 1h, Learning outcomes:7 4.Basic concept of vector algebra, 2h, Learning outcomes:3 Dot, outer and triple cross of vectors and their applications., 1h, Learning outcomes:3 5.Concept of real functions with one real variable. Function natural domain. Bijective function and its inverse., 3h, Learning outcomes:1 6.Polynomials. Polynomial roots. Basic theorem of algebra., 3h, Learning outcomes:1,6 7.Polynomial long division. Rational functions. Zeros and poles of rational function. Partial fraction decomposition of rational function., 3h, Learning outcomes:1,6 8.A sequence of real numbers. Limit of a sequence of real numbers. Number e. Limit of a real function of a real variable. Some basic limits., 3h, Learning outcomes:5 9.Continuous function. Local and global components of continuous function., 2h, Learning outcomes:1,5 10.Derivation of a real function of a real variable. Derivation rules. Getting some elementary derivations of real functions., 3h, Learning outcomes:4 11.Some derivation techniques., 3h, Learning outcomes:4 12. Basic theorems of differential calculus (Fermat, Rolle, Lagrange and Cauchy theorem)., 3h, Learning outcomes:1,4 13.Local and global extrema of a real function. LHospital-Bernoulli rule. Asymptotes., 3h, Learning outcomes:1,4,5 14.Derivative of order 2. Intervals of concavity and convexity. Inflection points. Examining a real function of a real variable., 3h, Learning outcomes:1,4,6 15.Higher order derivatives. Concept of differentials., 3h, Learning outcomes:1,4				
Course content auditory	1.Basic principles of mathematical logics., 3h 2.Forms of complex numbers. De Moivre formulas. Euler formula., 3h, Learning outcomes:2 3.The basic concepts of matrix algebra., 3h, Learning outcomes:3 4.The basic concepts of vector algebra., 3h, Learning outcomes:3,7 5.Real functions of a real variable - general notion and domain. Algebraic operations with functions. Inverse of a bijective function., 3h, Learning outcomes:1,7 6.Polynomials. Rational functions. Decomposition of rational function into partial fractions., 2h, Learning outcomes:7 7.Harmonic function. Superposition of two harmonic functions., 3h, Learning outcomes:1,7 8.1. preliminary exam, 2h, Learning outcomes:1,2,3,7 Hyperbolic functions., 1h, Learning outcomes:1,7 9.Limit of a sequence of real numbers. Limit of a real variable function., 3h, Learning outcomes:5 10.Derivation of real function with one real variable. Derivation rules., 3h, Learning outcomes:4 11.The chain rule. Derivation of implicite defined function. Derivation of parametric defined function., 3h, Learning outcomes:4 12.Tangent and normal of plain curve. LHospital-Bernoulli rule., 3h, Learning outcomes:1,4 13.Intervals of monotonicity of real function. Finding the extrema of a real function. Mathematical modelling of simple optimization tasks., 3h, Learning outcomes:1,4,6 14.Intervals of concavity and convexity. Inflection points. Examining a real function., 3h, Learning outcomes:1,4,6 15.Examining a real function., 1h, Learning outcomes:1,4,5,6 2. preliminary exam., 2h, Learning outcomes:1,4,5,6				

Required materials	Basic: classroom, blackboard, chalk... Whiteboard with markers Overhead projector not necessary
Exam literature	Obavezna: 1. I. Vuković: Matematika 1: udžbenik za stručni studij elektrotehnike, Redak, 2015. 2. Autorizirani radni materijal za predavanja i vježbe. 3. B. Kovačić, L. Marohnić, T. Strmečki: Repetitorij matematike za studente elektrotehnike, priručnik, Tehničko veleučilište u Zagrebu, 2016. 4. A. Aglić Aljinović et.al.: Matematika 1, Element, Zagreb, 2014. 5. S. Suljagić: Matematika 1, interna skripta, Tehničko veleučilište u Zagrebu, Zagreb, 2003. Dodatna: 1. B. Apsen: Repetitorij elementarne matematike, Tehnička knjiga, Zagreb, 1994. 2. B. Apsen: Repetitorij više matematike 1, Golden-marketing - Tehnička knjiga, Zagreb, 2003. 3. T. Bradić et.al.: Matematika za tehnološke fakultete, Element Zagreb, 2006. 4. I. Brnetić: Matematička analiza 1, zadaci s pismenih ispita, Element, Zagreb, 2005. 5. B.P. Demidovič, Zadaci i riješeni primjeri iz više matematike, Danjar, Zagreb, 1995. 6. V.P. Minorski: Zbirka zadataka iz više matematike, Tehnička knjiga, Zagreb, 1972.
Students obligations	70% of class attendance of the total class number. In case of less class attendance, valid excuse and submitted obligatory assignments are required.
Knowledge evaluation during semester	Total 2 preliminary exams (numerical tasks). 1. preliminary exam: eliminatory, pass: 50% of total points at the exam; 2. preliminary exam: eliminatory, pass: 50% of total points at the exam. Final mark: 50% - 62% of total points at both preliminary exams = sufficient(2) 63% - 74% of total points at both preliminary exams = good(3) 75% - 87% of total points at both preliminary exams = very good(4) 88% - 100% of total points at both preliminary exams = excellent (5); no obligation of oral exam.
Knowledge evaluation after semester	Written exam: 4 examining terms; pass: 50% od total points; Written exam mark: see final mark formed as the result of both preliminary exams; Oral exam: obligatory condition: passed written exam; pass: correct answers at 50% of questions; Oral exam mark: maximum 1 mark better than mark of written exam.
Student activities:	Aktivnost — ECTS (Written exam) — 5 (Oral exam) — 2
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
ISVU equivalents:	22240;
Proposal made by	Bojan Kovačić, M.Sc., senior lecturer, Luka Marohnić, B.Sc., lecturer (31.5.2018.)

Code WEB/ISVU	23957/184786	**ECTS**	8.0	**Academic year**	2018/2019
Name	Mathematics II				
Status	2nd semester - Undergraduate professional study in electrical engineering (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				45+60 (60+0+0+0) 135
Teachers	Lectures:1. Luka Marohnić Lectures:2. mr.sc. Bojan Kovačić , viši predavač Lectures:3. Ivica Vuković Lectures:4. dr. sc. Anđa Valent viši predavač Auditory exercises:mr.sc. Bojan Kovačić , viši predavač Auditory exercises: Luka Marohnić Auditory exercises:dr. sc. Anđa Valent viši predavač Auditory exercises: Ivica Vuković				
Course objectives	Students will understand the teaching material and develop the skill required for solving the problems independently.				
Learning outcomes:	1.ability to integrate some elementary real functions of a real variable. Level:6,7 2.ability to examine convergence of number series and functions series using some basic convergence and divergence tests. Level:6 3.ability to calculate the area of plane shape and the arc length of plane curve and the volume of solid of revolution using integral calculus. Level:6 4.ability to expand the real value function into Taylor series.. Level:6,7 5.ability to expand real value function defined on the segment into Fourier series.. Level:6,7 6.classify and solve some basic ordinary differential equations of order 1. Level:6,7 7.ability to classiffy and solve the first order linear (non)homogeneous differential equation namely, of the second order with constant coefficients. Level:6,7 8.ability to make a similarity/difference between the methods of solving ordinary differential equations. Level:6				
Methods of carrying out lectures	Ex cathedra teaching Case studies Discussion Questions and answers Other The course material is being presented in the classroom with detailed explanations and comments.				
Methods of carrying out auditory exercises	Computer simulations Other The problems are being solved on the blackboard with detailed explanations				
Course content lectures	1.Primitive function. Standard antiderivative and indefinite integral., 2h, Learning outcomes:1 Some basic methods for indefinite integral calculation: integration by integral table., 1h, Learning outcomes:1 2.Some basic methods for indefinite integral calculation: integration by substitution and partial integration., 3h, Learning outcomes:1 3.Riemann sum for a given function. Definite integral. Newton-Leibniz formula., 3h, Learning outcomes:1 4.Some basic application of definite integral: calculation of an area of a plane shape, a volume of a solid of revolution and a length of a plane curve., 3h, Learning outcomes:3 5.Improper integrals., 3h, Learning outcomes:1 6.Number series. Basic number series convergence criteria., 3h, Learning outcomes:2 7.Function series. Power series. Expanding some elementary function into Taylor and MacLaurin series., 3h, Learning outcomes:2,4 8.Trigonometric polynomial. Trigonometric series. Fourier series., 3h, Learning outcomes:2,5 9.Fourier series of even and odd functions., 3h, Learning outcomes:2,5 10.Ordinary differential equations of order 1. Linear ordinary differential equations of order 1., 3h, Learning outcomes:6 11.Ordinary differential equations of order 2. Linear ordinary differential equations of order 2 with constant coefficients., 3h, Learning outcomes:7 12.Laplace transformation (definition, characteristics, examples). Finding Laplace transforms of some elementary functions., 3h, Learning outcomes:8 13.Solving Cauchy problems with linear ordinary differential equations of order 2 with constant coefficients using the Laplace transforms., 3h, Learning outcomes:8 14.Some examples of application of ordinary differential equations of order 1, 3h, Learning outcomes:6 15.Some examples of application of ordinary differential equations of order 2., 3h, Learning outcomes:7				
Course content auditory	1.Primitive function. Standard antiderivative and indefinite integral. Integration by integral table., 2h, Learning outcomes:1 Some basic methods for indefinite integral calculation: integration by substitution and partial integration., 2h, Learning outcomes:1 2.Integration of rational functions., 2h, Learning outcomes:1 Integration of irrational functions., 2h, Learning outcomes:1 3.Integration of trigonometric functions., 2h, Learning outcomes:1 Integration of hyperbolic functions., 2h, Learning outcomes:1 4.Definite integral. Newton-Leibniz formula., 1h, Learning outcomes:1 Calculating definite integrals by substitution and partial integration., 3h, Learning outcomes:1 5.Application of definite integral on the calculating of an area of a plane shape., 4h, Learning outcomes:3 6.Application of definite integral on the calculating a volume of a solid of revolution., 2h, Learning outcomes:3 Application of definite integral on the calculating a length of a plane curve., 2h, Learning outcomes:3 7.1. preliminary exam., 2h, Learning outcomes:1,3 Impromper integrals., 2h, Learning outcomes:1 8.Improper integrals., 1h, Learning outcomes:1 Numerical series. Convergent geometric series., 1h, Learning outcomes:2 Criteria of convergence of numerical series., 2h, Learning outcomes:2 9.Convergence criteria of numerical series., 2h, Learning outcomes:2				

	Finding Taylor and MacLaurin series of elementary functions, 2h, Learning outcomes:4 10.Expanding certain periodic functions into Fourier series., 2h, Learning outcomes:5 Fourier series of even and odd functions., 2h, Learning outcomes:5 11.2. preliminary exam, 2h, Learning outcomes:1,2,4,5 Ordinary differential equations with separated variables., 1h, Learning outcomes:6 Homogeneous ordinary differential equations of order 1., 1h, Learning outcomes:6 12.(Non)Homogeneous linear ordinary differential equations of order 1., 2h, Learning outcomes:6 Homogeneous linear ordinary differential equations of order 2 with constant coefficients., 2h, Learning outcomes:7 13.Non-homogeneous linear ordinary differential equations of order 2 with constant coefficients., 2h, Learning outcomes:7 The variation of contants method., 2h, Learning outcomes:7,8 14.Solving Cauchy problems with linear ordinary differential equations of order 2 with constant coefficients using the Laplace transforms., 4h, Learning outcomes:7,8 15.Examples of applications of the ordinary differential equations of order 1 and 2., 2h, Learning outcomes:6,7,8 3. preliminary exam, 2h, Learning outcomes:6,7,8
Required materials	Basic: classroom, blackboard, chalk... Whiteboard with markers Overhead projector a laptop
Exam literature	Obavezna: 1. I. Vuković: Matematika 2: udžbenik za stručni studij elektrotehnike, Redak, 2016. 1. Autorizirani radni materijal za predavanja i auditorne vježbe 2. B. Kovačić, L. Marohnić, T. Strmečki: Repetitorij matematike za studente elektrotehnike, priručnik, Tehničko veleučilište u Zagrebu, 2016. 3. A. Aglić Aljinović et.al.: Matematika 2, Element, Zagreb, 2016. 4. S. Suljagić: Matematika 2, interna skripta, Tehničko veleučilište u Zagrebu, Zagreb, 2003. Dodatna: 1. B. Apsen: Repetitorij elementarne matematike, Tehnička knjiga, Zagreb, 1994. 2. B. Apsen: Repetitorij više matematike 1, Golden-marketing - Tehnička knjiga, Zagreb, 2003. 3. B.P. Demidovič, Zadaci i riješeni primjeri iz više matematike, Danjar, Zagreb, 1995. 4. V.P. Minorski: Zbirka zadataka iz više matematike, Tehnička knjiga, Zagreb, 1972.
Students obligations	70% of class attendance of the total class number. In case of less class attendance, valid excuse and submitted obligatory assignments are requested.
Knowledge evaluation during semester	Total 3 preliminary exams (numerical tasks). 1. preliminary exam: eliminatory, pass: 50% of total points at the exam; 2. preliminary exam: eliminatory, pass: 50% of total points at the exam. 3. preliminary exam: eliminatory, pass: 50% of total points at the exam. Final mark: 50% - 62% of total points at both preliminary exams = sufficient(2) 63% - 74% of total points at both preliminary exams = good(3) 75% - 87% of total points at both preliminary exams = very good(4) 88% - 100% of total points at both preliminary exams = excellent (5); no obligation of oral exam.
Knowledge evaluation after semester	Written exam: 4 examining terms; pass: 50% od total points; Written exam mark: see final mark formed as the result of both preliminary exams; Oral exam: obligatory condition: passed written exam; pass: correct answers at 50% of questions; Oral exam mark: maximum 1 mark better than mark of written exam.
Student activities:	Aktivnost — ECTS (Constantly tested knowledge) — 6 (Oral exam) — 2
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
ISVU equivalents:	22246;155993;
Proposal made by	Bojan Kovačić, M.Sc., senior lecturer, Luka Marohnić, B.Sc., lecturer (31.5.2018.)

Code WEB/ISVU	23662/169757	**ECTS**	5.0	**Academic year**	2018/2019
Name	Mobile Radiocommunication				
Status	5th semester - Communication and computer technology (Redovni elektrotehnika) - elective 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 Sonja Zentner Pilinsky prof.v.š. Auditory exercises: Siniša Lacković struč.spec.ing.el. Auditory exercises:dr.sc Sonja Zentner Pilinsky prof.v.š. Laboratory exercises: Siniša Lacković struč.spec.ing.el.				
Course objectives	students will be qualified to recognize and solve engineering problems related to mobile radio communications				
Learning outcomes:	1.ability to identify 2G, 3G, 4G network components as well as TETRA networks components. Level:6 2.ability to analyze specific features of air interfaces of public and functional mobile networks. Level:6 3.ability to calculate coverage area based on the loss calculations. Level:6 4.ability to calculate the network efficiency. Level:6 5.ability to distinguish between 2G, 3G, 4G, Wi-Fi and Bluetooth air interface operation. Level:6 6.test and analyse coverage parameters for specific 3G and/or 4G network area. Level:6				
Methods of carrying out lectures	Ex cathedra teaching Guest lecturer Discussion Questions and answers The subject matter is presented by using drawings, tables and diagrams to make the material easier to understand. The teacher tests the students continuously. Beside the blackboard it is necessary to have an LCD projector.				
Methods of carrying out auditory exercises	Group problem solving The problems of each topic are solved on the blackboard with the participation of the students.				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Part of laboratory exercises are in-field measurements with Nemo Handy A tool and the rest of lab exercises are analysis of these and other measurements in programs Nemo Outdoor and Excel.				
Course content lectures	1.Introduction, free space loss and power budget calculations, 2h, Learning outcomes:2 2.Wi-Fi and Bluetooth Tehnologies - basic architecture and characteristics, 2h, Learning outcomes:1,2,6 3.basic GSM architecture, Geografical area coverage model, 2h, Learning outcomes:1,2,3 4.Multiple Access, GSM packages and time slots, 2h, Learning outcomes:2,5 5.Physical and logical channels in GSM, Speech transmission in GSM - voice coding, channel coding, interleaving and bit rates , 2h, Learning outcomes:1,2,5 6.GMSK modulation, Traffic management and the efficiency coefficient of the whole mobile network , 2h, Learning outcomes:2,4 7.Micro location field structure, Doppler shift, coherence frequency band, Rayleigh distribution , 2h, Learning outcomes:2 8.mprovement of receiving signal quality using diversity techniques, intermodulations, frequency hopping, 2h, Learning outcomes:2,6 9.GPRS and EDGE systems, 2h, Learning outcomes:1,2,5 10.Basics of TETRA , 2h, Learning outcomes:1,2 11.UMTS system architecture, encoding and scrambling, 2h, Learning outcomes:1,2,5 12.UMTS - power control, soft and softer handover, system capacity and coverage, 2h, Learning outcomes:1,2,5 13.HSDPA/HSUPA system, 2h, Learning outcomes:1,2,5 14.LTE system basic, LTE system architecture, demands on LTE systems, 2h, Learning outcomes:1,2,5 15.OFDMA and MIMO in LTE systems, 2h, Learning outcomes:2,5				
Course content auditory	1.antenna directivity and gain, free space losses, 2h, Learning outcomes:2,3 2.tramsmitter and receiver power, electric field strength and voltage at receivers side, 2h, Learning outcomes:2,3 3.tramsmitter and receiver power, electric field strength and voltage at receivers side, ARFCN, 2h, Learning outcomes:2,3 4.C/I carrier to interference signal ratio at receivers side, 2h, Learning outcomes:3 5.First semiexam, 2h, Learning outcomes:2,3 6.C/I ratio, signal attenuation due to various EM wave signal polarizations, 2h, Learning outcomes:3 7.C/I ratio with direct and one reflected ray, 2h, Learning outcomes:2,3 8.C/I ratio with direct and one reflected ray, cell radius, 2h, Learning outcomes:2,3 9.traffic and system efficiency calculations, 2h, Learning outcomes:3,4 10.Second semiexam, 2h, Learning outcomes:2,3,4 11.system efficiency calculations, number of MS in sector/cell/cluster, MS density over specific area, 2h, Learning outcomes:3,4 12.space diversity enhancement calculation, Rayleigh distribution of received signal, Doppler frequency, 2h, Learning outcomes:2,6 13.BER, allowed errors and packet losses, 2h, Learning outcomes:2 14.BER calculations in TETRA system, 2h, Learning outcomes:2,3 15.Third semiexam, 2h, Learning outcomes:2,3,4,6				
Course content laboratory	1.Nemo HAndy A characteristics and measurement possibilities; script construction, 1h, Learning outcomes:1,2,5,6 2.introduction to Nemo Outdoor analysis possibilities and data transfer to Excel, 1h, Learning outcomes:1,2,5,6 3.introduction to Nemo Outdoor analysis possibilities and data transfer to Excel, 1h, Learning outcomes:1,2,5,6 4.introduction to Nemo Outdoor analysis possibilities and data transfer to Excel, 1h, Learning outcomes:1,2,5,6 5.3G signal coverage measurements, 1h, Learning outcomes:1,2,5,6 6.4G signal coverage measurements, 1h, Learning outcomes:1,2,5,6 7.3G measurements analysis, 1h, Learning outcomes:1,2,5,6 8.3G measurements analysis, 1h, Learning outcomes:1,2,5,6 9.4G measurements analysis, 1h, Learning outcomes:1,2,5,6				

	10.4G measurements analysis, 1h, Learning outcomes:1,2,5,6 11.measurements of end-user satisfaction with network performance, 1h, Learning outcomes:1,2,5,6 12.Nemo Outdoor analysis of end-user satisfaction with network performance measurements , 1h, Learning outcomes:1,2,5,6 13.Nemo Outdoor analysis of end-user satisfaction with network performance measurements , 1h, Learning outcomes:1,2,5,6 14.Excel analysis of end-user satisfaction with network performance measurements , 1h, Learning outcomes:1,2,5,6 15.Excel analysis of end-user satisfaction with network performance measurements , 1h, Learning outcomes:1,2,5,6
Required materials	Basic: classroom, blackboard, chalk... Whiteboard with markers Overhead projector
Exam literature	Basic literature: 1. E. Zentner, Antene i radiosustavi,Graphis, Zagreb, 2001. 2. E. Zentner, S. Zentner, Radiomreže, poglavlje u knjizi Inženjerski priručnik IP Additional literature: 1. Elektrotehnika Elektronika, komunikacije i električni strojevi, školska knjiga, Zagreb, 2002, str. 865 916 2. Lehpamer H.: Transmission Systems Design Handbook for Wireless Networks, Artech House, Boston-London,2002. 3. W.C.Y.Lee: Mobile Communications Design Fundamentals, McGraw-Hill, 1993.
Students obligations	minimum of 20 class attendance (lecture and exercises), submitted and presented seminar paper and performed laboratory exercises
Knowledge evaluation during semester	Redovitost pohaa#5#10#50$Mini-test#2#30#50$Kolokvij, numeri zadaci#3#45#50$Kolokvij, teorijska pitanja#3#15#50$
Knowledge evaluation after semester	written exam (5 numerical exercises) and if passes (more then 50% correct) oral exam (3 theoretical questions)
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
ISVU equivalents:	22313;155995;
Proposal made by	Professor Sonja Zentner Pilinsky, Ph.D.

Code WEB/ISVU	22861/22282	**ECTS**	5.0	**Academic year**	2018/2019
Name	Numerical Mathematics				
Status	4th semester - Communication and computer technology (Redovni elektrotehnika) - 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. Anđa Valent viši predavač Lectures:2. Ivica Vuković Auditory exercises:dr. sc. Anđa Valent viši predavač Auditory exercises: Ivica Vuković				
Course objectives	Students should learn some basic methods of numerical mathematics necessary for solving engineering problems using computers.				
Learning outcomes:	1.ability to analyze numerical errors made in calculating polynomial approximations. Level:6 2.ability to calculate different interpolation polynomials (Newton'sand Lagrange's polynomial) intended for calculating approximations of empirical data set . Level:6 3.ability to calculate an integral using different methods for numeric integration (trapezoidal and Simpson's rule). Level:6 4.ability to solve initial value (Cauchy) problem using different methods for numerical solution of ordinary differential equations (Euler's method, modified Euler's method) and estimate the value and order . Level:6 5.ability to solve non-linear equation using different iterative methods for numerical solution of non-linear equations (Newton's method, the interval halving method), and estimate the value and order of the error. Level:6 6.ability to solve a system of linear equations using Gauss method. Level:6				
Methods of carrying out lectures	Ex cathedra teaching Case studies Simulations Modelling Discussion Questions and answers Other The course material is being presented in the classroom with detailed explanations and comments.				
Methods of carrying out auditory exercises	Laboratory exercises, computer simulations Group problem solving Computer simulations Other The problems are being solved on the blackboard with detailed explanations.				
Course content lectures	1.Basic principles of error analysis theory., 2h, Learning outcomes:1 2.Calculation of approximative values of elementary functions., 2h, Learning outcomes:1,2 3.Numerical solving of the systems of linear equations. Gauss eliminations, Gauss-Jordan algorithm., 2h, Learning outcomes:6 4.Iteration method, Gauss-Seidel method., 2h, Learning outcomes:5 5.Numerical solving of nonlinear equations. Newton method. Regula falsi method., 2h, Learning outcomes:5 6.Standard iteration method. , 2h, Learning outcomes:5 7.Error analysis., 2h, Learning outcomes:1,5 8.Lagrange interpolation., 2h, Learning outcomes:2 9.Newton interpolation., 2h, Learning outcomes:2 10.Least squares method., 2h, Learning outcomes:2 11.Numerical differentiation., 2h, Learning outcomes:4 12.Numerical integration. Trapezoidal rule. Error analysis., 2h, Learning outcomes:3 13.Simpson rule. Error analysis., 2h, Learning outcomes:3 14.Numerical solution of ordinary differential equations. Euler method., 2h, Learning outcomes:4 15.Modified Euler method. Runge-Kutta method, 2h, Learning outcomes:4				
Course content auditory	1.Basics of theory of errors., 2h, Learning outcomes:1 2. Calculation of approximate values of some elementary functions., 2h, Learning outcomes:1 3.Numerical solving systems of linear equations. Gauss eliminations. Gauss-Jordan algorithm., 2h, Learning outcomes:6 4.Iteration method, Gauss-Seidel method., 2h, Learning outcomes:5 5.Numerical solving of nonlinear equations. Newton method. Regula falsi method., 2h, Learning outcomes:5 6.Standard iteration method., 2h, Learning outcomes:5 7.First preliminary exam., 2h, Learning outcomes:1,5,6 8.Lagrange interpolation., 2h, Learning outcomes:2 9.Newton interpolation. Least square method., 2h, Learning outcomes:2 10.Least square method., 2h, Learning outcomes:2 11.Numerical differentiation., 2h, Learning outcomes:4 12.Numerical integration., 2h, Learning outcomes:3 13.Numerical integration. Numerical solution of ordinary differential equations. Euler method., 2h, Learning outcomes:3 14.Modified Euler, 2h, Learning outcomes:3 15.Second preliminary exam., 2h, Learning outcomes:2,3,4				
Required materials	Basic: classroom, blackboard, chalk... General purpose computer laboratory Whiteboard with markers Overhead projector Special equipment a laptop for each of the teachers				
Exam literature	Basic literature: 1. Josipa Pina Milišić, Ana Žgaljić Keko: Uvod u numeričku matematiku za inženjere, Element, Zagreb, 2013.				

	2. Boris Čulina, Dragana Čulina: Elementarna numerička matematika uz pomoć MS Excela, Veleučilište Velika Gorica, Velika Gorica, 2010. 3. Autorizirani radni materijal za predavanja i vježbe Additional literature: 1. I. Ivanšić: Numerička matematika, Element, Zagreb 1998. 2. V. Benić: Primijenjena i numerička matematika, Veleučilište u Splitu, Split, 2003. 3. N. Ujević: Uvod u numeričku matematiku, Fakultet prirodoslovno-matematičkih znanosti i odgojnih područja Sveučilišta u Splitu, Split, 2004. 4. N.I. Danilina, N.S. Dubrovskaya: Computational Mathematics, Mir Publishers, Moscow 1988. 5. F. Scheid, Numerical Analysis, McGraw-Hill, 1989. 6. R. Scitovski: Numerička matematika, Odjel za matematiku Sveučilišta u Osijeku, Osijek, 2004.
Students obligations	70% of class attendance of the total class number.
Knowledge evaluation during semester	Total 2 preliminary exams (numerical tasks). 1. preliminary exam: eliminatory, pass: 50% of total points at the exam; 2. preliminary exam: eliminatory, pass: 50% of total points at the exam. Final mark: 50% - 62% of total points at both preliminary exams = sufficient(2) 63% - 74% of total points at both preliminary exams = good(3) 75% - 87% of total points at both preliminary exams = very good(4) 88% - 100% of total points at both preliminary exams = excellent (5). Oral exam: pass: correct answers at 60% of total number of questions; Final mark is not more than 1 mark better than mark of written exam. Instead of 2. preliminary exam and oral exam, seminar paper could be written in condition of 90% of total points got on 1. preliminary exam.
Knowledge evaluation after semester	Written exam: 4 examining terms; pass: 50% od total points; Written exam mark: see final mark formed as the result of both preliminary exams; Oral exam: pass: correct answers at 60% of total number of questions; Final mark is not more than 1 mark better than mark of written exam.
Student activities:	Aktivnost — ECTS (Constantly tested knowledge) — 4 (Oral exam) — 1
Remark	This course can be used for final thesis theme
Prerequisites:	Students cannot pass this course unless they have passed Matematika II
Proposal made by	Bojan Kovačić, M.Sc., senior lecturer; Luka Marohnić, B.Sc., lecturer

Code WEB/ISVU	23103/104555	**ECTS**	5.0	**Academic year**	2018/2019
Name	Object-oriented programming				
Status	5th semester - Communication and computer technology (Redovni elektrotehnika) - elective course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+45 (0+30+0+15) 75
Teachers	Lectures:1. Tomislav Novak mag. ing. inf. et comm. techn. Laboratory exercises: Tomislav Novak mag. ing. inf. et comm. techn. Construction exercises: Tomislav Novak mag. ing. inf. et comm. techn.				
Course objectives	Introduction to basics of the object oriented programming, applications, structure and design of the source code, and basic design patterns.				
Learning outcomes:	1.integrate object and classes into composite program solutions. Level:6,7 2.construct classes to solve given programming problems. Level:6,7 3.comparision of traditional (procedural) and object oriented programming languages. Level:6,7 4.design of object oriented programming systems. Level:6 5.analysis of object oriented software systems. Level:6				
Methods of carrying out lectures	Ex cathedra teaching Case studies Demonstration Simulations Discussion Theoretical explanation is followed by interactive demonstration of computer simulated examples. Frequent discussion with students regarding examples and theory.				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Laboratory exercises, computer simulations Computer simulations Workshop Writing programming solutions. There are 15 workplaces in the lab and the work is individual.				
How construction exercises are held	Group problem solving Computer simulations Interactive problem solving Workshop				
Course content lectures	1.Introduction to Java object oriented programming language, 2h, Learning outcomes:2,3 2.Operators, branching, loops and switch case structure, 2h, Learning outcomes:2,3 3.Methods, 2h, Learning outcomes:1,2,3,4 4.Objects and references, 2h, Learning outcomes:1,3,4 5.Arrays and ArrayList collection, 2h, Learning outcomes:1,3,4 6.String manipulation, 2h, Learning outcomes:1,3,4 7.Classes and encapsulation 1, 2h, Learning outcomes:1,2,3,4,5 8.Classes and encapsulation 2, 2h, Learning outcomes:1,2,3,4,5 9.Inheritance and polymorphism 1, 2h, Learning outcomes:1,2,3,4,5 10.Inheritance and polymorphism 2, 2h, Learning outcomes:1,2,3,4,5 11.Constructors and abstract classes, 2h, Learning outcomes:1,2,4,5 12.Nested classes, 2h, Learning outcomes:1,2,4,5 13.Interfaces and enumerations, 2h, Learning outcomes:1,2,4,5 14.Data streams, 2h, Learning outcomes:1 15.Common design patterns, 2h, Learning outcomes:4,5				
Course content laboratory	1.No excercises 2.No excercises 3.No excercises 4.Methods, branching, loops and switch case structure, 3h, Learning outcomes:1,2,3,4 5.Holiday 6.Objects and references, 3h, Learning outcomes:1,3,4,5 7.Arrays and ArrayList collection, 3h, Learning outcomes:1,3,4 8.String manipulation, 3h, Learning outcomes:1,3,4 9.First test, 3h, Learning outcomes:1,2,3,4,5 10.Classes and encapsulation , 3h, Learning outcomes:1,2,3,4,5 11.Inheritance and polymorphism , 3h, Learning outcomes:1,2,3,4,5 12.No excercises 13.Constructors, abstract and nested classes, 3h, Learning outcomes:1,2,4,5 14.Interfaces, enumerations, Data streams and design patterns, 3h, Learning outcomes:1,2,4,5 15.Second test, 3h, Learning outcomes:1,2,3,4,5				
Course content constructures	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.Giving construction tasks to students, 3h, Learning outcomes:1,2,3,4,5 11.No classes 12.consultations, 3h, Learning outcomes:1,2,3,4,5				

	13.consultations, 3h, Learning outcomes:1,2,3,4,5 14.consultations, 3h, Learning outcomes:1,2,3,4,5 15.consultations, 3h, Learning outcomes:1,2,3,4,5
Required materials	Basic: classroom, blackboard, chalk... General purpose computer laboratory Whiteboard with markers Overhead projector
Exam literature	Obavezna: 1. Cay S. Horstmann, Gary Cornell: Core Java - Volume I - Fundamentals 2. Interni materijali za vježbe i predavanja, autori Milan Draganić, Marijan Matić i Tomislav Novak. Dodatna: 1. Kathy Sierra, Bert Bates: SCJP Study Guide 2. Bruce Eckel: Thinking in Java
Students obligations	- attendance on 70% predavanja - attendance on all lab exercises - enough points from exit quiz on lab exercises - program (construction) task done with passing grade
Knowledge evaluation during semester	8 short answer tests on laboratory exercises - each test 5 points Sum1: 40 points (min 20 for signature) 2 preliminary exams - each of 30 points Sum2: 60 points (min 30 for grade 2) SUM: 100 points =90=5
Knowledge evaluation after semester	Exam is written on computer. Maximum of 100 points, with grade distribution: =90=5
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
Proposal made by	Tomislav Novak i Stipe Predanić 17.12.2013; based on Dražen Ćika, MScEE, lecturer, 8.5.2013

Code WEB/ISVU	23485/155996	**ECTS**	5.0	**Academic year**	2018/2019
Name	Optical communications				
Status	6th semester - Communication and computer technology (Redovni elektrotehnika) - 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 Sonja Zentner Pilinsky prof.v.š. Auditory exercises:dr.sc Sonja Zentner Pilinsky prof.v.š. Laboratory exercises: Siniša Lacković struč.spec.ing.el. Laboratory exercises:dr.sc Sonja Zentner Pilinsky prof.v.š.				
Course objectives	students will acquire knowledge of basic components of optical communication systems and their links; be introduced to specific features of fiber optic information transmission and basic characteristics of all-optical network devices, be familiar with basic measuring equipment and its application.				
Learning outcomes:	1.ability to identify suitable components to establish an optical link. Level:6 2.ability to calculate optical link based on power and rise time calculations. Level:6 3.ability to test an optical link using OTDR. Level:6 4.ability to plan optical link (choose fiber and active equipment). Level:6 5.inspect optical connectors and solve problem of invalid connector. Level:6				
Methods of carrying out lectures	Ex cathedra teaching Guest lecturer Discussion Questions and answers Other Lectures are presented at the blackboard with an additional help of PowerPoint presentations with various graphs and examples built into them (LCD projector needed). Presentations of new technologies and products given by experts from the industry will be also built into the lectures.				
Methods of carrying out auditory exercises	Group problem solving Student are encouraged to solve various numerical examples and tasks by them self				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Laboratory exercises, computer simulations Lab exercises will be partially on computers and partially on measurement equipment, students do allmeasurements and result analysis alone.				
Course content lectures	1.Introduction to optical communications - fibers and optical cables, fibers capacity and possibilities of optical network transmission, definition of LASER and coherent EM wave radiation, 3h, Learning outcomes:1 2.Optical sources lasers and laser diodes (LD), basic operating modes, characteristics and examples , 3h, Learning outcomes:1 3.Optical sources lasers and laser diodes (LD), basic operating modes, characteristics and examples , 3h, Learning outcomes:1 4.Semiconductor photodetectors PIN and APD, introduction to fiber - SM and MM fibers, 3h, Learning outcomes:1 5.Fiber standards (SM, MM,POF, PCF), attenuation, dispersion (chromatic), loss, nonlinear effects (SPM, XPM, FWM, SBS, SRS) , 3h, Learning outcomes:1 6.Fiber standards (SM, MM,POF, PCF), attenuation, dispersion (chromatic), loss, nonlinear effects (SPM, XPM, FWM, SBS, SRS) , 3h, Learning outcomes:1 7.Planar dielectrical waveguide basic principles, propagation modes. Integrated optical circuits operating modes and examples , 3h, Learning outcomes:1 8.OTDR, fiber cables, 3h, Learning outcomes:1,3 9.Optical cables - standards, ducts, DTH channels, connectors and adapters , 3h, Learning outcomes:1 10.Optical cables - standards, ducts, DTH channels, connectors and adapters , 3h, Learning outcomes:1,4 11.Receiver sensitivity, receiver noise, receiver circuits , 3h, Learning outcomes:1,4 12.Optical link power calculation with and without EDFA, rise-time , 3h, Learning outcomes:1,2 13.Basics of WDM transmission - CWDM and DWDM standards , 3h, Learning outcomes:1,4 14.WDM network devices, introduction to FTTx technologies, 3h, Learning outcomes:1,4 15.Passive optical networks (PONs) and PON equipment, 3h, Learning outcomes:1,4				
Course content auditory	1.no numerical exercises 2.LASERs, 1h, Learning outcomes:1 3.LED, 1h, Learning outcomes:1 4.optical detectors, 1h, Learning outcomes:1 5.First semiexam, 2h, Learning outcomes:1 6.no numerical exercises 7.fibers - NA, acceptance angle, number of modes, SM condition, 1h, Learning outcomes:1 8.fiber - dispersion and losses, 1h, Learning outcomes:1 9.slab waveguides, 1h, Learning outcomes:1 10.Second semiexam, 2h, Learning outcomes:1,2,3 11.no numerical exercises 12.OTDR, receiver S/N calculations, 1h, Learning outcomes:2,3 13.receiver S/N calculations, designing the optical link power budget with and without EDFA, rise-time , 1h, Learning outcomes:3,4 14.Designing the optical link power budget with and without EDFA, rise-time , 1h, Learning outcomes:3,4 15.Third semiexam, 2h, Learning outcomes:1,2,3,4				
Course content laboratory	1.no lab exercises 2.no lab exercises 3.Basic HeNe laser parameters and difraction gratting, 2h, Learning outcomes:1 4.Connectorizing, 2h, Learning outcomes:1 5.WWDM, 1h, Learning outcomes:1				

	6.no lab exercises 7.PON link OTDR measurements, 2h, Learning outcomes:4 8.OTDR measurements, 2h, Learning outcomes:3 9.Computer analysis of OTDR measurements, 2h, Learning outcomes:3 10.A digital link, 2h, Learning outcomes:2 11.no lab exercises 12.no lab exercises 13.Macrobending losses, 2h, Learning outcomes:1,2,3 14.no lab exercises 15.no lab exercises
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory Whiteboard with markers Overhead projector Special equipment Lab exercises will be partially on computers and partially on measurement equipment, students do allmeasurements and result analysis alone.
Exam literature	Basic literature: Bilješke s predavanja G.P.Agrawal:Fiber Optic Communication Systems, 3rd ed, John WileySons Inc 2002 Dopunska A.Girard et all.: Guide to WDM Technology and Testing, EXFO 2008 A.Girard: FTTx PON Technology and Testing, EXFO 2005 ili novije izdanje
Students obligations	finished practical work, regular class attendance and passed mini test
Knowledge evaluation during semester	Redovitost pohaa#5#10#50$Mini-test#2#30#40$Kolokvij, numeri zadaci#3#30#50$Kolokvij, teorijska pitanja#3#15#50$Prakti rad#30#15#50$
Knowledge evaluation after semester	written exam, upon copletion of more then 50% oral exam
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
ISVU equivalents:	22308;
Proposal made by	prof.Sonja Zentner Pilinsky,Ph.D.

Code WEB/ISVU	23965/184797	**ECTS**	4.0	**Academic year**	2018/2019
Name	Personal computers in electrical engineering				
Status	1st semester - Undergraduate professional study in electrical engineering (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				15+30 (0+30+0+0) 75
Teachers	Lectures:1. Trpimir Alajbeg Lectures:dr. sc. Mladen Sokele predavač Laboratory exercises: Trpimir Alajbeg Laboratory exercises: Robert Herčeki Laboratory exercises: Andrea Jurman Laboratory exercises: Iva Lemac				
Course objectives	Obtaining comprehension of IT technology, terminology and basic structure and architecture of personal computers. Understand the data formats. Become familiar with particular software specific for electronic design automation (EDA). Develop the ability of task/algorithm solving via pseudo code.				
Learning outcomes:	1.ability to identify hardware and software components which make a personal computer. Level:6 2.ability to estimate which peripheral units can be optimally used for particular applications. Level:6,7 3.create task solving algorithm. Level:6,7 4.draw a flowchart diagram. Level:6 5.ability to propose a sofware application which is used in various engineering applications. Level:6,7 6.develop the ability to use the EDA program package; draw electrical schemes, use component library and measuring instruments. Simulation of electrical and electronics circuit operation. Level:6,7				
Methods of carrying out lectures	Ex cathedra teaching Case studies Demonstration Simulations Discussion Questions and answers Lectures and literature are available to students on the relevant web pages and in the LMS. Midterm exams will be held during laboratory exercises as separate computer tests via LMS.				
Methods of carrying out laboratory exercises	Laboratory exercises, computer simulations Group problem solving Computer simulations Each student works individually, practice the work on a computer using written instructions relating to the specific exercise and with the help of the teacher. Midterm exams for each exercise will be held via LMS.				
Course content lectures	1.Introductory lecture: course plan; content and literature; way of teaching, assessment and examination. LMS introduction. , 2h, Learning outcomes:1,2,3,4,5,6 2.Types and history of computers, IT terminology, application for various engineering purposes., 2h, Learning outcomes:1,2,5 3.Basic structure of a computer, computer architecture., 2h, Learning outcomes:1,2,6 4.Computer programs and application., 2h, Learning outcomes:1,2,3,5 5.Data formats., 2h, Learning outcomes:1,2,3,4,5 6.Programming, pseudocode algorithm. , 2h, Learning outcomes:1,2,3,4,5 7.Input and output circuits and devices. Electronic design automation software (EDA)., 2h, Learning outcomes:1,2,5,6 8.Electronic design automation software., 1h, Learning outcomes:5,6 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 classes 2.no classes 3.Introduction: exercise plan, organization, assessment and examination. LMS introduction. TVZ online services. Basics of work with an operating system - GUI and command line interface., 3h, Learning outcomes:1,2 4.Work with text processing programs., 3h, Learning outcomes:1,2,5 5.No classes due to holiday (1.11) 6.Work with spreadsheet programs., 3h, Learning outcomes:1,2,5 7.Quizzes-practical work in word processing and spreadsheet programs. Pseudocode algorithms and flowcharts., 3h, Learning outcomes:1,2,3,4,5 8.Pseudocode algorithms and flowcharts. 1st midterm exam., 3h, Learning outcomes:1,2,3,4,5 9.Quiz-practical work in drawing flowchart and its purpose. EDA interface, components library., 3h, Learning outcomes:1,2,3,4,5,6 10.EDA- Measuring instruments in EDA. 2nd midterm exam., 3h, Learning outcomes:1,2,3,4,5,6 11.Quiz-practical work in EDA. DC circuits in EDA., 3h, Learning outcomes:5,6 12.no classes 13.AC circuits in EDA., 3h, Learning outcomes:5,6 14.EDA-overall practicing. Quiz-practical work in EDA., 3h, Learning outcomes:5,6 15.no classes				
Required materials	Basic: classroom, blackboard, chalk... General purpose computer laboratory Overhead projector				

Exam literature	Osnovna: 1. Pisani materijali s predavanja i laboratorijskih vježbi, dostupni u LMS Mooodle. 2. Baez-Lopez, D.; Guerrero-Castro, F.; CIRCUIT ANALYSIS WITH MULTISIM, Morgan Claypool Publishers, 2011, San Rafael, California, USA 3. Nacionalni portal za učenje na daljinu Nikola Tesla https://tesla.carnet.hr algoritmi, dijagrami toka... Dodatna: 4. Grundler, D.; Kako radi računalo, Pro-mil, Varaždin 2004. 5. Bulić, B.; Proračunske tablice, SRCE, Zagreb, 2016.
Students obligations	- attendance on all laboratory exercises (one absence is allowed) - achieving at least 46% of total points from laboratory exercises quizzes
Knowledge evaluation during semester	2 x midterm exam, 50% total points for passing grade. 5 x quizzes - practical work/skill in software, each 3 points, achieving at least 46% of total points from laboratory exercises quizzes is student obligation.
Knowledge evaluation after semester	-Written part of the exam test via LMS. -Verbal part of the exam: conversation with the teacher
Student activities:	Aktivnost — ECTS (Classes attendance) — 1 (Practical work) — 2 (Oral exam) — 1
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
ISVU equivalents:	22242;
Proposal made by	Trpimir Alajbeg, Master of Electrical Engineering

Code WEB/ISVU	23961/184793	**ECTS**	6.0	**Academic year**	2018/2019
Name	Physics				
Status	1st semester - Undergraduate professional study in electrical engineering (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				45+30 (30+0+0+0) 105
Teachers	Lectures:1. prof.vis.šk. Ivica Levanat Lectures:2. Alemka Knapp Auditory exercises: Valentino Jadriško Auditory exercises: Alemka Knapp Auditory exercises: Borna Radatović Auditory exercises: Diana Šaponja-Milutinović dipl.ing.fizike, pred.				
Course objectives	Students will understand physical phenomena and quantities used in the study of electrical engineering described within a broader context of the basic laws of physics. (The topics studied in details in the other compulsory core modules are not included.)				
Learning outcomes:	1.ability to calculate simple rectilinear and circular motions and projectile motion . Level:6 2.ability to analyze kinematic quantities in curvilinear motion motion. Level:6 3.ability to calculate translational acceleration of a body acted upon by forces and simpler examples of angular acceleration. Level:6 4.ability to correlate work of forces with changes in kinetic and potential energy of a body. Level:6,7 5.ability to analyze simple motions in gravitational field (satellites). Level:6 6.ability to distinguish between classical mechanical description and special relativity . Level:6 7.ability to analyze simple harmonic oscillations without damping. Level:6 8.ability to relate Bohr's model of atom with qualitative description of electronic shells and bands. Level:6,7 9.ability to calculate simpler examples of emission/absorption of photons and photoelectric effect . Level:6 10.ability to relate the knowledge of the nucleus structure to radioactive decay. Level:6,7				
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 simpler 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. Teacher explains and illustrates the procedure, students solve the problems on the blackboard and in their notebooks.				
Course content lectures	1.Physical quantities and units., 2h, Learning outcomes:1,2 Polynomial derivative., 1h, Learning outcomes:1,2 2.Polynomial integration, definite integral., 1h, Learning outcomes:1,2 Rectilinear motion, free fall., 2h, Learning outcomes:1 3.Motion along curve and circle., 3h, Learning outcomes:1,2 4.Newton axioms, momentum., 3h, Learning outcomes:3 5.Work, power and energy., 3h, Learning outcomes:4 6.Rigid body rotation., 3h, Learning outcomes:2,3 7.Motion in gravitational field., 3h, Learning outcomes:5 8.Relativity of motion, inertial forces., 2h, Learning outcomes:6 The absolute and greatest speed c., 1h, Learning outcomes:6 9.Einstein special theory of relativity., 3h, Learning outcomes:6 10.Harmonic oscillations., 3h, Learning outcomes:7 11. Wave optics, photoelectric effect., 3h, Learning outcomes:8,9 12.Atomic structure, wave properties of particles., 3h, Learning outcomes:8,9 13.Electron shells., 1h, Learning outcomes:8 Semiconductors., 2h, Learning outcomes:8 14.Elementary particles, nuclear structure., 2h, Learning outcomes:10 Unstable nuclei., 1h, Learning outcomes:10 15.Radioactive decay, nuclear energy., 3h, Learning outcomes:10				
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.Newton axioms., 2h, Learning outcomes:3 7.Work and power, energy., 2h, Learning outcomes:4 8.Collisions., 2h, Learning outcomes:4 9.1. partial exam, 2h, Learning outcomes:1,2,3,4 10.Rigid body rotation., 2h, Learning outcomes:2,3 11.Motion in gravitational field., 2h, Learning outcomes:5 12.Special theory of relativity., 2h, Learning outcomes:6 13.Bohr model of atom., 2h, Learning outcomes:8				

	14.Photoelectric effect., 1h, Learning outcomes:9 Radioactivity., 1h, Learning outcomes:10 15.2. partial exam, 2h, Learning outcomes:5,6,7,8,9,10
Required materials	Basic: classroom, blackboard, chalk... Whiteboard with markers Overhead projector
Exam literature	Basic literature: 1. Levanat, I., Fizika za TVZ: Kinematika i dinamika, TVZ, Zagreb, 2010; 2. Knapp, A., Zbirka riješenih zadataka iz fizike, TVZ, Zagreb, 2013 Additional literature: 1. Young and Freedman, University Physics, Addison Wesley, San Francisco, 2007; 2. Kulišić, P., Mehanika i toplina, Školska knjiga, Zagreb, 2005
Students obligations	none
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 (Written exam) — 3 (Oral exam) — 3
Remark	This course can not be used for final thesis theme
Prerequisites:	No prerequisites.
ISVU equivalents:	22239;
Proposal made by	Ivica Levanat, prof.v.šk, 14. 01. 2014

Code WEB/ISVU	22860/22280	**ECTS**	5.0	**Academic year**	2018/2019
Name	Power Electronics				
Status	4th semester - Electrical power engineering (Redovni elektrotehnika) - obligatory course4th semester - Control and computer engineering in automation (Redovni elektrotehnika) - elective course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (30+0+0+0) 90
Teachers	Lectures:2. Željko Stojanović Auditory exercises: Neven Čobanov Auditory exercises: Željko Stojanović				
Course objectives	students will acquire knowledge in power electronics				
Learning outcomes:	1.ability to classify electrical components according to their conversion properties . Level:6,7 2.ability to distinguish between particular types of converters. Level:6 3.ability to analyze basic DC converter circuits. Level:6 4.ability to analyze basic rectifier circuits. Level:6 5.ability to comment influence of rectifier on mains. Level:6 6.ability to analyze basic inverter circuits. Level:6				
Methods of carrying out lectures	Ex cathedra teaching Case studies Demonstration Discussion Questions and answers All topics are explained and illustrated by means of characteristic examples.				
Methods of carrying out auditory exercises	Group problem solving Discussion, brainstorming Other Solving problems and discussion of results. Visit to the power electronic factory "Kon"				
Course content lectures	1.Power converters. Basic properties of power converters , 2h, Learning outcomes:1 2.Concept of a power conversion device. Constitutive devices and topology of power converters, 2h, Learning outcomes:1,3,4,5 3.Power semiconductor devices, 2h, Learning outcomes:1,3,4,5 4.Development of uncontrolled switches, unilateral current switches, unilateral voltage switches, bilateral switches, 2h, Learning outcomes:1,3,4,5 5.DC converters, 2h, Learning outcomes:1,2,3 6.One-quadrant direct and indirect dc converters., 2h, Learning outcomes:1,2,3 7.Isolated DC converters, 2h, Learning outcomes:1,2,3 8.Four-quadrant DC converters, 2h, Learning outcomes:1,2,3 9.Rectifiers. Uncontrolled rectifiers, 2h, Learning outcomes:1,2,4 10.Uncontrolled rectifiers. Single phase bridge rectifier with RL load., 2h, Learning outcomes:1,2,4 11.Uncontrolled rectifiers. Single phase bridge rectifier with RL and RC load., 2h, Learning outcomes:1,2,4 12.Uncontrolled rectifiers. Three phase rectifier with RL load., 2h, Learning outcomes:1,2,4 13.Influence of rectifiers on AC network and its suppresion , 2h, Learning outcomes:1,2,4 14.Autonomous voltage-stiff inverters, 2h, Learning outcomes:1,2,5 15.Reduction of input current harmonic, 2h, Learning outcomes:1,2,5				
Course content auditory	1.Visit to the power electronics factory , 2h, Learning outcomes:2 2.Repetition: commutation laws, average and effective value, 2h, Learning outcomes:3,4,5 3.Power converters. Basic properties of power converters , 2h, Learning outcomes:1 4.Development of uncontrolled switches, unilateral current switches, unilateral voltage switches, bilateral switches, 2h, Learning outcomes:1,3,4,5 5.DC converters, 2h, Learning outcomes:1,2,3 6.One-quadrant direct dc converters. , 2h, Learning outcomes:1,2,3 7.One-quadrant direct and indirect dc converters., 2h, Learning outcomes:1,2,3 8.Isolated DC converters, 2h, Learning outcomes:1,2,3 9. Four-quadrant DC converters, 2h, Learning outcomes:1,2,3 10.Isolated DC converters, 2h, Learning outcomes:1,2,4 11.Uncontrolled rectifiers , 2h, Learning outcomes:1,2,4 12.Uncontrolled rectifiers , 2h, Learning outcomes:1,2,4 13.Influence of rectifiers on AC network and its suppresion , 2h, Learning outcomes:1,2,4 14.Autonomous voltage-stiff inverters, 2h, Learning outcomes:1,2,5 15.Autonomous voltage-stiff inverters, 2h, Learning outcomes:1,2,5				
Required materials	Basic: classroom, blackboard, chalk... Whiteboard with markers				
Exam literature	Basic literature: 1. I. Flegar, Elektronički energetski pretvarači, Kigen, Zagreb, 2010 Additional literature: 1. K. Thorborg, Power electronics, Prentice Hall, New York, 1988 2. R. W. Erickson, D. Maksimovic, Fundamentals of power electronics, Springer, 2001 3. I. Flegar, Sklopovi energetske elektronike, Graphis, Zagreb, 1996				
Students obligations	Minimum of 25% of total points achieved on attendance and partial exams.				
Knowledge evaluation during semester	Attendance-maximum 10% of points on partial exams. Two partial exams. Numerical problems (about 80%) and theory (about 20%).				

	Grades: - 0 - 50% #8594; 1 , not passed - 50 - 64% #8594; 2 , passed - 64 - 80% #8594; 3 , passed - 80 - 90% #8594; 4 , passed - 90 - 100% #8594; 5 , passed	
Knowledge evaluation after semester	Written exam and oral exam. Minimum of 50% on written exam is requred for oral exam. Optional seminar work.	
Student activities:	Aktivnost (Constantly tested knowledge) (Classes attendance)	ECTS 4 1
Remark	This course can be used for final thesis theme	
Prerequisites:	No prerequisites.	
Proposal made by	Željko Stojanović	

Code WEB/ISVU	22862/22284	**ECTS**	6.0	**Academic year**	2018/2019
Name	Power Plants Construction				
Status	5th semester - Electrical power engineering (Redovni elektrotehnika) - elective course5th semester - Control and computer engineering in automation (Redovni elektrotehnika) - elective course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				45+45 (0+45+0+0) 90
Teachers	Lectures:1. mr.sc. Davor Gadže Lectures: Tomislav Špoljarić d. i. e., v. pred. Laboratory exercises:mr.sc. Davor Gadže Laboratory exercises: Mario Ličanin Laboratory exercises: Tomislav Špoljarić d. i. e., v. pred.				
Course objectives	students will acquire knowledge required for the electric power plant design and construction				
Learning outcomes:	1.ability to analyze the energy requirements of simple facilities. Level:6 2.ability to calculate the elements of overload protection of simple facilities. Level:6 3.ability to calculate the elements of protection against indirect contact of simple facilities. Level:6 4.ability to calculate cooling of the simple facility equipment. Level:6 5.ability to draw a simple scheme applying the power plant design software. Level:6				
Methods of carrying out lectures	Ex cathedra teaching Discussion Questions and answers				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Other CAD supported documentation				
Course content lectures	1.Electric power plant - energy flow and information., 3h, Learning outcomes:1,5 2.Laws, regulations and standards in design (IEC, ISO, and HRN)., 3h, Learning outcomes:1,5 3.Stages of plant construction: design, installment, commissioning and maintenance, 3h, Learning outcomes:1,5 4.Technical documentation for each stage., 3h, Learning outcomes:2,3,5 5.Energy requirements, power supply and quality., 3h, Learning outcomes:1,5 6.Plant safety procedure for staff and equipment., 3h, Learning outcomes:2,3,5 7.Protection against voltage shock. TN, 3h, Learning outcomes:2,5 8.Protection against voltage shock. TT, 3h, Learning outcomes:2,5 9.Grounding and potential equalizing., 3h, Learning outcomes:2,5 10.Protection against short circuits and overload., 3h, Learning outcomes:3,5 11.Mechanical protection IP code , 3h, Learning outcomes:2,3 12.EX equipment design., 3h, Learning outcomes:2,3 13.Cooling., 3h, Learning outcomes:4 14.Commissioning, 3h, Learning outcomes:5 15.Maintenance., 3h, Learning outcomes:5				
Course content laboratory	1.no classes, 2h 2.no classes, 2h 3.no classes, 2h 4.no classes, 2h 5.no classes, 2h 6.Organizing project documentation, 4h, Learning outcomes:1,2,3,4,5 7.Organizing project documentation, 4h, Learning outcomes:1,2,3,4,5 8.components, 4h, Learning outcomes:5 9.installation site, 4h, Learning outcomes:5 10.marking, 4h, Learning outcomes:5 11.symbols, 4h, Learning outcomes:5 12.wires, 4h, Learning outcomes:5 13.cables, 4h, Learning outcomes:5 14.equipment layout, 4h, Learning outcomes:5 15.generating reports, 2h, Learning outcomes:5				
Required materials	Special equipment CAD electrical software, EPLAN				
Exam literature	Basic literature: 1. Electrical installation guide According to IEC Standards 2010; Schneider Electric SAS, Rueil-Malmaison Cedex, France. 2. Westermannov elektrotehnički priručnik; Školska knjiga, Zagreb 1991. Additional literature: 1. Tehnički priručnik; Končar elektroindustrija dd Zagreb, 1991. 2. E Plan upute za korištenje				
Students obligations	passed preliminary exams in exercises				
Knowledge evaluation during semester	Presence 10 Kolokvij 40 Seminar 50				
Knowledge evaluation after semester	Written 50 Oral 50				
Student activities:	Aktivnost (Constantly tested knowledge)			ECTS 6	
Remark	This course can be used for final thesis theme				

Prerequisites:	No prerequisites.
Proposal made by	Mr. sc. Davor Gadže, viši predavač

Code WEB/ISVU	23066/83431	**ECTS**	6.0	**Academic year**	2018/2019
Name	Practical work				
Status	6th semester - Electrical power engineering (Redovni elektrotehnika) - elective course6th semester - Control and computer engineering in automation (Redovni elektrotehnika) - elective course6th semester - Communication and computer technology (Redovni elektrotehnika) - elective course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				0+90 (90+0+0+0) 90
Teachers	Auditory exercises:1. Tomislav Špoljarić d. i. e., v. pred.				
Course objectives	Students will obtain their first working experience in the work environment as a preparation for their future profession				
Learning outcomes:	1.ability to relate theoretical knowledge acquired through education to specific tasks and skills required during practical work. Level:6,7 2.ability to distinguish between ideal theoretical models and real practical examples at work. Level:6 3.ability to compare their own level of competence with the level of competence required by employer. Level:6,7 4.ability to assess demand for their own qualification at the labour market. Level:6,7 5.ability to conclude if they want to be in the same profession in future. Level:6,7				
Methods of carrying out auditory exercises	Data mining and knowledge discovery on the Web Essay writing Other Practical work in an electrical engineering environment				
Course content auditory	1.Following the instructions of the practice menthor, 12h 2.Following the instructions of the practice menthor, 12h 3.Following the instructions of the practice menthor, 12h 4.Following the instructions of the practice menthor, 12h 5.Following the instructions of the practice menthor, 12h 6.Following the instructions of the practice menthor, 12h 7.Following the instructions of the practice menthor, 12h 8.Following the instructions of the practice menthor, 12h 9.Following the instructions of the practice menthor, 12h 10.Following the instructions of the practice menthor, 12h 11.Following the instructions of the practice menthor, 12h 12.Following the instructions of the practice menthor, 12h 13.Following the instructions of the practice menthor, 12h 14.Following the instructions of the practice menthor, 12h 15.Following the instructions of the practice menthor, 12h				
Required materials	Practical work in an electrical engineering environment				
Exam literature	Osnovna: Obavezno je poznavanje zaštite na radu sa specifičnim zahtijevima koji su u primjeni na radnom mjestu, ostalo ovisi o instituciji u kojoj se praksa provodi Additional literature: 1.Zakon o zaštiti na radu Republike Hrvatske				
Students obligations	Regular practice attendance and a signed confirmation of the completed assignments				
Knowledge evaluation during semester	Practice journal 100%				
Knowledge evaluation after semester	Practice journal 100%				
Student activities:	Aktivnost (Practical work)		ECTS 6		
Remark	This course can not be used for final thesis theme				
Prerequisites:	No prerequisites.				
Proposal made by	Ivan Lujo, MSc, Lecturer				

Code WEB/ISVU	23085/85624	**ECTS**	3.0	**Academic year**	2018/2019
Name	Probability and Statisics				
Status	3rd semester - Electrical power engineering (Redovni elektrotehnika) - obligatory course3rd semester - Control and computer engineering in automation (Redovni elektrotehnika) - obligatory course3rd semester - Communication and computer technology (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+15 (15+0+0+0) 45
Teachers	Lectures:1. Luka Marohnić Lectures:2. mr.sc. Bojan Kovačić , viši predavač Lectures:3. dr. sc. Anđa Valent viši predavač Auditory exercises:mr.sc. Bojan Kovačić , viši predavač Auditory exercises: Luka Marohnić Auditory exercises:dr. sc. Anđa Valent viši predavač				
Course objectives	Students will be introduced to basic principles of probability and basic statistical methods and procedures.				
Learning outcomes:	1.calculate basic numerical descriptors of data sequence (mean, mode, quartiles, variance, standard deviation). Level:6 2.ability to calculate probability of elementary events and the events in a discrete probability space. Level:6 3.ability to combine elementary combinatorial techniques in calculatiion of probabilities. Level:6,7 4.ability to make (diagram, graph, map) various descriptiva statistics diagrams (histogram, frequency polygons). Level:6 5.ability to distinguish between basic discrete and continuous probability distribution and adjust them to empirical data. Level:6 6.ability to edit nongrouped statistic sequence of empirical statistical data and make its tabulation. Level:6,7 7.calculate probability of events in basic measurable subsets of two- and three-dimensional Euclidean space. Level:6 8.calculate basic statistic parameters of discrete and continuous random variables. Level:6				
Methods of carrying out lectures	Ex cathedra teaching Case studies Discussion Questions and answers Other The course material is being presented in the classroom with detailed explanations and comments.				
Methods of carrying out auditory exercises	Laboratory exercises, computer simulations Group problem solving Computer simulations Other The problems are being solved on the blackboard with detailed explanations.				
Course content lectures	1.Introduction, 2h, Learning outcomes:3 2.One stage amplifiers. Common emitter amplifier, 2h, Learning outcomes:2 3.One stage amplifiers. Common emitter amplifier, 2h, Learning outcomes:2 4.One stage amplifiers. Common emitter amplifier, 2h, Learning outcomes:2 5.One stage amplifiers. Common collector amplifier, 2h, Learning outcomes:2 6.Transistor series voltage regulator, 2h, Learning outcomes:4,6 7.Common source amplifier, 2h, Learning outcomes:1,6 8.Common drain amplifier, 2h, Learning outcomes:1,2,4,6 9.Multistage amplifiers, 2h, Learning outcomes:5 10.Amplitude and phase frequency response, 2h, Learning outcomes:5 11.Amplitude and phase frequency response, 2h, Learning outcomes:5 12.Differential amplifier, 2h, Learning outcomes:5 13.Power amplifiers, 2h, Learning outcomes:5 14.Feedback, 2h, Learning outcomes:5 15.Oscillators, 2h, Learning outcomes:2,3,5				
Course content auditory	1.Algebra of sets. Basic operation with sets. , 1h, Learning outcomes:3 2.Basic principles of combinatorics. Permutations and combinations. , 1h, Learning outcomes:3 3.Elementary events. Events. Algebra of events., 1h, Learning outcomes:2 4.Classical (discrete) probability spaces., 1h, Learning outcomes:2 5.Geometrical probability., 1h, Learning outcomes:6 6.Conditional probability. Independent probability. Bernoulli schema., 1h, Learning outcomes:2 7.Total probability rule. Bayes rule., 1h, Learning outcomes:2 8.Means. Measures of position. Measures of dispersion., 1h, Learning outcomes:1,6,7 9.Discrete random variables. Mathematical expectation and standard deviation of discrete random variables., 1h, Learning outcomes:7 10.Binomial distribution., 1h, Learning outcomes:5,8 11.Poisson distribution., 1h, Learning outcomes:5,8 12.Geometric distribution., 1h, Learning outcomes:5,8 13.Unique continuous distribution. Exponential distribution., 1h, Learning outcomes:5,8 14.Normal distribution., 1h, Learning outcomes:5,8 15.Central limit theorem. De Moivre-Laplace theorem., 1h, Learning outcomes:5,8				
Required materials	Basic: classroom, blackboard, chalk... General purpose computer laboratory Whiteboard with markers Overhead projector Special equipment a laptop				
Exam literature	Obavezna:				

	1. Autorizirani radni materijal za predavanja i auditorne vježbe 2. B. Čulina, D. Čulina: Elementarna vjerojatnost i statistika uz pomoć MS Excela, Veleučilište Velika Gorica, Velika Gorica, 2011. 3. S. Suljagić: Vjerojatnost i statistika, interna skripta, Tehničko veleučilište u Zagrebu, Zagreb, 2005. Additional literature: 1. N. Elezović, Diskretna vjerojatnost, Element, 2007. 2. N. Elezović, Slučajne varijable, Element, 2007. 3. Ž. Pauše, Riješeni primjeri i zadaci iz vjerojatnosti i statistike, Školska knjiga, Zagreb, 1989. 4. Ž. Pauše, Uvod u matematičku statistiku, Školska knjiga, Zagreb, 1993. 5. Ž.Pauše, Vjerojatnost, Školska knjiga, Zagreb, 1974.
Students obligations	70% of class attendance of the total class number. In case of less class attendance, valid excuse and submitted obligatory assignments are required.
Knowledge evaluation during semester	Preliminary exam in the last lecture week; eliminatory, pass: 50% of total points at the exam. Marks: 50% - 62% = sufficient (2) 63% - 74% = good (3) 75% - 89% = very good (4) 90% - 100% = excellent (5); Oral exam: Optional (student choice). Pass: correct answers at 50% of total number of questions; The final mark is not more than 1 mark better than the mark of written exam.
Knowledge evaluation after semester	Written exam (numerical tasks): 4 exam terms; pass: 50% of total points; Marks: 50% - 62% of total points = sufficient (2) 63% - 74% of total points = good (3) 75% - 89% of total points = very good (4) 90% - 100% of total points = excellent (5) Oral exam: Optional (student choice). Pass: correct answers at 50% of total number of questions; The final mark is not more than 1 mark better than mark of written exam.
Student activities:	Aktivnost — ECTS (Constantly tested knowledge) — 2 (Oral exam) — 1
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
ISVU equivalents:	22251;
Proposal made by	Bojan Kovačić, M.Sc., senior lecturer; Luka marohnić, predavač (31.5.2018.)

Code WEB/ISVU	22854/22256	**ECTS**	5.0	**Academic year**	2018/2019
Name	Process Control Computers				
Status	5th semester - Electrical power engineering (Redovni elektrotehnika) - obligatory course5th semester - Control and computer engineering in automation (Redovni elektrotehnika) - obligatory course5th semester - Communication and computer technology (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (0+30+0+0) 90
Teachers	Lectures:1. mr.sc. Goran Malčić v.pred. Laboratory exercises: Mario Lučan Laboratory exercises: Pavao Maković Laboratory exercises:mr.sc. Goran Malčić v.pred. Laboratory exercises: Ivica Vlašić				
Course objectives	students will be introduced to specific requirements of computer systems implemented in the process technology and industry				
Learning outcomes:	1.ability to distinguish between the real-time computer systems and the others . Level:6 2.ability to connect the hardware elements of asystem with software. Level:6,7 3.ability to sketch control logic based on graphic programming language. Level:6 4.ability to develop a control program for simple systems . Level:6,7 5.ability to establish a relation between software, computer and the end hardware elements of the system. Level:6,7				
Methods of carrying out lectures	Ex cathedra teaching Case studies Demonstration Discussion Questions and answers The lectures are based on presentations of particular control devices and micro-controlling systems.				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Laboratory exercises, computer simulations Group problem solving Interactive problem solving Workshop Exercises are performed on PLC devices connected to your PC. Preparations for the exercise in the form of training courses for programmers to work on the devices.				
Course content lectures	1.Real-time computer controlled systems , 2h, Learning outcomes:1,2,3,4,5 2.Basic functional elements of industrial control systems, 2h, Learning outcomes:1,2,3,4,5 3.Programmable logic controller (PLC) as the main part of a control system, 2h, Learning outcomes:1,2,3,4,5 4.Types of processes and sequential and distributed control systems, 2h, Learning outcomes:1,2,3,4,5 5.Connection of the process with PLC circuits and addressing the external devices, 2h, Learning outcomes:1,2,3,4,5 6.Bit level instructions and Ladder diagram programming, 2h, Learning outcomes:1,2,3,4,5 7.Direct and indirect adressing, optimizing program code, 2h, Learning outcomes:1,2,3,4,5 8.Commands and work with timers, 2h, Learning outcomes:1,2,3,4,5 9.Commands and work with counters and high-speed counters, 2h, Learning outcomes:1,2,3,4,5 10.Pulse width modulation and pulse control device, 2h, Learning outcomes:1,2,3,4,5 11.Operation on data - comparison instructions and examples, 2h, Learning outcomes:1,2,3,5 12.Operation on data - mathematical instructions and examples, 2h, Learning outcomes:1,2,3,4,5 13.Commands and presentation of control by PLC computer, 2h, Learning outcomes:1,2,3,4,5 14.Instructions and changes of program flow control, 2h, Learning outcomes:1,2,3,4,5 15.Work with interruptive subroutines, 2h, Learning outcomes:1,2,3,4,5				
Course content laboratory	1.Basic units of programmable logic controller (PLC), 2h, Learning outcomes:1,2,3,4,5 2. Interaction with the environment and the PLC input and output control , 2h, Learning outcomes:1,2,3,4,5 3.Direct and indirect addressing, 2h, Learning outcomes:1,2,3,4,5 4.Programming language and the application development software, 2h, Learning outcomes:1,2,3,4,5 5.Application simulation on a PC, 2h, Learning outcomes:1,2,3,4,5 6.Operating with timers, 2h, Learning outcomes:1,2,3,4,5 7.Examples of work from timers, 2h, Learning outcomes:1,2,3,4,5 8.Operating counters, 2h, Learning outcomes:1,2,3,4,5 9.Control switching equipment, sequential control, 2h, Learning outcomes:1,2,3,4,5 10.Examples of processes combined timers and counters, 2h, Learning outcomes:1,2,3,4,5 11.Analog modules, analog value scaling, 2h, Learning outcomes:1,2,3,4,5 12.Operating with analog values, 2h, Learning outcomes:1,2,3,4,5 13.Operating with mathematical instructions, 2h, Learning outcomes:1,2,3,4,5 14.Interruptive subroutines and operation jump start program, 2h, Learning outcomes:1,2,3,4,5 15.Writing the software project documentation, 2h, Learning outcomes:1,2,3,4,5				
Required materials	Special purpose laboratory General purpose computer laboratory Special purpose computer laboratory Overhead projector Special equipment PLC computer, switching equipment				
Exam literature	Basic literature: G. Malčić, D. Maršić: Programirljivi logički kontroleri, interna skripta za kolegij Procesna računala, Tehničko veleučilište u Zagrebu, Elektrotehnički odjel, Zagreb, 2009. Additional literature: L.A. Bryan, E.A. Bryan: Programmable Controllers -Theory and Implementation, Second Edition, An Industrial Text				

	Company Publication, Atlanta, 1997. John R. Hackworth and Frederick D. Hackworth: Programmable logic controllers: Programing methods and applications, 2003. H. Jack: Automating manufacturing systems with PLCs, Version 6, 2009. Priručnici za rad	
Students obligations	Mandatory attendance (80% level)	
Knowledge evaluation during semester	Colloquium numerical tasks, Seminar Verbal knowledge testing	
Knowledge evaluation after semester	The written exam Verbal exam Seminar	
Student activities:	Aktivnost (Written exam) (Oral exam)	ECTS 3 2
Remark	This course can be used for final thesis theme	
Prerequisites:	No prerequisites.	

Code WEB/ISVU	22859/22270	**ECTS**	5.0	**Academic year**	2018/2019
Name	Process Measurements				
Status	4th semester - Electrical power engineering (Redovni elektrotehnika) - elective course4th semester - Control and computer engineering in automation (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (15+15+0+0) 90
Teachers	Lectures:1. v.pred. Mato Fruk dipl.ing. Auditory exercises:mr.sc. Goran Malčić v.pred. Laboratory exercises: Mario Lučan Laboratory exercises:mr.sc. Goran Malčić v.pred.				
Course objectives	Students will learn the operating principles of measuring sensors, learn to select measuring sensors for automation of certain plants and processes				
Learning outcomes:	1.ability to propose measurement of the required physical values in the control system. Level:6,7 2.ability to compare measuring sensors whose physical values are based on different functional principles. Level:6,7 3.ability to propose appropriate measuring sensor. Level:6,7 4.ability to test the measuring sensor. Level:6 5.ability to integrate the measuring sensor into the closed loop system. Level:6,7				
Involvement of learning outcomes of the course in study programme:	6.5.KIRT Izabrati transformatore, nadzemne vodove i sklopne aparate za prijenos i distribuciju električne energije: 5h in 150h				
Methods of carrying out lectures	Ex cathedra teaching Case studies Discussion The matter is presented by using block diagrams, and explanation of basic physical principles,tables and diagrams using illustrative examples.				
Methods of carrying out auditory exercises	Group problem solving Data mining and knowledge discovery on the Web Auditory: Examples are discussed and solved by students participation on the board for every topic in connection with laboratory examples.				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Group problem solving Laboratory: Measurements are done on prepared models and measurement equipment.				
Course content lectures	1.Introduction, 2h, Learning outcomes:1 2.One stage amplifiers. Common emitter amplifier, 2h, Learning outcomes:1,2,3,4 3.One stage amplifiers. Common emitter amplifier, 2h, Learning outcomes:1,2,3,4 4.One stage amplifiers. Common emitter amplifier, 2h, Learning outcomes:1,2,3,4 5.One stage amplifiers. Common collector amplifier, 2h, Learning outcomes:1,3,4 6.Transistor series voltage regulator, 2h, Learning outcomes:1,3,4 7.Common source amplifier, 1h, Learning outcomes:3 Common drain amplifier, 1h, Learning outcomes:1 8.Common drain amplifier, 2h, Learning outcomes:2,3 9.Multistage amplifiers, 2h, Learning outcomes:2,3 10.Amplitude and phase frequency response, 2h, Learning outcomes:2,3 11.Amplitude and phase frequency response, 2h, Learning outcomes:2,3,4 12.Differential amplifier, 2h, Learning outcomes:3,4,5 13.Power amplifiers, 2h, Learning outcomes:3,4,5 14.Feedback, 2h, Learning outcomes:4,5 15.Oscillators, 2h, Learning outcomes:5				
Course content auditory	1.Introductory exercise, sensor model, integral elements., 1h, Learning outcomes:1,2 2.Measuring sensor model, components., 1h, Learning outcomes:1,2 3.Displacement transducers., 1h, Learning outcomes:1,2,4 4.Displacement transducers., 1h, Learning outcomes:1,2,4 5.Force transducers., 1h, Learning outcomes:1,2,4 6.Force transducers., 1h, Learning outcomes:1,2,4 7.Pressure transducers., 1h, Learning outcomes:1,2,4 8.Pressure transducers., 1h, Learning outcomes:1,2,4 9.Flow transducers., 1h, Learning outcomes:1,2 10.Flow transducers., 1h, Learning outcomes:1,2 11.Level transducers., 1h, Learning outcomes:1,2 12.Level transducers., 1h, Learning outcomes:1,2 13.Temperature transducer., 1h, Learning outcomes:1,2,4 14.Temperature transducer., 1h, Learning outcomes:1,2,4 15.Light intensity transducer., 1h, Learning outcomes:1,2				
Course content laboratory	1.Introductory exercise, sensor model, integral elements., 1h, Learning outcomes:1,2 2.Measuring sensor model, components., 1h, Learning outcomes:1,2 3.Displacement transducers., 1h, Learning outcomes:1,2,4 4.Displacement transducers., 1h, Learning outcomes:1,2,4 5.Force transducers., 1h, Learning outcomes:1,2,4 6.Force transducers., 1h, Learning outcomes:1,2,4 7.Pressure transducers., 1h, Learning outcomes:1,2,4 8.Pressure transducers., 1h, Learning outcomes:1,2,4 9.Flow transducers., 1h, Learning outcomes:1,2				

	10.Flow transducers., 1h, Learning outcomes:1,2 11.Level transducers., 1h, Learning outcomes:1,2 12.Level transducers., 1h, Learning outcomes:1,2 13.Temperature transducer., 1h, Learning outcomes:1,2,4 14.Temperature transducer., 1h, Learning outcomes:1,2,4 15.Light intensity transducer., 1h, Learning outcomes:1,2
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory Overhead projector Maquette Laboratory: Measurements are done on prepared models and measurement equipment.
Exam literature	Basic literature: 1. N.Perić,I.Petrović, Procesna mjerenja, FER Zagreb, skripta, 1999. Additional literature: 1. P. Profos, T. Pfeiffer: Handbuch der Industriellen Messtechnik, Springer Verlag. Deutschland 1994. 2. Međunarodni i državni mjeriteljski propisi i preporuke: HN, EN, ISO, IEC.
Students obligations	Attend 70 percent of classes and auditory exercises and attend at all labaratory exercises
Knowledge evaluation during semester	3 exams: At least 50 percent from every exam to pass
Knowledge evaluation after semester	Written and oral exam: At least 50 percent from every exam to pass
Student activities:	Aktivnost — ECTS (Constantly tested knowledge) — 4 (Oral exam) — 1
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
Proposal made by	Senior lecturer Mato Fruk,dipl.ing.

Code WEB/ISVU	23486/155998	**ECTS**	5.0	**Academic year**	2018/2019
Name	Programmable Logic Controllers				
Status	6th semester - Control and computer engineering in automation (Redovni elektrotehnika) - elective course6th semester - Communication and computer technology (Redovni elektrotehnika) - elective course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (0+30+0+0) 90
Teachers	Lectures:1. mr.sc. Goran Malčić v.pred. Lectures: Ivica Vlašić Laboratory exercises: Mario Lučan Laboratory exercises: Ivica Vlašić				
Course objectives	Students will be introduced to solving particular problems in process technology				
Learning outcomes:	1.ability to connect the elements of a system with software . Level:6 2.ability to sketch control logic based on graphic programming language. Level:6,7 3.ability to develop a control program for simple systems. Level:6 4.ability to establish relation between software, computer and end hardware elements of the system. Level:6,7 5.ability to solve a simple problem in facilities and processing technology using PLC . Level:6,7				
Methods of carrying out lectures	Ex cathedra teaching Case studies Discussion Questions and answers Seminar, students presentation and discussion The lectures are based on a number of presentations of particular materials related to control systems and PLC standard devices.				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Laboratory exercises, computer simulations Group problem solving Interactive problem solving The exercises are carried out on various PLC devices connected to PCs.				
Course content lectures	1.Elementary functional parts of a PLC, 2h 2. Interaction with the environment and the PLC input and output control , 2h 3.Programming language and the application development software, 2h 4.Application simulation on a PC, 2h 5.Specific application programming languages, 2h 6.Ladder diagrams (LAD), 2h 7.Statement list (STL), 2h 8.Sequencal function charts (SFC), 2h 9.Function block diagram (FBD), 2h 10.Instruction list (IL), 2h 11.Features and time response of control devices realized by a PLC, 2h 12.Protocols and standards, 2h 13.Connecting separate systems into a whole, 2h 14.Human machine interface, 2h 15.Scada system, 2h				
Course content laboratory	1.Basic parts of a PLC. Interaction with the environment, 2h 2.Methods, ways of programming, addressing, 2h 3.Connecting a PLC to a PC, work with software used for developing control applications, 2h 4.Interaction with the environment and the PLC input and output control, 2h 5.Receiving analog signals (sensors) on a PLC and work with analog values, 2h 6.Ladder diagrams (LAD), 2h 7.Statement list (STL), 2h 8.Sequencal function charts (SFC), 2h 9.Function block diagram (FBD), 2h 10.Instruction list (IL), 2h 11.Control switching equipment, sequential control, 2h 12.Work with mathematics instructions, 2h 13.Work with comparison instructions, 2h 14.Work with program jump instructions, 2h 15.Writing the project documentation, 2h				
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory Special purpose computer laboratory Overhead projector				
Exam literature	Basic literature: 1. Priručnici za rad sa odabranim PLC-om. Additional literature: Clarence T. Jones: STEP 7 in 7 Steps - A Practical Guide to Implementing S7-300/S7-400 Programmable Logic Controllers, 1st Edition, Patrick-Turner Publishing, United States, 2006. H. Berger: Automating with STEP 7 in LAD and FBD, 3rd revised edition, Publicis Corporate Publishing, Berlin and Munich, 2005.				
Students obligations	Mandatory attendance (80% level)				
Knowledge	Colloquium numerical tasks, Seminar Verbal knowledge testing				

evaluation during semester		
Knowledge evaluation after semester	The written exam Verbal exam Seminar	
Student activities:	Aktivnost (Written exam) (Oral exam)	ECTS 3 2
Remark	This course can be used for final thesis theme	
Prerequisites:	No prerequisites.	
ISVU equivalents:	32771;	

Code WEB/ISVU	22870/22303	**ECTS**	5.0	**Academic year**	2018/2019
Name	Programming				
Status	4th semester - Electrical power engineering (Redovni elektrotehnika) - elective course4th semester - Control and computer engineering in automation (Redovni elektrotehnika) - obligatory course4th semester - Communication and computer technology (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (0+30+0+0) 90
Teachers	Lectures:1. Tomislav Novak mag. ing. inf. et comm. techn. Lectures:2. Prof.dr.sc. Slavica Ćosović Bajić Laboratory exercises: Nikola Majstorović dipl.ing. Laboratory exercises: Tomislav Novak mag. ing. inf. et comm. techn. Laboratory exercises: Vatroslav Zuppa Bakša				
Course objectives	students will acquire basic knowledge and competences in programming				
Learning outcomes:	1.ability to develop mathematical algorithm for solving numerical problems. Level:6,7 2.ability to decompose parts of algorithm into simple elements. Level:6 3.ability to classify the elements of algorithm into data and procedures. Level:6,7 4.ability to propose an example of mathematical algorithm in the form of computer program code. Level:6,7 5.ability to predict borderline cases of applying the algorithm . Level:6,7				
Methods of carrying out lectures	Ex cathedra teaching Case studies Demonstration Simulations Questions and answers Lectures: The subject matter is taught by using a great number of particular examples C programmes.Students are constantly motivated to take an active part in class.Teaching equipment: board, overhead projector and LCD projector.				
Methods of carrying out laboratory exercises	Laboratory exercises, computer simulations Group problem solving Traditional literature analysis Computer simulations Workshop Laboratory: Students solve practical examples on computers.				
Course content lectures	1.Basics of programming and C language, 2h, Learning outcomes:1,2 2.Data types, 2h, Learning outcomes:1,2,3 3.Variables, constants, operators and operands. Assignment operators, arithmetical operators. Expressions, arithmetical statements , 2h, Learning outcomes:1,2,3 4.Cast operators. relational and logical expressions and operators , 2h, Learning outcomes:1,2,3 5.Selection Statements which include if, nested ifs and switch, 2h, Learning outcomes:1,2,3,4 6.Program loops (for, while, do-while). Loops with test criteria at the beginning or at the end of the structure. Loop with known number of repetitions. Termination of the loop., 2h, Learning outcomes:1,2,3,4 7.Data arrays. Character array (string), 2h, Learning outcomes:2,3 8.Arrays (two-Dimensional Arrays and multidimensional Arrays). Examples, 2h, Learning outcomes:2,3 9.Solving problems given in midterm test, 2h, Learning outcomes:1,2,3,4,5 10.Functions, The General Form of a Function .Function Parameters and Arguments., 2h, Learning outcomes:2,3,4 11.Pointers, methods of data transfer to functions (call by value, call by reference), work with arrays in functions, 2h, Learning outcomes:2,3,4,5 12.Built-in libraries and functions (strings, math functions etc.), 2h, Learning outcomes:1,2,3,4,5 13.Working with files: formatted files (text), 2h, Learning outcomes:2,3,4 14.Working with files: unformatted files (binary), 2h, Learning outcomes:2,3,4 15.Solving problems given in the final test, 2h, Learning outcomes:1,2,3,4,5				
Course content laboratory	1.no classes, 2h 2.no classes, 2h 3.no classes, 2h 4.introduction, using IDE, 2h, Learning outcomes:2,3 5.data types, 2h, Learning outcomes:1,2,3 6.arithmetic operators (math type tasks), 2h, Learning outcomes:1,2,3 7.relational and logic operators and selection operators (if, switch) (simple tasks), 2h, Learning outcomes:1,2,3,4 8.usage of all accumulated knowledge in complex computer problems (preparing for midterm), 2h, Learning outcomes:1,2,3,4,5 9.midterm, 2h, Learning outcomes:1,2,3,4,5 10.loops (for, while, do-while), 2h, Learning outcomes:1,2,3,4 11.working with arrays, 2h, Learning outcomes:1,2,3,4 12.using and writing functions, 2h, Learning outcomes:1,2,3,4,5 13.using built-in functions for strings and advanced math, 2h, Learning outcomes:1,2,3,4,5 14.final exam, 2h, Learning outcomes:1,2,3,4,5 15.working with files, 2h, Learning outcomes:1,2,3,4				
Required materials	Basic: classroom, blackboard, chalk... General purpose computer laboratory Whiteboard with markers Overhead projector				
Exam literature	Basic literature: 1. S.Ćosović Bajić, G.Trutanić PROGRAMIRANJE u C-u i vježbe , Udžbenik u pripremi , radni materijal nalazi se na WEB stranici odjela www.tvz.hr Additional literature:				

	1. Boris Motik, Julijan Šribar:Demistificirani C++, Zagreb, Element , 1997
Students obligations	50% of maximum points from mini tests held on laboratory exercises
Knowledge evaluation during semester	Tests during the semester may allow exemption from the written exam and the oral examination, depending on the scoring: - mini test - 67,5% or 87,5% (depends on wanted exemption) - numerical tests (midterm, final term) - over 50% of maximum points
Knowledge evaluation after semester	Written exam gives 50% of final mark Oral exam gives the other 50%.
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
ISVU equivalents:	22275;
Proposal made by	Stipe Predanić, dipl.ing

Code WEB/ISVU	22982/32767	**ECTS**	5.0	**Academic year**	2018/2019
Name	Protection and Measurements in Switchgear				
Status	6th semester - Electrical power engineering (Redovni elektrotehnika) - elective 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. Davor Petranović dipl.ing.el. Auditory exercises:dr.sc. Davor Petranović dipl.ing.el.				
Course objectives	Students will be qualified to independently solve problems in the field of protection and measurements in power plants				
Learning outcomes:	1.ability to analyze requirements for plant protection. Level:6 2.ability to design the type of protection. Level:6 3.ability to identify the problem related to protection. Level:6 4.ability to calculate the time required for protective action. Level:6 5.ability to classify various types of protection which can be applied. Level:6,7				
Involvement of learning outcomes of the course in study programme:	5.1.EE Razumjeti princip rada električnih rotacijskih strojeva, transformatora, dalekovoda i sklopnih aparata: 30h in 150h 6.5.KIRT Izabrati transformatore, nadzemne vodove i sklopne aparate za prijenos i distribuciju električne energije: 30h in 150h				
Methods of carrying out lectures	Ex cathedra teaching Case studies Discussion Drawings, tables and diagrams are used to ease understanding. Specific examples are also shown through photographs, design, project and test documentation. All exposed materials are analyzed and discussed with students to achieve their active participation. It is necessary to have blackboard and LCD projector.				
Methods of carrying out auditory exercises	Group problem solving Traditional literature analysis Data mining and knowledge discovery on the Web Discussion, brainstorming Mind mapping Computer simulations Workshop Problems are solved on the blackboard but with the students participation.				
Course content lectures	1.Task and development of measurement and protection in switchgears and networks of different voltage level , 2h, Learning outcomes:1,2,3 2.Task and development of measurement and protection in switchgears and networks of different voltage level , 2h, Learning outcomes:1,2,3 3.Stationary and extreme states of electrical systems , 2h, Learning outcomes:1,2,3 4.Stationary and extreme states of electrical systems , 2h, Learning outcomes:1,2,3 5.Symmetrical components , 2h, Learning outcomes:2,3,4 6.Symmetrical components , 1h, Learning outcomes:1,3,4 Typical failures -Measuring systems in electrical systems: constructions and functions , 1h, Learning outcomes:2,3,4 7.Typical failures -Measuring systems in electrical systems: constructions and functions , 2h, Learning outcomes:1,2,3 8.Typical failures -Measuring systems in electrical systems: constructions and functions , 2h, Learning outcomes:1,2,3 9.Current and voltage transformers and transducers (current, voltage, frequency, power and phase angle), 2h, Learning outcomes:2,3,4 10.Current and voltage transformers and transducers (current, voltage, frequency, power and phase angle), 1h, Learning outcomes:1,2,3 Protection systems in switchgears and structures and time characteristics , 1h, Learning outcomes:2,3,4 11.Protection systems in switchgears and structures and time characteristics , 2h, Learning outcomes:1,2,3 12.Over-current, voltage, impedance, reactance, admittance, directional and frequency protection relays , 2h, Learning outcomes:2,3,4 13.Protection of feeders, busbars, transformers, generators and motors, 2h, Learning outcomes:1,2,4 14.Remote control and management, 2h, Learning outcomes:2,3,4 15.Measurement, protection and control integration in switchgear, 2h, Learning outcomes:2,3,4				
Course content auditory	1.Examples of short-circuit calculations , 2h, Learning outcomes:4,5 2.Examples of short-circuit calculations , 2h, Learning outcomes:3,4,5 3.Examples of short-circuit calculations , 2h, Learning outcomes:3,4,5 4.Examples of sizing and selection of measuring devices , 2h, Learning outcomes:3,4,5 5.Examples of sizing and selection of measuring devices , 2h, Learning outcomes:3,4,5 6.Examples of sizing and selection of measuring devices , 2h, Learning outcomes:3,4,5 7.Examples of sizing and selection of protection devices , 2h, Learning outcomes:2,3,4 8.Examples of sizing and selection of protection devices , 2h, Learning outcomes:3,4,5 9.Examples of sizing and selection of protection devices , 2h, Learning outcomes:3,4,5 10.Review of project documentation , 2h, Learning outcomes:3,4,5 11.Review of project documentation , 2h, Learning outcomes:3,4,5 12.Review of project documentation , 2h, Learning outcomes:3,4,5 13.Review of catalog documentation, 2h, Learning outcomes:3,4,5 14.Review of catalog documentation, 2h, Learning outcomes:3,4,5 15.Review of catalog documentation, 2h, Learning outcomes:3,4,5				
Required materials	Basic: classroom, blackboard, chalk... Whiteboard with markers Overhead projector				
Exam literature	Basic literature:				

	1. S.Nikolovski;Zaštita u elektroenergetskom sustavu, ETF, Osijek,2008.god. 2. H. Požar, Visokonaponska rasklopna postrojenja, Tehnička knjiga, Zagreb Additional literature: 1. Tehnički priručnik, Končar, Zagreb, 1999. 2. Siemens Engineering Guide, Edition 7.1 3. Numerički releji zaštite RFX i RFD, Končar Inem
Students obligations	80 % class attendence
Knowledge evaluation during semester	Writting test #1#100#50$
Knowledge evaluation after semester	Writting exame #1#80#50$ Oral exame #1#20#50$
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	Senior lecturer Davor Petranović MSEE (hon.)

Code WEB/ISVU	23636/157314	**ECTS**	4.0	**Academic year**	2018/2019
Name	Quality Management				
Status	4th semester - Control and computer engineering in automation (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+0 (0+0+0+0) 90
Teachers	Lectures:1. dr.sc. Davor Petranović dipl.ing.el. Lectures:2. dr.sc. Ljubivoj Cvitaš dipl.ing.				
Course objectives	students will be qualified to manage the tasks of testing and assessing the quality of electronic products; be familiar with the equipment and the ways of testing				
Learning outcomes:	1.ability to organize testing of electrotechnical products/systems in production line. Level:6,7 2.ability to prepare introduction of quality control system in an organization . Level:6,7 3.ability to relate the effect to the cause of the failure by using Isikawa diagram. Level:6,7 4.ability to plan protective measures from too high touch voltage. Level:6,7 5.ability to identify processes and activities related to the quality control. Level:6 6.ability to devise maintenance of electrotechnical products. Level:6,7 7.ability to plan general and type-examination testing of electrotechnical products. Level:6,7 8.ability to analyze requirements of ISO 9001 and ISO 14001 standards. Level:6 9.ability to manage the activities for process improvement using PDCA cycle. Level:6,7				
Methods of carrying out lectures	Ex cathedra teaching Guest lecturer Case studies Homework presentation Teaching material is delivered exclusively with the use of an LCD projector, and a synopsis of the key lessons is published in the repository of the course.				
Course content lectures	1.Introductory lecture, 2h, Learning outcomes:1,2,7,8 2.GENERAL TERMS AND DEFINITION OF QUALITY, 2h, Learning outcomes:1,2,7,8 3.LAWS AND SYSTEMS STANDARDS, 2h, Learning outcomes:1,2,7,8 4.QUALITY MANAGEMENT SYSTEM - INTRODUCTION, 2h, Learning outcomes:1,2,4,7,8 5.QUALITY MANAGEMENT SYSTEM - REQUIREMENT, 2h, Learning outcomes:1,2,4,7,8 6.Environmental Management Systems, 2h, Learning outcomes:8 7.QUALITY CONTROL, 2h, Learning outcomes:1,4,5 8.Repetition knowledge 1-6, 2h, Learning outcomes:1,2,4,8,9 9.Testing and measurement techniques 1, 2h, Learning outcomes:1,5 10.Testing and measurement techniques 2, 2h, Learning outcomes:1,5 11.GENERAL PRODUCT TESTING, 2h, Learning outcomes:1,5 12.TYPE PRODUCT TESTING, 2h, Learning outcomes:6 13.MAINTENANCE TECHNICAL SYSTEMS, 2h, Learning outcomes:6 14.Overvoltage protection, 2h, Learning outcomes:3 15.Repetition knowledge 9-15, 2h, Learning outcomes:3,6,7				
Required materials	Basic: classroom, blackboard, chalk... Overhead projector				
Exam literature	Basic literature: 1. Lj. Cvitaš, Bilješke s predavanja, 2012 2. ISO standardi serije 9000 Additional literature: 1. I. Bakija, Osiguranje kvalitete, Privredni vjesnik, Zagreb, 1991.				
Students obligations	presence in 30 lectures, 10 auditory exercises, 15 laboratory exercises and passed mini test				
Knowledge evaluation during semester	Kolokvij, teorijska pitanja#2#0#0$Domazada10#0#0$				
Knowledge evaluation after semester	Written and oral examination the written part of the examination consists of 30 questions. the oral part of the examination, if the student earned 60 % of points or more in the written part of the examination				
Student activities:	Aktivnost (Written exam) (Oral exam)			ECTS 3 1	
Remark	This course can be used for final thesis theme				
Prerequisites:	No prerequisites.				
ISVU equivalents:	22267;				
Proposal made by	dr. sc. Ljubivoj Cvitaš, senior lecturer				

Code WEB/ISVU	22873/22314	**ECTS**	5.0	**Academic year**	2018/2019
Name	Radar Systems				
Status	5th semester - Communication and computer technology (Redovni elektrotehnika) - elective course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (15+15+0+0) 90
Teachers	Lectures:1. Mirko Jukl Auditory exercises: Mirko Jukl Laboratory exercises: Mirko Jukl Laboratory exercises: Siniša Lacković struč.spec.ing.el.				
Course objectives	students will acquire basic knowledge of radar sabsystems needed for further professional development and work with radars				
Learning outcomes:	1.ability toconnect the basic features of the radar signal and the physical principles of radar techniques with prior knowledge acquired and performances radar subsystems. Level:6,7 2.ability to analyze complex radar signals using different models. Level:6 3.ability to calculate the main characteristics of radar systems using the acquired knowledge and additional resources. Level:6 4.ability to measure fundamental parameters of radar subsystems and analyze test results. Level:7 5.ability to compare mathematical models with the obtained of measurements radar signals. Level:6,7 6.ability to make conclusion on optimal parameters of radar subsystems. Level:6,7				
Methods of carrying out lectures	Ex cathedra teaching Case studies Demonstration Simulations Discussion Questions and answers Seminar, students presentation and discussion Lectures: Multi media lessons with verbal communication between the teacher and students.				
Methods of carrying out auditory exercises	Group problem solving Computer simulations Interactive problem solving Excercises on solving numerical problems in radar technology				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Laboratory exercises, computer simulations Interactive problem solving Workshop Laboratory excercises in small grups on particular radar system using regueded methods and equipment.				
Course content lectures	1.Pulse radar , 1h, Learning outcomes:1,2,3 Radar equation for monostatic, bistatic radars and the radar with active feedback, 2h, Learning outcomes:1,2,3,6 2.Detection of radar signals in noise, 1h, Learning outcomes:1,2,3 Impact of clutter land, rain and sea on target detection, 1h, Learning outcomes:1,2,3 3. Measurement of angular coordinates, coverage volume, search time, resolution and the accuracy of angular coordinate measurements, 2h, Learning outcomes:1,2,3 4. Radar transmitters, 2h, Learning outcomes:1,2,3,6 5.No classes 6.Microwave components in radar technology, first a small test, 10 minutes, 2h, Learning outcomes:1,2,3 7. Radar antenna, parabolic reflector antennas, 1h, Learning outcomes:1,2,3 Radar antennas with electronic scanning antenna - phased array antenna, 1h, Learning outcomes:1,2,3,6 Radar receivers, 1h, Learning outcomes:1,2,3 8.Radar receivers, First colloquium outside the planned teaching, 1h, Learning outcomes:1,2,3 Moving target selection system, 2h, Learning outcomes:1,2,3 Radar displays, 1h, Learning outcomes:1,2 9. Radar consoles, 1h, Learning outcomes:1,2 Digital processing of radar signals , 2h, Learning outcomes:1,2,3 10. Surveillance radars, first a small test, 10 minutes, 2h, Learning outcomes:1,2,3,5 Tracking radars, 2h, Learning outcomes:1,2,3,5 11.Radar networks , 2h, Learning outcomes:1,2,5 Methods and effects of electronic jamming of radar systems, 2h, Learning outcomes:1,2,3,6 12.No classes 13.No classes, second colloquium outside the planned teachingcolloquium 14.No classes 15.No classes				
Course content auditory	1.No classes 2.Basic principles of radiolocation, 2h, Learning outcomes:2,3 3.Basic principles of radiolocation, 2h, Learning outcomes:2,3 4. Radar system range, 2h, Learning outcomes:2,3 5.Radar system range, 2h, Learning outcomes:2,3 Computer simulated radar range calculation, 2h, Learning outcomes:2,3 6.Radar reflection area, 2h, Learning outcomes:3 7.Radar reflection area, 1h, Learning outcomes:3 8.No classes, Learning outcomes:1,2,3 9.Presentations of seminar papers., 1h, Learning outcomes:1,2,3,6 10.No classes 11.No classes 12.Presentations of seminar papers., 1h, Learning outcomes:1,2,3,6 13.No classes				

	14.No classes 15.No classes
Course content laboratory	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.Measurements of parameters of radar transmitter : LE1 Introduction to radar cabinet, measuring instruments and equipment and measurement , 1h, Learning outcomes:2,3,4 LE1 Measurement, pulse period, pulse width and power of the transmitter, simulation using the transmitter pulse generator and signal generator , 2h, Learning outcomes:2,3,4 13.LE2 Measurement of frequency and frequency spectrum of a pulsed radar transmitter, transmitter simulation using the pulse generator and signal generator , 2h, Learning outcomes:2,3,4 LE3 Measuring frequency and frequency spectrum on secondary radar transmitter , 2h, Learning outcomes:2,3,4 14.Measurements of parameters of radar receivers: LE4 Measurement sensitivity of the radar receiver , 2h, Learning outcomes:2,3,4 LE5 Measurement pass band of the receiver , 2h, Learning outcomes:2,3,4 15.LE6 Measurement of noise receivers , 2h, Learning outcomes:2,3,4 LE7 Measurements of sensitive time control characteristics (STC), 2h, Learning outcomes:2,3,4
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory Whiteboard with markers Overhead projector Maquette Classes are conducted in small groups, on a laboratory model of radar
Exam literature	Basic literature: 1. M.Jukl, Radarski sklopovi lekcije, TVZ, Zagreb 2013. 2. E. Zentner, Radiokomunikacije, Školska knjiga, Zagreb 1989. 3. D. K. Barton, Radar system analysis, 1976. 4. M. I. Skolnik, Radar Handbook, McGraw-Hill, New York, 1970. Additional literature: Internet teme vezane za radarske sklopove
Students obligations	Class attendance, max. 8 points: Lectures by 4 points, 1 point for delay or failure to appear. Condition: min 0 points Exercises by 4 points, 1 point for delay or failure to appear. Condition: min 0 points
Knowledge evaluation during semester	There are two colloquiums. Each colloquium consists of a theoretical part, max 15 points and tasks, max 10 points The theoretical part of the learning outcomes, max. 40 points Two small test by 5 points, the passage of> 2.5 points Two preliminary tests by 15 points, the passage of> 7 points A positive evaluation of the theory: Both exams by> 7 points Tasks, max 20 points Two preliminary tests by 10 points, the passage of> 6 points Each of the colloquiums will have a fix. Laboratory exercises, max. 32 points to 5 points per exercise. Evaluates the preparation, dedication and the content and layout of the report. Class attendance, max. 8 points: Total, max. 100 points. from 91 to 100 = 5 from 81 to 90 = 4 from 71 to 80 = 3 from 61 to 70 = 2 60 and under, 60 and under, not enough achievement
Knowledge evaluation after semester	The theoretical part of the learning outcomes, max. 40 points The classic exam 40 points, the passage of> 20 A positive evaluation of the theory: The classic exam> 20

	Tasks max 20 points: The classic exam 20 points, passage> 10 Positive assessment of tasks: The classic exam> 10 Classical exam the poppy max 40 points: Laboratory exercises, max 32 points Class attendance, max. 8 points: Total, max. 100 points. from 91 to 100 = 5 from 81 to 90 = 4 from 71 to 80 = 3 from 61 to 70 = 2 60 and under, 60 and under, not enough achievement	
Student activities:	Aktivnost (Classes attendance) (Constantly tested knowledge) (Practical work)	ECTS 1 2 2
Remark	This course can be used for final thesis theme	
Prerequisites:	No prerequisites.	
Proposal made by	Mr.sc. Mirko Jukl, lecturer	

Code WEB/ISVU	22872/22311	**ECTS**	4.0	**Academic year**	2018/2019
Name	Radiocommunication Techniques and Systems				
Status	5th semester - Communication and computer technology (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (15+15+0+0) 60
Teachers	Lectures:1. Prof.dr.sc. Slavica Ćosović Bajić Lectures:2. mr.sc. Krunoslav Martinčić Auditory exercises:mr.sc. Krunoslav Martinčić Laboratory exercises: Siniša Lacković struč.spec.ing.el. Laboratory exercises:mr.sc. Krunoslav Martinčić				
Course objectives	students will acquire basic knowledge and competences in the radio communication systems				
Learning outcomes:	1.ability to analyze radio communication system, definitions and divisions, definition of electromagnetic wave (EM). Level:6 2.ability to design basic radio systems. Level:6 3.ability to identify active microwave components. Level:6 4.ability to calculate the path for the EM wave propagation. Level:6 5.ability to analyze point to point and mobile systems. Level:6,7 6.ability to generalize on television, satellite and optical systems. Level:6,7				
Methods of carrying out lectures	Ex cathedra teaching Case studies Demonstration Simulations Modelling Seminar, students presentation and discussion The subject matter is taught by using a number of particular examples. Students are constantly questioned in order to motivate them to take an active part in class.Teaching equipment: board, overhead projector and LCD projector.				
Methods of carrying out auditory exercises	Computer simulations Students solve examples with the use of computers.				
Methods of carrying out laboratory exercises	Interactive problem solving Students solve examples with the use of computers				
Course content lectures	1.Classification of radio equipment and systems, 2h, Learning outcomes:1 2.Electromagnetic wave, 2h, Learning outcomes:1,3 3.Propagation of EMW, 2h, Learning outcomes:3 4.ITU frequency bands classification, 2h, Learning outcomes:1,4 5.Interferences and distortions, 2h, Learning outcomes:3,4 6.Noise, S/N ratio, 2h, Learning outcomes:3 7.Passive and active electronic componnents in radio equipment, 2h, Learning outcomes:2 8.Radio receiver and transmitter, Heterodyne Rx, 2h, Learning outcomes:1 9.Basic electronic circuits in radio equipment, 2h, Learning outcomes:6 10.Pulse and doppler radar, 2h, Learning outcomes:4 11.Radio telescope, 2h, Learning outcomes:6 12.GSM (Global System for Mobile Communications), 2h, Learning outcomes:6 13.GPS (Global Positioning System), 2h, Learning outcomes:6 14.Wireless networks, 2h, Learning outcomes:6 15.Radio relay systems, 2h, Learning outcomes:6				
Course content auditory	1.Propagation of EMW, 4h, Learning outcomes:1,2 2.Propagation of EMW, 4h, Learning outcomes:3 3.S/N ratio calculation, 2h, Learning outcomes:3,6 4.Propagation of EMW, 3h, Learning outcomes:2,3,4,5 5.Distance and velocity calculation, Radar, 2h, Learning outcomes:3,6 6.- 7.- 8.- 9.- 10.- 11.- 12.- 13.- 14.- 15.-				
Course content laboratory	1.Free space EMW propagation, 2.5h, Learning outcomes:1 2.Noise Figure and S/N Ratio, PC simulation, 2.5h, Learning outcomes:2,3 3.Connector Losses, 2.5h, Learning outcomes:4,5 4.Harmonic Mixer Products, PC simulation, 2.5h, Learning outcomes:1,5 5.Transmission Line Losses, 2.5h, Learning outcomes:1,6 6.DVB-T and FM radio broadcast, spectrum, 2.5h, Learning outcomes:4,6 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
Required materials	Special purpose laboratory General purpose computer laboratory
Exam literature	Basic literature: 1. Zentner, Antene i radiosustavi ,Graphis, Zagreb, 2001 Additional literature:
Students obligations	50% of class attendance. Additional assignments required (essay-discussion, an article review, seminar paper, etc.) for 50% to 70% of class attendance
Knowledge evaluation during semester	Redovitost pohaa#10#10#0$Mini-test#2#10#0$Kolokvij, numeri zadaci#2#10#0$Kolokvij, teorijska pitanja#2#20#0$Usmena provjera znanja#1#50#0$
Knowledge evaluation after semester	Written examination#1#50#50$ Oral examination#1#50#50$
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
Proposal made by	Doc. dr. sc. Slavica Čosović-Bajić, mr. sc. Krunoslav Martinčić, lecturer

Code WEB/ISVU	23087/85705	**ECTS**	5.0	**Academic year**	2018/2019
Name	Radiofrequency and Microwave Electronics				
Status	5th semester - Communication and computer technology (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (0+30+0+0) 90
Teachers	Lectures:1. mr.sc. Krunoslav Martinčić Laboratory exercises:mr.sc. Krunoslav Martinčić				
Course objectives	students will be introduced to topologies, operating modes and properties of electronic components and circuits used in the equipment in the field of high and microwave frequencies and high speed digital circuits				
Learning outcomes:	1.ability to analyze function of electronic module. Level:6 2.ability to detect possible problems in functionality of the system components. Level:6,7 3.ability to suggest architecture of specific electronic modules. Level:6,7 4.ability to inspect the functionality of each block. Level:6 5.ability to organize procurement of standard and specific components of the system. Level:6,7				
Methods of carrying out lectures	Ex cathedra teaching Simulations Discussion Questions and answers				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Laboratory exercises, computer simulations Traditional literature analysis Discussion, brainstorming				
Course content lectures	1.Z,Y,S-parameters, 2h, Learning outcomes:1 2.Hybrid-Pi Model (Giacoletto model), 2h, Learning outcomes:1 3.Microwave Active Componets, Diodes, 2h, Learning outcomes:1,2,5 4.Microwave Active Componets, Transistors, MIMICs, 2h, Learning outcomes:1,2,5 5.Dielectric Materials (Supstrats), 2h, Learning outcomes:1,2,5 6.Diodes in Microwave Circuits, Detectors, Multipiers, 2h, Learning outcomes:3 7.Diodes in Microwave Circuits: Mixers, 2h, Learning outcomes:3 8.Diodes in Microwave Circuits: Attenuators, Phase Shifters, 2h, Learning outcomes:3 9.Transistors in Microwave and HF Circuits: Amplifiers, 2h, Learning outcomes:3,4 10.Transistors in Microwave and HF Circuits: Frequency Multitpliers, Mixers, 2h, Learning outcomes:3,4 11.Transistors in Microwave and HF Circuits: Oscillators, 2h, Learning outcomes:3,4 12.Passive Circuits: Filters, Power Splitters, Attenuators, 2h, Learning outcomes:4,5 13.Technology Comparison: Coaxial, Microstrip, MIMIC, 2h, Learning outcomes:4,5 14.Ultra High Speed Digital Circuits, 2h, Learning outcomes:4,5 15.Measuring Instruments: VNA, Spectrum Analyzer, Power Meter, 2h, Learning outcomes:4				
Course content laboratory	1.Characteristic Impedance Simulation, PC, 5h, Learning outcomes:1 2.Frequency Characteristic of BPF, 5h, Learning outcomes:2,3,5 3.S-Parameters, Gain, Noise, PC-Simulation, 5h, Learning outcomes:2,3,5 4.Low Noise Amplifier, 5h, Learning outcomes:4,5 5.Square Law Power Detector, PC-Simulation, 5h, Learning outcomes:3,4,5 6.VNA, S-Parameter Measurements, 5h, Learning outcomes:3,5 7.- 8.- 9.- 10.- 11.- 12.- 13.- 14.- 15.-				
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory General purpose computer laboratory Whiteboard with markers Overhead projector				
Exam literature	Juraj Bartolić, Mikrovalna elektronika, Graphis, 2012 Zagreb D.M.Pozar, Microwave Engineering, J.W.S 2005. S.A. Maas, Microwave Mixers, Artech House, 1993.				
Students obligations	presence in 70% of lectures and in all laboratory exercises				
Knowledge evaluation during semester	Redovitost pohaa#5#5#100$Kolokvij, numeri zadaci#2#70#35$Kolokvij, teorijska pitanja#2#13#35$Prakti rad#6#12#50$				
Knowledge evaluation after semester	Written examination#1#30#50$ Oral examination#1#40#0$ Practical examination#1#30#0$				
Remark	This course can be used for final thesis theme				
Prerequisites:	No prerequisites.				

Proposal made by	mr.sc. Krunoslav Martinčić, lecturer

Code WEB/ISVU	23102/104554	**ECTS**	6.0	**Academic year**	2018/2019
Name	Renewable energy resources				
Status	5th semester - Electrical power engineering (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (15+15+0+0) 120
Teachers	Lectures:1. Zvonimir Meštrović mag. ing. Auditory exercises: Zvonimir Meštrović mag. ing. Laboratory exercises: Zvonimir Meštrović mag. ing.				
Course objectives	Getting expert knowledge in the renewable energy field				
Learning outcomes:	1.analyze pros and cons of renewable energy technologies. Level:6 2.calculate power, production and other important parameters of renewable energy technologies. Level:6 3.identify key obstacles to greater integration of renewable energy sources in the electric power system. Level:6 4.examime behaviour of photovoltaic modules in laboratory conditions. Level:6 5.propose appropriate type of renewable energy technology for specific application. Level:6,7 6.measure I-V curve of photovoltaic module in laboratory. Level:7 7.compare various energy storage technologies in renewable energy context. Level:6,7				
Methods of carrying out lectures	Ex cathedra teaching Demonstration Discussion Questions and answers Seminar, students presentation and discussion				
Methods of carrying out auditory exercises	Group problem solving				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment				
Course content lectures	1.Introduction and organization, 2h 2.Introduction to renewable energy systems, 2h, Learning outcomes:1,2,3 3.Energy basics in renewable energy context, 2h, Learning outcomes:1,2,3 4.Solar energy, 2h, Learning outcomes:1,2,3 5.Photovoltaic systems, 2h, Learning outcomes:1,2,3,4,6 6.Geothermal energy, 2h, Learning outcomes:1,2,3 7.Small hydropower plants, 2h, Learning outcomes:1,2,3 8.First midterm exam, 2h 9.Wind energy, 2h, Learning outcomes:1,2,3 10.Wind energy conversion systems, 2h, Learning outcomes:1,2,3 11.Biomass energy, 2h, Learning outcomes:1,2,3 12.Energy storage in RES , 2h, Learning outcomes:7 13.Fuel cell, 2h, Learning outcomes:1,2,3 14.Hybrid autonomous power supply systems, 2h, Learning outcomes:1,2,3,6 15.Final exam, 2h				
Course content auditory	1.AV1, 2h, Learning outcomes:2 2.AV2, 2h, Learning outcomes:2 3.AV3, 2h, Learning outcomes:2 4.AV4, 2h, Learning outcomes:2 5.AV5, 2h, Learning outcomes:2 6.AV6, 2h, Learning outcomes:2 7.AV7, 2h, Learning outcomes:2 8.AV8, 1h, Learning outcomes:2 9.no class 10.no class 11.no class 12.no class 13.no class 14.no class 15.no class				
Course content laboratory	1.PV measurement with various light intesity, 2h, Learning outcomes:4 2.PV measurement with various light incident angle, 2h, Learning outcomes:4 3.U-I characteristic of PV panel, 2h, Learning outcomes:4 4.Shading of pv module, 2h, Learning outcomes:4 5.Temperature impact on PV module, 2h, Learning outcomes:4 6.Charging lead acid battery with PV module, 2h, Learning outcomes:4 7.Solar thermal collector - installation, 2h, Learning outcomes:4 8.Solar thermal collector - commissioning and measurements, 1h, Learning outcomes:4 9.no class 10.no class 11.no class 12.no class 13.no class 14.no class 15.no class				

Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory Whiteboard with markers Overhead projector
Exam literature	- Lj. Majdandžić, Obnovljivi izvori energije - Energetske tehnologije koje će obilježiti 21. stoljeće, Graphis d.o.o., Zagreb - P. Kulišić, Novi izvori energije II. dio - Sunčana energija i energija vjetra, Školska knjiga, Zagreb 1991. - Gilbert M. Masters, Renewable and Efficient Electric Power Systems, John Wiley Sons Inc. - L. Freris, D. Infield, Renewable Energy in Power Systems, Wiley, 2008.
Students obligations	Final points > 50%
Knowledge evaluation during semester	Seminar papper: 10 points Laboratory: 10 points 1. midterm: 40 points 2. midterm: 40 points Total: 100 points Grades: 90 - 100 = 5 75 - 89 = 4 60 - 74 = 3 50 - 59 = 2 0 - 49 = 1
Knowledge evaluation after semester	Final exam (100 points)
Student activities:	Aktivnost ECTS (Written exam) 6
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.

Code WEB/ISVU	23086/85647	**ECTS**	6.0	**Academic year**	2018/2019
Name	Signals, theory and processing				
Status	3rd semester - Communication and computer technology (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				45+30 (15+15+0+0) 105
Teachers	Lectures:1. dr. sc. Mladen Sokele predavač Auditory exercises:dr. sc. Mladen Sokele predavač Laboratory exercises:dr. sc. Mladen Sokele predavač Laboratory exercises: Vjeran Šimunić				
Course objectives	students will master basic concepts of theory of signals, theory, methods and application of the analog signal processing in communication and information systems				
Learning outcomes:	1.ability to differentiate electrical signals identified by their basic properties. Level:6 2.ability to compare mathematical models with the obtained signal measurement results. Level:6,7 3.ability to analyze complex signals using different models. Level:6 4.ability to compose complex periodic signals. Level:6,7 5.ability to categorize, measure, analyze and model random signals. Level:6 6.ability to make conclusion on optimal parameters of A/D and D/A signal conversion. Level:6,7 7.ability to present analog modulation procedures. Level:6,7 8.Generate, measure and analyze modulated signals. . Level:6,7 9.ability to compare original, modulated and interference signals of a telecommunication channel. Level:6,7				
Methods of carrying out lectures	Ex cathedra teaching Case studies Demonstration Simulations Modelling Discussion Oral lecturing supported with a modern presentation technology. Theoretical explanation and equations derivation is followed by multimedia interactive demonstration of an information coding algorithm or real telecommunication signals analysis and processing. Discussion with students is frequent too.				
Methods of carrying out auditory exercises	Laboratory exercises on laboratory equipment Laboratory exercises, computer simulations Computer simulations Numerical problem solving on the blackboard and in notebooks is supported with a spreadsheet MS Excel and MatLab. Examples and problems for homework.				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Laboratory exercises, computer simulations Computer simulations Laboratory with 6 workplaces equipped with certain specialized measurement instruments and PC-s for data analysis and reporting. Working in the pairs of students.				
Course content lectures	1.The plan of the course content and exams, 1h Introduction to SP; Mathematics and math test, 3h, Learning outcomes:1 2.Harmonic signal definitions and examples; Time domain signal presentation (signal graph), 2h, Learning outcomes:1,2 3.Parameters of the harmonic signal; Waveform dependence on signal parameters., 2h, Learning outcomes:1,2 Frequency domain (spectrum) signal presentations. Phasor representation of harmonic signals., 2h, Learning outcomes:2 4.The synthesis of different signal presentations; Time, frequency and phasor signal presentations, examples., 2h, Learning outcomes:2 dB and dBm, examples;, 2h, Learning outcomes:2 5.Mathematics for the analysis and modeling of signal., 2h, Learning outcomes:2 6.FR, definitions, calculation, FR for harmonic signals, pulse signals and FR, examples, 2h, Learning outcomes:3,4 FR, DFT and FFT in the lab, preparing, DFT, definition and calculation algorithm, 2h, Learning outcomes:3,4 7.DFT, properties, FFT, DFT comparison with FFT, 1h, Learning outcomes:3,4 FFT, properties, FFT in the lab, results analyzing and comments, 1h, Learning outcomes:3,4 8.Random signals, definitions and properties; Stochastic signals, measurement and generating, 2h, Learning outcomes:5 Random signals, presentation and analysis, 1h, Learning outcomes:5 K1 First preliminary exam, 1h, Learning outcomes:1,2,3,4,5 9.LTI systems, 2h, Learning outcomes:9 Impulse response and transfer function, 2h, Learning outcomes:9 10.Discrete systems and signals; Examples and properties, 2h, Learning outcomes:6 A / D conversion, sampling theorem, 2h, Learning outcomes:6 11.Analog modulation, AM, DSB, SSB, Analog modulation, PM, 2h, Learning outcomes:7 Analog modulation, FM, AM and FM Comparison, 2h, Learning outcomes:7,8 12.Digital modulation, ASK, and FSK, Digital modulation, PSK and QPSK, 2h, Learning outcomes:6 Digital modulation, QAM and MTM, ASK, FSK, PSK; conclusion of the course., 2h, Learning outcomes:8 13.K1A, repeated first preliminary exam, 1h, Learning outcomes:1,2,3,4,5 14.No lectures 15.K2 Second preliminary exam, 1h, Learning outcomes:6,7,8,9 K2A, repeated second preliminary exam, 1h, Learning outcomes:6,7,8,9				
Course content auditory	1.No exercises 2.No exercises 3.The first project: generation and measurement of harmonic signals, 1h, Learning outcomes:1,2,6 4.The first project: generation and measurement of harmonic signals, 1h, Learning outcomes:1,2,6 5.Nema vjebi 6.The first project: generation and measurement of harmonic signals, 1h, Learning outcomes:1,2,6				

	7.The first project: generation and measurement of harmonic signals, 1h, Learning outcomes:4,5 8.The first project: generation and measurement of harmonic signals, 1h, Learning outcomes:4,5 9.The first project: generation and measurement of harmonic signals, 1h, Learning outcomes:4,5 Continuous assessment of first project, 1h, Learning outcomes:4,5 10.The second project: Signal transmission, 1h, Learning outcomes:9 11.The second project: Signal transmission, 1h, Learning outcomes:9 12.The second project: Signal transmission, 1h, Learning outcomes:9 Continuous assessment of second project, 1h, Learning outcomes:9 13.The third project, signal modulation, 1h, Learning outcomes:8 14.The third project, signal modulation, 1h, Learning outcomes:8 15.The third project, signal modulation, 1h, Learning outcomes:8 Continuous assessment of third project, 1h, Learning outcomes:8
Course content laboratory	1.No exercises 2.No exercises 3.The first project: generation and measurement of harmonic signals, 1h, Learning outcomes:2 4.The first project: generation and measurement of harmonic signals, 2h, Learning outcomes:2 5.No exercises 6.The first project: generation and measurement of harmonic signals, 1h, Learning outcomes:2 7.The first project: generation and measurement of harmonic signals, 2h, Learning outcomes:2,3 8.The first project: generation and measurement of harmonic signals, 1h, Learning outcomes:2,3,4,5 9.The first project: generation and measurement of harmonic signals, 1h, Learning outcomes:2,3,4,5 10.The second project: Signal transmission, 1h, Learning outcomes:9 11.The second project: Signal transmission, 2h, Learning outcomes:9 12.The second project: Signal transmission, 1h, Learning outcomes:9 13.The third project, signal modulation, 1h, Learning outcomes:8 14.The third project, signal modulation, 1h, Learning outcomes:8 15.The third project, signal modulation, 1h, Learning outcomes:8
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory General purpose computer laboratory Overhead projector Special equipment Laboratory with 10 workplaces equipped with certain specialized measurement instruments and PC-s for data analysis and reporting. Working in the pairs of students.
Exam literature	Basic literature: 1. P. Valožić: Signali, skripta TVZ, 2011. 2. P. Valožić: Signali, zbirka riješenih zadataka, TVZ, 2011. 3. P. Valožić: Signali, laboratorijske vježbe,TVZ, 2011. Additional literature: 1.P. Valožić: Interaktivna zadaćnica numeričkih primjera za vježbu, TVZ, 2011. 2.R.K. Rao Yarlagadda: Analog and Digital Signals and Systems, Springer New York Dordrecht Heidelberg London, 2010 3. Simon Haykin, Michael Moher: Communication Systems, 5e, John Wiley Sons, Inc. New York, 2009. 4. Signal Processing for Communications free online textbook by Paolo Prandoni and Martin Vetterli (2008) 5. www, ključne riječi za pretragu: Telecommunications, signal, signal analysis, signal processing, Fourier analysis, random signals, LTI systems, modulation
Students obligations	Attendance, max. 30 points: Lectures: start 20 points, -1 point for delay or failure to appear. Condition: min. 15 points Exercises start 10 points, -1 point for delay or failure to appear. Condition: min. 8 points
Knowledge evaluation during semester	The theoretical part of the learning outcomes, max. 20 points Two preliminary tests by 10 points, the passage> 5 points A positive evaluation of the theory: Both exams > 5 points Tasks (3, 5, 6, 7, 8 and 9), max 20 points Two preliminary tests by 10 points, the passage of> 6 points Each of the preliminary tests will have a second chance. Exercises, max. 30 points; 10 points per project. Evaluation: preparation, dedication and the content and layout of the report. Continuous assessment of exercises: individual report is a condition for a positive assessment exercises. Total, max. 100 points. 90 100 = 5 (A) 80 89 = 4 (B) 65 79 = 3 (C) 60 64 = 2 (D) 50 59 = 2 (E) 49 and under, under-achievement
Knowledge evaluation after	The theoretical part of the learning outcomes, max. 20 points The classic exam 20 points, passage> 10

semester	A positive evaluation of the theory: The classic exam> 10 Tasks (3, 5, 6, 7, 8 and 9), max 20 points: The classic exam 20 points, passage> 12 Positive assessment of tasks: Both preliminary exams > 5 points or classic exam> 10 Total, max. 100 points. 90 100 = 5 (A) 80 89 = 4 (B) 65 79 = 3 (C) 60 64 = 2 (D) 50 59 = 2 (E) 49 and under, under-achievement	
Student activities:	Aktivnost (Classes attendance) (Written exam) (Oral exam) (Practical work)	ECTS 1 2 1 2
Remark	This course can be used for final thesis theme	
Prerequisites:	No prerequisites.	
ISVU equivalents:	22302;	
Proposal made by	PhD. Predrag Valožić, prof.	

Code WEB/ISVU	22856/22265	**ECTS**	2.0	**Academic year**	2018/2019
Name	Social Philosophy				
Status	6th semester - Electrical power engineering (Redovni elektrotehnika) - obligatory course3rd semester - Control and computer engineering in automation (Redovni elektrotehnika) - obligatory course4th semester - Communication and computer technology (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+0 (0+0+0+0) 30
Teachers	Lectures:1. Pred. Ida Popčević prof. Lectures:2. Doc. dr. sc. Lidija Tepeš Golubić v. pred.				
Course objectives	Students will acquire basic knowledge of social philosophy				
Learning outcomes:	1.ability to comment on aspects of social philosophy. Level:6 2.ability to compare law and justice. Level:6,7 3.ability to distinguish between people and nation. Level:6 4.ability to analyze relation between humans, world and history. Level:6 5.ability to formulate social aspects of postmodernism. Level:6,7				
Methods of carrying out lectures	Ex cathedra teaching Guest lecturer Discussion Questions and answers Seminar, students presentation and discussion Homework presentation				
Course content lectures	1.Introductory lecture, 2h, Learning outcomes:1,2,3,4,5 2.Introduction to sociology, 2h, Learning outcomes:1,2,3,4,5 3.Introduction to philosophy, 2h, Learning outcomes:1,2,3,4,5 4.Culture and society, 2h, Learning outcomes:1,2,3,4,5 5.Social interaction, 2h, Learning outcomes:1,2,3,4,5 6.Family, 2h, Learning outcomes:1,2,3,4,5 7.Preliminary exam 1, 2h, Learning outcomes:1,2,3,4,5 8.Media and communication, 2h, Learning outcomes:1,2,3,4,5 9.Media and communication, 2h, Learning outcomes:1,2,3,4,5 10.Work and economic life, 2h, Learning outcomes:1,2,3,4,5 11.Education, 2h, Learning outcomes:1,2,3,4,5 12.Religion, 2h, Learning outcomes:1,2,3,4,5 13.Ideology, 2h, Learning outcomes:1,2,3,4,5 14.World in changes, 2h, Learning outcomes:1,2,3,4,5 15.Preliminary exam 2, 2h, Learning outcomes:1,2,3,4,5				
Required materials	Basic: classroom, blackboard, chalk... Overhead projector				
Exam literature	Basic literature: 1. A. Giddens: Sociologija, Zagreb, Nakladni zavod Globus, 2007. 2. M. Galović: Socijalna filozofija, Zagreb, 1996. 3. M. Haralambos: Uvod u sociologiju (bilo koje izdanje) Additional literature: 1. Blackwellova enciklopedija političke misli I-III				
Students obligations	Regular class attendance Seminar paper Written/oral exam				
Knowledge evaluation during semester	Regular class attendance Activity in class Homework 2 written exam Oral exam				
Knowledge evaluation after semester	Written exam Oral exam Seminar paper				
Student activities:	Aktivnost (Written exam) (Seminar Work)			ECTS 1 1	
Remark	This course can be used for final thesis theme				
Prerequisites:	No prerequisites.				
Proposal made by	Ida Popčević prof., 3.6.2018				

Code WEB/ISVU	22864/22288	**ECTS**	4.0	**Academic year**	2018/2019
Name	Switching Equipment				
Status	3rd semester - Electrical power engineering (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+15 (15+0+0+0) 75
Teachers	Lectures:1. Prof.dr.sc. Krešimir Meštrović Auditory exercises:Prof.dr.sc. Krešimir Meštrović				
Course objectives	students will be qualified to independently solve problems in the field of switching equipment				
Learning outcomes:	1.diferentiate. Level:6 2.analyse. Level:6 3.calculate. Level:6 4.comment. Level:6 5.formulate. Level:6,7 6.identfy. Level:6				
Methods of carrying out lectures	Ex cathedra teaching Case studies Discussion Drawings, tables and diagrams are used to ease understanding. The specific examples are also shown through photographs, design, project and test documentation. All exposed materials are analysed and discussed with students to achieve their active participation. It is necessary to have a blackboard and an LCD projector.				
Methods of carrying out auditory exercises	Group problem solving Problems are solved on the blackboard with the students participation.				
Course content lectures	1.Definitions, switching equipment types according to the rated voltage, function and circuit interruption systems, 2h, Learning outcomes:1 2.Current, voltage, mechanical and chemical stresses, 2h, Learning outcomes:2,3 3.Current, voltage, mechanical and chemical stresses, 2h, Learning outcomes:2,3 4.Basics of the electrical contact theory, 2h, Learning outcomes:3,4 5.Types and the selection of the contact materials, 2h, Learning outcomes:1,2,5 6. Basics of the DC and AC electrical arc theory , 2h, Learning outcomes:1,2,6 7.Current interruption theory, 2h, Learning outcomes:1,2 8.1. coloqium, 2h 9.Transient phenomena during switching operations, 2h, Learning outcomes:1,2,3 10.Terminal fault, short line fault, phase opposition, switching of the long lines, switching of the capacitor banks, interruption of the small inductive currents, 2h, Learning outcomes:1,2,3 11.Three-phase switching, 2h, Learning outcomes:1,2,3 12.Types and characteristics of the low, medium and high voltage switching equipment, 2h, Learning outcomes:1,6 13.Testing and standards, 2h, Learning outcomes:2,5,6 14.Sizing selection and maintenance of the switching equipment, 2h, Learning outcomes:1,4,5 15.2. coloqium, 2h				
Course content auditory	1.Illustrative calculation examples of contact resistance, 1h, Learning outcomes:3 2.Illustrative calculation examples of contact resistance, 1h, Learning outcomes:3 3.Illustrative calculation examples of contact resistance, 1h, Learning outcomes:3 4.Illustrative calculation examples of switching equipment current stresses, 1h, Learning outcomes:3 5.Illustrative calculation examples of switching equipment current stresses, 1h, Learning outcomes:3 6.Illustrative calculation examples of switching equipment voltage stresses, 1h, Learning outcomes:3 7.1. coloqium, 1h, Learning outcomes:6 8.Illustrative calculation examples of switching equipment voltage stresses, 1h, Learning outcomes:3 9.Illustrative calculation examples of switching equipment mechanical stresses, 1h, Learning outcomes:3 10.Illustrative calculation examples of switching equipment mechanical stresses, 1h, Learning outcomes:3 11.Illustrative calculation examples of current switching, 1h, Learning outcomes:3 12.Illustrative calculation examples of current switching, 1h, Learning outcomes:3 13.Illustrative calculation examples of current switching, 1h, Learning outcomes:3 14.Illustrative calculation examples of current switching, 1h, Learning outcomes:3 15.2. coloqium, 1h				
Required materials	Basic: classroom, blackboard, chalk... Whiteboard with markers Overhead projector				
Exam literature	Basic literature: 1. K. Meštrović: Sklopni aparati srednjeg i visokog napona, Udžbenik Sveučilišta u Zagrebu,Graphis, Zagreb, 2007. Additional literature: 1. B. Belin: Uvod u teoriju električnih sklopnih aparata, Školska knjiga Zagreb, 1978. 2. V. Jurjević: Električni sklopni aparati niskog napona, skripta FER, Zagreb, 1995.				
Students obligations	performed laboratory exercises				
Knowledge evaluation during semester	Two colloquia by 16 points, the passage of> 8 points. Repeated colloquium by 20 points, the passage of> 10 points.				
Knowledge evaluation after semester	The classic exam 20 points, passage> 10 points.				

Student activities:	Aktivnost (Constantly tested knowledge)	ECTS 4
Remark	This course can be used for final thesis theme	
Prerequisites:	No prerequisites.	
Proposal made by	Prof.dr.sc. Krešimir Meštrović	

Code WEB/ISVU	23132/128246	**ECTS**	2.0	**Academic year**	2018/2019
Name	Technology Entrepreneurship				
Status	6th semester - Electrical power engineering (Redovni elektrotehnika) - obligatory course5th semester - Control and computer engineering in automation (Redovni elektrotehnika) - obligatory course6th semester - Communication and computer technology (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+0 (0+0+0+0) 30
Teachers	Lectures:1. mr.sc. Sergej Lugović MBA Lectures:mag.oec Kristina Perec				
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 Venture. Level:6,7 2.Business team. Level:6,7 3.ability to recognize business opportunities . Level:6 4.ability to analyze intangible values . Level:6 5.ability to manage organizational culture. Level:6,7				
Methods of carrying out lectures	Ex cathedra teaching Guest lecturer Case studies Discussion Seminar, students presentation and discussion				
Course content lectures	1.Course introduction, 2h, Learning outcomes:1 2.The role of entrepreneurship in economy, 2h, Learning outcomes:1 3.Business opportunities, 2h, Learning outcomes:1,2 4.Vision and Business Model, 2h, Learning outcomes:1,2 5.Risk and Return, 2h, Learning outcomes:2,3 6.Marketing and Sales, 2h, Learning outcomes:1,2,3,4,5 7.Knowledge assessment, 2h, Learning outcomes:1,2,5 8.Intellectual Property, 2h, Learning outcomes:1,2,3,4 9.3 dimensions of Organization - Structure, Functions, Processes, 2h, Learning outcomes:3,4,5 10.Management of operations, 2h, Learning outcomes:1,2,3,4,5 11.Profit and Harvest, 2h, Learning outcomes:1,2,3,4,5 12.The Finacial Plan, 2h, Learning outcomes:1,2,3,4,5 13.Knowledge assessment, 2h, Learning outcomes:1,2,3,4,5 14.Business Model Canvas, 2h, Learning outcomes:1,2,3,4,5 15.Assessment and seminars, 2h, Learning outcomes:1,2,3,4,5				
Required materials	Basic: classroom, blackboard, chalk...				
Exam literature	Technology Ventures: From Idea to Enterprise, (Thomas Byers, Richard Dorf, Andrew Nelson)				
Students obligations	performed laboratory exercises				
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$Prakti rad#1#25#100$				
Remark	This course can be used for final thesis theme				
Prerequisites:	No prerequisites.				
ISVU equivalents:	22273;22297;22310;				
Proposal made by	Mr. sc. Dobrivoj Demeter (hon.)				

Code WEB/ISVU	22871/22309	**ECTS**	5.0	**Academic year**	2018/2019
Name	Telecommunication Networks				
Status	5th semester - Communication and computer technology (Redovni elektrotehnika) - elective course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+45 (15+30+0+0) 75
Teachers	Lectures:1. Mr.sc. Vladimir Lebinac dipl.ing. Lectures: Bruno Valić Auditory exercises:Mr.sc. Vladimir Lebinac dipl.ing. Laboratory exercises:Mr.sc. Vladimir Lebinac dipl.ing. Laboratory exercises: Bruno Valić				
Course objectives	students will acquire basic knowledge of communication networks necessary for further professional development and work with telecommunication networks				
Learning outcomes:	1.ability to design TCP/IP computer network for small and medium businesses and institutions. Level:6 2.ability to make professional requirements for network design, technical requirements and characteristics of particular components of telecom network. Level:6,7 3.ability to identify particular components, devices, equipment, protocols, interfaces in telecommunication networks. Level:6 4.ability to integrate components and IP, FR sub-systems of ATM networks into a functional computer network. Level:6,7 5.ability to examine functionality of particular components of telecommunication networks. Level:6 6.ability to analyze user requirements for designing telecommunication networks. Level:6,7 7.ability to sketch a telecommunication network for small and medium businesses and institutions. 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 150h 1.3.OPĆI Koristiti tehnike, vještine i suvremene alate neophodne za inženjersku praksu.: 10h in 150h 1.4.OPĆI Povezati inženjerske aktivnosti konstruiranja, proizvodnje i marketinga s potrebama korisnika proizvoda i usluge.: 10h in 150h 1.5.OPĆI Identificirati, modelirati i rješavati inženjerske probleme.: 20h in 150h 2.2.OSOBNE Odgovornost, dosljednost, točnost, ažurnost.: 5h in 150h 2.7.OSOBNE Predstavljanje informacija, ideja, problema i rješenja stručnoj i općoj publici.: 5h in 150h 2.10.OSOBNE Prilagodljivost novim tehnologijama i tehnikama kao dio procesa cjeloživotnog učenja.: 5h in 150h 2.12.OSOBNE Fleksibilnost i prilagodljivost u iznalaženju tehničkih rješenja uz neupitno poštivanje temeljnih etičkih načela, pravnih normi i pravila struke.: 5h in 150h 3.2.ELO Dimenzionirati elemente i opremu prema tehničkim zahtjevima korisnika i tehničkim normama: 5h in 150h 3.5.ELO Voditi održavanje opreme, pružati korisnicima pomoć pri korištenju i servisiranju kod proizvođača i na terenu: 10h in 150h 5.1.EE Razumjeti princip rada električnih rotacijskih strojeva, transformatora, dalekovoda i sklopnih aparata: 30h in 150h 6.2.KIRT Organizirati i nadzirati kvalitetnu izvedbu projekata za postizanje ciljanih funkcionalnosti telekomunikacijskih objekata, mreža ili sustava : 20h in 150h 6.3.KIRT Formulirati tehničke zahtjeve za intervencije na telekomunikacijskom objektu, mreži ili sustavu kako bi se funkcionalnost uskladila s normama i zahtjevima korisnika: 20h in 150h				
Methods of carrying out lectures	Ex cathedra teaching Case studies Demonstration Discussion Questions and answers Other Lectures: Multi medial projection with verbal communications teacher-students.				
Methods of carrying out auditory exercises	Group problem solving Data mining and knowledge discovery on the Web Essay writing Discussion, brainstorming				
Methods of carrying out laboratory exercises	Laboratory exercises, computer simulations Data mining and knowledge discovery on the Web Discussion, brainstorming Computer simulations Workshop				
Course content lectures	1.Entities, structure and functions of telecommunication networks. Transport and routing information, 2h, Learning outcomes:3 2.Public and private networks. Services in telecommunication networks. Channel switching and packet switching. , 2h, Learning outcomes:3 3.Physical layer , 2h, Learning outcomes:1,3,4 4.Data link layer and protocols, 2h, Learning outcomes:1,3 5.Network layer protocols., 2h, Learning outcomes:1,3 6.Transport layer protocols. Additional layers and protocols, 2h, Learning outcomes:1,3 7.ISDN and B-ISDN, 2h, Learning outcomes:2,3,5 8.LANs., 2h, Learning outcomes:2,3,5 9.Frame relay, 2h, Learning outcomes:2,3,5 10.ATM, 2h, Learning outcomes:2,3,5 11.Internet, 2h, Learning outcomes:2,3,5 12.TCP/IP, 2h, Learning outcomes:2,3,4,5 13.VoIP, 2h, Learning outcomes:2,3,4,5 14.Standards, 2h, Learning outcomes:2,5,7 15.Network management. Network security and protection, 2h, Learning outcomes:7				

Course content auditory	1.Discussion of telecommunication systems and networks, 1h, Learning outcomes:2 2.Discussion about the information and signal transmission, 1h, Learning outcomes:2 3.The characteristics of the physical layer (interfaces, signals, media), 1h, Learning outcomes:2,4 4.Analysis of DLL protocols (Ethernet, PPP), 1h, Learning outcomes:2,4 5.Colloquium, 1h, Learning outcomes:2,3,5,7 6.IP addressing IPv4, IPv6, 1h, Learning outcomes:3 7.Analysis of transport protocols (TCP, UDP), 1h, Learning outcomes:3,5 8.Discussion about ISDN, 1h, Learning outcomes:2,3,5 9.Discussion about LANs, 1h, Learning outcomes:2,3,5 10.Colloquium, 1h, Learning outcomes:2,3,5 11.Discussion about FR ATM, 1h, Learning outcomes:2,3,5 12.Discussion about Internet, 1h, Learning outcomes:2,3,5 13.Analysis of the VoIP network by components, 1h, Learning outcomes:2,3,5 14.Presentation of the most important standards in the Internet and their use, 1h, Learning outcomes:1 15.Colloquium, 1h, Learning outcomes:1,2,3
Course content laboratory	1.Introduction to the network simulator and its use, 2h, Learning outcomes:3,7 2.Simulation of the LAN (Ethernet and WiFi), 2h, Learning outcomes:3,7 3.Simulation VLAN network (Ethernet), 2h, Learning outcomes:3,7 4.Simulation WAN network (IP), 2h, Learning outcomes:3,7 5.Simulation WAN network (IP) - routing, 2h, Learning outcomes:3,7 6.Simulation integration of IP and IT networks in a WAN environment, 2h, Learning outcomes:3,7 7.Simulation home network, 2h, Learning outcomes:3,7 8.Project computer networks (LAN and WAN integration), 2h, Learning outcomes:1,2,3,4,7 9.Project computer networks (LAN and WAN integration), 2h, Learning outcomes:1,2,3,4,7 10.Project computer networks (LAN and WAN integration), 2h, Learning outcomes:1,2,3,4,5,6,7 11.Project computer networks (LAN and WAN integration), 2h, Learning outcomes:1,2,3,4,7 12.Project computer networks (LAN and WAN integration), 2h, Learning outcomes:1,2,3,4,7 13.Project computer networks (LAN and WAN integration), 2h, Learning outcomes:1,2,3,4,6 14.Project computer networks (LAN and WAN integration), 2h, Learning outcomes:1,2,3,4,6 15.Labs Colloquium, 2h, Learning outcomes:1,2,3,4,5,6,7
Required materials	Basic: classroom, blackboard, chalk... General purpose computer laboratory Overhead projector
Exam literature	Basic literature: 1. V.Lebinac, D.Valenčić, Računalne mreže, Veleučilište Velika Gorica, 2013. 2. V. Sinković, Informacijske mreže, Školska knjiga, Zagreb, 1994. Additional literature: 1. F. Halsall: Data Communications, Computer networks and Open Systems, Wesley, 1996. 2. D.B. Hoang and K.J. Pye: Computer Communication Networks Lecture Notes, 1995., School of Electronic Engineering, La Trobe University
Students obligations	Attending lectures and excercises -> Requirement: 33% attendance. Execution of 10 laboratory exercises. Condition: 8 worked exercises.
Knowledge evaluation during semester	Colloquia: Three exams at 20 points (e-tests) = 60 points. The passage of 30 points. Independent work on e-learnig system (expert discussions, seminars) = 20 points The presence of lectures and exercises = 10 points Special dedication to teaching = 10 points Total maximum of 100 points. The passage of 50 points. Rating: 90-100 points = 5 80 to 89.99 points = 4 65 to 79.99 points = 3 50 to 64.99 points = 2 less than 50 points = 1
Knowledge evaluation after semester	Written exam (E-test) = 60 points (replaces colloquia) Oral = + - 20 points
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
Proposal made by	Vladimir Lebinac, MScEE, sen.lect.

Code WEB/ISVU	24037/189951	**ECTS**	5.0	**Academic year**	2018/2019
Name	Transformers				
Status	3rd semester - Electrical power engineering (Redovni elektrotehnika) - obligatory course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (15+15+0+0) 90
Teachers	Lectures:1. Ivor Marković , mag. ing. Auditory exercises: Ivor Marković , mag. ing. Laboratory exercises: Marko Babić Laboratory exercises: Tomislav Đuran , dipl. ing. Laboratory exercises: Ivor Marković , mag. ing.				
Course objectives	students will acquire knowledge of construction, types and operating principle and operational characteristics of transformers				
Learning outcomes:	1.ability to calculate basic parameters of power transformers . Level:6 2.ability to design power transformer electrical protection. Level:6,7 3.ability to make a specification for power and instrument transformers. Level:6,7 4.ability to calculate parameters of instrument transformers. Level:6 5.ability to analyze solutions to measurements and eletrical protection design . Level:6				
Methods of carrying out lectures	Ex cathedra teaching Case studies Discussion The topics are presented by emphasizing fundamentals of transformers, typical operation conditions and main characteristics of distribution and power transformers. Practical problems are elaborated.				
Methods of carrying out auditory exercises	Laboratory exercises on laboratory equipment Group problem solving				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Laboratory: Students have to make preparation for exercises, carry out testing and finalize the test report.				
Course content lectures	1.Operating principle, equivalent scheme and phasor diagram of a transformer, 2h, Learning outcomes:1 2.Operating principle, equivalent scheme and phasor diagram of a transformer, 2h, Learning outcomes:1 3. Main parts of a transformer, 2h, Learning outcomes:1 4.Losses, no-load current, no-load test, 2h, Learning outcomes:1 5.No-load losses, no-load current, no-load test, 2h, Learning outcomes:1 6.Load losses, efficiency, voltage drop, leakage reactance, 2h, Learning outcomes:1,3 7.Load losses, efficiency, voltage drop, leakage reactance, 2h, Learning outcomes:1,3 8.Short-circuit test , 2h, Learning outcomes:1 9.Heating, cooling and life cycle, 2h, Learning outcomes:1 10.Three-phase transformer, connection circuits, angular displacement, 2h, Learning outcomes:1,3 11.Transformers parallel operation, 2h, Learning outcomes:1 12.Scaling laws. Tap changing. Voltage regulation., 2h, Learning outcomes:1,3 13.Autotransformer, 2h, Learning outcomes:1,3 14.Transients at transformer switch-on. Transients at transformer short-circuit, mechanical and thermal stresses, 2h, Learning outcomes:1 15.Transformer testing, 2h, Learning outcomes:1,2,3				
Course content auditory	Dimenzioniranje energetskih transformatora. Proračun zagrijavanja, hlađenja i životnog vijeka energetskih transformatora. Proračun paralelnog rada. Proračun gubitaka. Laboratorijske vježbe.				
Course content laboratory	1.no teaching, 2h, Learning outcomes:1 2.No-load test, 2h, Learning outcomes:1 3.No-load test, 2h, Learning outcomes:1 4.No-load test, 2h, Learning outcomes:1 5.No-load test, 2h, Learning outcomes:1 6.Short-circuit test, 2h, Learning outcomes:1 7.Short-circuit test, 2h, Learning outcomes:1 8.Short-circuit test, 2h, Learning outcomes:1 9.Short-circuit test, 2h, Learning outcomes:1 10.Dielectric tests , 2h, Learning outcomes:1 11.Dielectric tests , 2h, Learning outcomes:1 12.Dielectric tests , 2h, Learning outcomes:1 13.Dielectric tests , 2h, Learning outcomes:1 14.no teaching, 2h 15.no teaching, 2h				
Required materials	Special purpose laboratory Overhead projector				
Exam literature	a				
Students obligations	performed laboratory exercises				
Knowledge evaluation during semester	Redovitost pohaa#15#0#50$Kolokvij, numeri zadaci#2#50#50$Kolokvij, teorijska pitanja#2#50#50$				
Knowledge evaluation after semester	Paper test#1#80#50$Verbal exam#1#20#50$				

Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
ISVU equivalents:	22289;156003;
Proposal made by	lecturer Zoran Kovačević, MSEE

Code WEB/ISVU	23490/156005	**ECTS**	5.0	**Academic year**	2018/2019
Name	Transformers and Electrical Rotating Machines				
Status	4th semester - Control and computer engineering in automation (Redovni elektrotehnika) - elective course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				45+45 (30+15+0+0) 60
Teachers	Lectures:1. mr.sc. Veselko Tomljenović viši predavač Auditory exercises: Tomislav Đuran , dipl. ing. Laboratory exercises: Tomislav Đuran , dipl. ing.				
Course objectives	Students will acquire general knowledge in the field of power transformers and electromechanical conversion of energy.				
Learning outcomes:	1.ability to solve simple problems related to transformers. Level:6 2.ability to calculate the examples related to the AC rotating machines. Level:6 3.ability to find out solutions to the problems related to the DC rotating machines. Level:6,7 4.ability to inspect experimentally (by measurements) some properties of transformers and electrical rotating machines. Level:6 5.ability to analyze the given problem, calculate required values and estimate physical aspect of the obtained calculated values. Level:6				
Involvement of learning outcomes of the course in study programme:	5.1.EE Razumjeti princip rada električnih rotacijskih strojeva, transformatora, dalekovoda i sklopnih aparata: 20h in 150h				
Methods of carrying out lectures	Ex cathedra teaching Case studies Discussion Questions and answers Lectures are delivered with the help of PowerPoint presentations, physical models and an excursion to the machine production plant.				
Methods of carrying out auditory exercises	Group problem solving Discussion, brainstorming Solving of examples with active participation of students.				
Methods of carrying out laboratory exercises	Laboratory exercises on laboratory equipment Group problem solving Test of student readiness for the exercise, students carry out the exercise as a team, individual preparation of the report, test of the acquired knowledge.				
Course content lectures	1.Construction of transformers. Equivalent scheme and phasor diagram of a transformer., 3h, Learning outcomes:1 2.Transformer at no load and short circuit. Leakage reactance., 3h, Learning outcomes:1 3.Three-phase transformer, connection circuits. Autotransformer., 3h, Learning outcomes:1 4.Basics of electromechanical energy conversion. Development of a conversion machine. Magnetic circuit., 3h, Learning outcomes:2 5.Model of a DC machine. Model of an AC machine., 3h, Learning outcomes:2 6.Model of an AC machine. Current and MMF diagrams., 3h, Learning outcomes:2 7.Alternating current MMF diagrams. Torque and induced voltage., 3h, Learning outcomes:2 8.Physical processes in a synchronous machine., 3h, Learning outcomes:2 9.Synchronous machine on an infinite busbar., 3h, Learning outcomes:2 10.Construction of synchronous machines., 3h, Learning outcomes:2 11.Physical processes in an induction machine., 3h, Learning outcomes:2 12.Construction of induction machines. Starting, reversing and braking., 3h, Learning outcomes:2 13.Kolektorski stroj: fizikalna slika, izvedbe i svojstva., 3h, Learning outcomes:3 14.Small electrical machines: construction, parameters and usage., 3h, Learning outcomes:5 15.Basics of testing the electrical rotating machinery., 3h, Learning outcomes:4				
Course content auditory	1.Elements of an equivalent circuit of a transformer., 2h, Learning outcomes:1 2.Transformer at no-load and short circuit., 2h, Learning outcomes:1 3.Connection circuits of a three-phase transformer., 2h, Learning outcomes:1 4.Numerical examples of electromechanical energy conversion., 2h, Learning outcomes:5 5.Torque and induced voltage computation., 2h, Learning outcomes:2,3,5 6.Examples of computation of synchronous machines on isolated network and infinite busbar., 2h, Learning outcomes:2,5 7.Phasor diagram of a synchronous machine., 2h, Learning outcomes:2,5 8.Phasor diagram of a synchronous machine., 2h, Learning outcomes:2,5 9.Characteristic curves of induction machine., 2h, Learning outcomes:2,5 10.Characteristic curves of induction machine., 2h, Learning outcomes:2,5 11.Losses in induction machine., 2h, Learning outcomes:2,5 12.Speed regulation of induction machine., 2h, Learning outcomes:2,5 13.Speed regulation of induction machine., 2h, Learning outcomes:2,5 14.DC machine induced voltage., 2h, Learning outcomes:3,5 15.Speed and torque regulation of DC machine., 2h, Learning outcomes:3,5				
Course content laboratory	1.Transformer at no-load and short circuit., 1h, Learning outcomes:1,4 2.Transformer at no-load and short circuit., 1h, Learning outcomes:1,4 3.Transformer at no-load and short circuit., 1h, Learning outcomes:1,4 4.Transformer at no-load and short circuit., 1h, Learning outcomes:1,4 5.No-load curve of a synchronous machine., 1h, Learning outcomes:4 6.No-load curve of a synchronous machine., 1h, Learning outcomes:4 7.Short circuit curve of a synchronous motor., 1h, Learning outcomes:4 8.No-load curve of an induction motor., 1h, Learning outcomes:4				

	9.No-load curve of an induction motor., 1h, Learning outcomes:4 10.Load and output curve of a DC motor., 1h, Learning outcomes:4 11.Load and output curve of a DC motor., 1h, Learning outcomes:4 12.Regulation of DC motors., 1h, Learning outcomes:4 13.Regulation of DC motors., 1h, Learning outcomes:4 14.Introduction to specialized test laboratories for rotating electrical machinery., 1h, Learning outcomes:4 15.Introduction to specialized test laboratories for rotating electrical machinery., 1h, Learning outcomes:4
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory Overhead projector
Exam literature	Basic literature: 1. A. Dolenc, Transformatori, skripta Sveučilišta u Zgrebu, 1991. 2. R.Wolf, Osnove električnih strojeva, Školska knjiga, Zagreb, 1985. 3. I. Mandić, V. Tomljenović, M. Pužar: Sinkroni i asinkroni električni strojevi, Tehničko veleučilište u Zagrebu, 2012., http://nastava.tvz.hr/el-strojevilI/SinAsink.pdf Additional literature: 1. L.M.Piotrovskij, Električni strojevi, Tehnička knjiga, Zagreb, 1974. 2. D. Ban, V. Štivčević, I. Gašparac, Osnove elelekromehaničke pretvorbe energije i električnih strojeva, Zbirka zadataka i ispitnih pitanja, Element, Zagreb, 1996. 3. I. Mandić, M. Pužar: Transformatori i električni rotacijski strojevi Bilješke s predavanja (PowerPoint format) 4. V. Tomljenović: Transformatori i električni rotacijski strojevi, Zbirka rješenja, TVZ, Zagreb, 2012. 5. Stephen D. Umans: Fitzgerald Kingsley's Electric Machinery, Seventh Edition, McGraw-Hill International Edition, 2014
Students obligations	Regular attendance, successfully performed laboratory exercises.
Knowledge evaluation during semester	Mid-term, numerical tasks#3#50#40$Mid-term, theoretical questions#3#50#40$
Knowledge evaluation after semester	Written examination#1#50#40$Oral examination#1#50#50$
Student activities:	Aktivnost — ECTS (Constantly tested knowledge) — 1 (Written exam) — 2 (Oral exam) — 2
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.
ISVU equivalents:	28950;

Code WEB/ISVU	23644/160839	**ECTS**	5.0	**Academic year**	2018/2019
Name	Virtual Instrumentation				
Status	6th semester - Electrical power engineering (Redovni elektrotehnika) - elective course6th semester - Control and computer engineering in automation (Redovni elektrotehnika) - elective course6th semester - Communication and computer technology (Redovni elektrotehnika) - elective course				
Teaching mode	Lectures + exercises (auditory + laboratory + seminar + metodology + construction) work at home				30+30 (12+18+0+0) 90
Teachers	Lectures:1. pred. Ivan Lujo , dipl.ing. Auditory exercises:pred. Ivan Lujo , dipl.ing. Laboratory exercises: Tomislav Novak mag. ing. inf. et comm. techn.				
Course objectives	To familiarize students with the possibilities and advantages of using virtual instruments instead of the standalone variants				
Learning outcomes:	1.to analyze individual steps of analog signal digitalization process. Level:6 2.to analyze advantages and demands of computer supported data acquisition systems. Level:6 3.to predict properties for a system designed to monitor a process (provide measurements). Level:6,7 4.to combine gained programing skills into developing a modular electric measurement system. Level:6,7 5.to design a method for gathering and storing data from a measurement. Level:6,7 6.to generate programing support needed to perform measurements. Level:6,7 7.to test the functionality of an existing measurement system. Level:6				
Methods of carrying out lectures	Ex cathedra teaching Guest lecturer Case studies Demonstration Simulations Discussion Questions and answers Seminar, students presentation and discussion				
Methods of carrying out auditory 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				
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 Interactive problem solving Workshop				
Course content lectures	1.Data acquisition and digitalization, 2h, Learning outcomes:1,2 2.DAQ system properties, limitations and options, 2h, Learning outcomes:1,2,3 3.Complex data structures, 2h, Learning outcomes:3,4,5 4.Measurement and data display/analysis program modularity , 2h, Learning outcomes:3,4,5,6,7 5.Managing data files and hardware resources, 2h, Learning outcomes:4,5,6 6.Sequential and non sequential programing, 2h, Learning outcomes:4,5,6,7 7.Variables and dataflow, 2h, Learning outcomes:4,5,6,7 8.Parallel process sinchronization, priorities, 2h, Learning outcomes:4,5,6,7 9.Program arhitecture implementation, 2h, Learning outcomes:4,5,6,7 10.Running the user interface (events), 2h, Learning outcomes:3,4,5,6,7 11.Input and output files, 2h, Learning outcomes:3,4,5,6,7 12.Big data structuring, search and analyze data, 2h, Learning outcomes:3,4,5,6,7 13.Upgrading existing virtual instruments, 2h, Learning outcomes:3,4,5,6,7 14.Delivering a final product (user application), 2h, Learning outcomes:3,4,5,6,7 15.Presentation of student projects in front of their colleagues, 2h				
Course content auditory	1.Computer assisted data acquisition, data structuring, in program manipulation, 3h, Learning outcomes:1,2,4,5,6 2.Designing a user interface, user ergonomy, code documentation, 3h, Learning outcomes:2,3,4,6 3.Integrating LabVIEW applications with mobile device control interface, remote access, 3h, Learning outcomes:2,3,4,6 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.Different DAQ systems, low level managment, 2h, Learning outcomes:1,2,3 2.Complex data structures, 2h, Learning outcomes:2,3,4,5,6 3.Producing a modular control program (MasteVI/SubVI), 2h, Learning outcomes:2,3,4,5,6 4.Implementing variables, measurement usage of variables, 2h, Learning outcomes:2,3,4,5,6 5.Picture acquisition and processing, 2h, Learning outcomes:2,3,4,5,6 6.Controling the user interface using an event structure, 2h, Learning outcomes:2,3,4,5,6 7.Strucutring files for measurement data storage, 2h, Learning outcomes:2,3,4,5,6 8.Big data and diadem, 2h, Learning outcomes:2,3,4,5,6 9.Finishing program production, delivering a functional application, 2h, Learning outcomes:2,3,4,5,6,7 10.No classes, 2h 11.No classes, 2h 12.No classes, 2h 13.No classes, 2h 14.No classes, 2h 15.No classes, 2h
Required materials	Basic: classroom, blackboard, chalk... Special purpose laboratory Special purpose computer laboratory Whiteboard with markers Overhead projector Video equipment Maquette
Exam literature	LabVIEW Core1 LabVIEW Core2 prezentacije s predavanja LabVIEW for Engineers, Ronald W. Larsen, 2011 Effective LabVIEW programming, Thomas Bress, 2013
Students obligations	Completing all laboratory exercises with at least 50% total success
Knowledge evaluation during semester	Producing a student project in phases
Knowledge evaluation after semester	Presentation of the completed students project
Student activities:	Aktivnost — ECTS (Classes attendance) — 1 (Research) — 2 (Practical work) — 2
Remark	This course can be used for final thesis theme
Prerequisites:	No prerequisites.