

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet: Elektrotehnika in elektronika
Course title: Electrical engineering and electronics

Študijski program Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Inženiring in vozila Engineering and vehicles		prvi first	prvi first

Vrsta predmeta / Course type obvezni/obligatory

Univerzitetna koda predmeta / University course code: VS_11006

Predavanja Lectures	Seminar Seminar	Sem. vaje Tutorial	Lab. vaje Laboratory work	Teren. vaje Field work	Samost. delo Individ. work	ECTS
45	-	15	15	-	75	5

Nosilec predmeta / Lecturer: doc. dr. /Asst. Prof. Damir Vrančič

Jeziki / Languages: Slovenski/slovenian
Predavanja / Lectures: slovenski/slovenian
Vaje / Tutorial: slovenski/slovenian

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

Prerequisites:

- vpis v prvi letnik študija	- inscription in the first year of study
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Vsebina:

Content (Syllabus outline):

<p><u>Predavanja:</u></p> <ul style="list-style-type: none"> Električna napetost in električni potencial. Kondenzator, kapacitivnost. Superkondenzatorji in njihova uporaba. Ohmov zakon, ohmska upornost, Kirchoffova zakona, Joulov zakon. Prevajanje električnega toka v tekočinah, baterije in akumulatorji. Magnetno polje premega tokovodnika in magnetno polje dolge ravne tuljave. Magnetilna krivulja in histerezna zanka. Sila na tokovodnik v magnetnem polju. Induktivnost. Faradayev zakon elektromagnetne indukcije. Izmenični tokokrogi. Enofazni in polifazni sistemi. Električni stroji in transformatorji. Električne meritve. Polprevodniške diode, poljski in bipolarni tranzistorji. Močnostna elektronika. Integrirana elektronska vezja. Osnovna analogna in digitalna vezja. Družine logičnih 	<p><u>Lectures</u></p> <ul style="list-style-type: none"> Voltage and electric potential. Capacitor and capacitance. Supercapacitors with applications. Ohm's law, ohmic resistance, Kirchoff laws, Joule law. Conduction of electric current in fluids, batteries and accumulators. Magnetic field of line conductors and magnetic field of the long straight coil. Magnetization curve and hysteresis loop. Computation of magnetic circuits. Force on the conductor in magnetic field. Inductance. Faraday law of electromagnetic induction. Alternate current circuits. Single phase and polyphase systems. Electric machines and transformers. Electric measurements. Semiconductor diodes, bipolar and field effect transistors. Power electronics. Integrated electronic circuits. Basic analog and digital circuits. Logic circuit families. Microprocessors and programable logic circuits.
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<p>vezij. Mikroprocesorji in programirana logična vezja.</p> <ul style="list-style-type: none"> – Simulacije delovanja elektronskih vezij <p><u>Seminarske in laboratorijske vaje:</u></p> <ul style="list-style-type: none"> – Poglobitev teoretičnih znanj na seminarskih vajah z reševanjem praktičnih primerov stroke. – Pridobitev praktičnih izkušenj na laboratorijskih vajah iz merilne tehnike in spoznavanja delovanja elektronskih vezij. 	<ul style="list-style-type: none"> – Simulations of electronic circuits <p><u>Tutorials and Lab works</u></p> <ul style="list-style-type: none"> – Tutorials are intended to deepen the theoretical knowledge with solving problems, which appear in practice – Lab works are intended for acquirement of practical experiences in measurement techniques and understanding the principles of working of electronic circuits
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Temeljni literatura in viri / Readings:

<ul style="list-style-type: none"> – R. Pušenjak: Elektrotehnika za strojnike, Univerza v Mariboru, Fakulteta za strojništvo, 2009. ISBN 86-435-0019-4. [COBISS.SI-ID 13946390] – R. Pušenjak: Elektrooprema in pogoni : zbrano gradivo. Maribor: Fakulteta za strojništvo, 1997. ISBN 86-435-0205-7. [COBISS.SI-ID 42226945] – R. Pušenjak, M. Kastrevc: Zbirka nalog z rešitvami iz elektrotehnike in elektronike za strojnike in tekstilce, Univerza v Mariboru, Fakulteta za strojništvo, 2009. ISBN 86-435-0204-9. [COBISS.SI-ID 13946134] – R. Pušenjak: Elektrotehnika in elektronika: elektronska učna gradiva 1.-5.del, Fakulteta za industrijski inženiring Novo mesto, 2015. – D. Vrančič: Elektronika 1 : zbirka nalog. Nova Gorica: Univerza v Novi Gorici, Fakulteta za aplikativno naravoslovje, 2007. 1 el. optični disk (CD-ROM). [COBISS.SI-ID 21491751] – D. Vrančič: Elektronika 1 : zbirka prosojnic s komentarji. Nova Gorica: Univerza v Novi Gorici, Fakulteta za aplikativno naravoslovje, 2007. 1 el. optični disk (CD-ROM). [COBISS.SI-ID 21491495] – E-gradiva predmeta / E-Course material <p>Priporočena literatura/ Recommended readings:</p> <ul style="list-style-type: none"> – J. J. Cathey, S. A. Nasar: Basic Electrical Engineering. Second Edition. Schaum's Outline Series, 1996. – G. Rizzoni, J. Kearns: Principles and Applications of Electrical Engineering. McGraw-Hill Education; 6th edition, 2015.

Cilji in kompetence:

Objectives and competences:

<p>Cilji</p> <ul style="list-style-type: none"> – pridobiti osnovna znanja elektrotehnike in elektronike, praktičnih znanj merilne tehnike, uporabe električnih strojev in naprav, poznavanja elektronskih komponent ter delovanja in uporabe elektronskih vezij v tehniki. <p>Kompetence</p> <ul style="list-style-type: none"> – sposobnost razčlenitve problemov elektrotehniške stroke, izvedbe njihove analize in sinteze, – sposobnost uporabe elektrotehniških zakonov, obvladanja standardnih metod in postopkov v analizi in pri projektiranju 	<p>Objectives</p> <ul style="list-style-type: none"> – acquirement of basic knowledge in electrical engineering and electronics as well as to gain the practical knowledges in measurement techniques, the use of electrical machines and devices, the knowledge of electronic components and circuits, their working principles and their use in engineering. <p>Competences</p> <ul style="list-style-type: none"> – ability to analyze problems appearing in the electrical engineering and electronics as well as to perform the synthesis of electronic circuits
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<p>električnih in elektronskih naprav in sistemov,</p> <ul style="list-style-type: none"> - sposobnost uporabe pridobljenega teoretičnega znanja v praksi, - sposobnost matematičnega opisovanja problemov elektrotehniške stroke in uporabe računalniških orodij v elektrotehniko in elektroniki - usposobljenost za eksperimentalno delo in samostojno izvajanje elektriških meritev v stroki, - sposobnost uporabe informacijskih in komunikacijskih tehnologij na elektrotehniškem strokovnem področju. 	<ul style="list-style-type: none"> - ability to apply electric laws, mastering of standard methods in the analysis and design of electrical devices and electronic systems - ability to use the gained theoretical knowledge in practice - ability to mathematically describe electrical engineering problems and to use computational tools in electrical engineering and electronics - ability for performing experimental work and electrical measurements in the field - ability to use information and communication technologies in the electrical engineering.
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Predvideni študijski rezultati:

Intended learning outcomes:

<p><i>Študent/študentka:</i></p> <ul style="list-style-type: none"> - pozna in razume osnovne zakonitosti elektrotehnike in elektronike, - pozna osnovne elektrotehniške elemente in naprave in njihove lastnosti - pozna elektronske elemente in gradnike ter module elektronskih sistemov - pozna postopke za analizo električnih in elektronskih vezij - pozna postopke projektiranja električnih in elektronskih vezij - pozna elektriške merilne instrumente in je sposoben izvajati elektriške meritve - pozna sodobna računalniška programska orodja za analizo in sintezo električnih in elektronskih vezij - zna načrtovati, uporabljati standarde in strokovno literaturo - pozna varnostne predpise in standarde za zaščito ljudi in naprav pri delu z električnim tokom. 	<p><i>Student:</i></p> <ul style="list-style-type: none"> - understands and conquers basic laws of electrical engineering and electronics - knows the basic elements and devices of electrical engineering and knows their properties - knows the electronic elements and modules of electronic systems - knows methods of analysis of electrical and electronic circuits, respectively - knows the procedures of synthesis of electrical and electronic circuits, respectively - knows the electrical measurement instruments and is qualified to perform electrical measurements - is acquainted with the use of computational tools in the analysis and synthesis of electrical and electronic circuits, respectively - knows safety regulations and standards for protection of the personal and of the equipment by work with electric current.
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Metode poučevanja in učenja:

Learning and teaching methods:

<ul style="list-style-type: none"> - predavanja z aktivno udeležbo študentov, ki vsebujejo razprave, diskusije, odgovore na vprašanja in reševanje nalog ob pomoči sodobnih pedagoških pripomočkov, - seminarske vaje za poglobljanje teoretičnih osnov in reševanje praktičnih problemov stroke - individualno in skupinsko delo s študenti v obliki konzultacij, - laboratorijske vaje v ustrezno opremljenem laboratoriju <p>Predmet je oblikovan na kombinirani način študija, ki vključuje aktivnosti preko elektronskega (on-line) okolja: te aktivnosti so sestavljene iz samostojnih in skupinskih aktivnosti z uporabo učnega okolja Moodle in drugih elektronskih vsebin. Praviloma</p>	<ul style="list-style-type: none"> - lectures with active attendance of students, which incorporate discussions, answers on the questions and solving of exercises with application of the contemporary pedagogical aids - tutorials with deepening of theoretical knowledge and solving problems, which appear in practice - individual and collective work in the form of consultations, - lab works, which are performed in a suitable equipped laboratory. <p>The course is designed as blended learning that includes online activities: Online activities consist of independent and group activities using the LMS Moodle and other electronic or online content. Activities usually include discussions</p>
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vključujejo diskusije v forumih, spletne strani, ogled posnetih predavanj in vaj, preverjanje znanja, odgovori na vprašanja, iskanje po spletu (bazah) itd.	in forums, websites, viewing of recorded lectures and tutorials, assessments, answering questions, searching the web (databases), etc.
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Načini ocenjevanja:
Delež/Weight (%)
Assessment:

<p>Pogoj za pristop k pisnemu izpitu so opravljene laboratorijske vaje.</p> <p>– pisni izpit</p> <p>Ocenjevalna lestvica je skladna z ECTS in Pravilnikom o preverjanju in ocenjevanju znanja FINI NM.</p>	100%	<p>The prerequisite for accession to the written exam is successfully performed lab works.</p> <p>– written exam</p> <p>Evaluation scale in accordance with ECTS and the Rules on the Evaluation and Assessment of Knowledge FINI NM.</p>
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Reference nosilca / Lecturer's references:

<ul style="list-style-type: none"> – VRANČIĆ, Damir. Rapid prototyping environment for control systems implementation. V: STRMČNIK, Stanko (ur.), JURIČIĆ, Đani (ur.). Case studies in control : putting theory to work, (Advances in industrial control, ISSN 1430-9491). London [etc.]: Springer. 2013, str. 289-326. [COBISS.SI-ID 26893095] – KOS, Tomaž, ROJAC, Tadej, PETROVČIĆ, Janko, VRANČIĆ, Damir. Control system for automated drift compensation of the stand-alone charge amplifier used for low-frequency measurement. AIP advances, ISSN 2158-3226, 2019, vol. 9, no. 3, str. 035133-1-035133 -9, doi: 10.1063/1.5064631. [COBISS.SI-ID 32207143] – GLAVAN, Miha, GRADIŠAR, Dejan, HUMAR, Iztok, VRANČIĆ, Damir. Refrigeration control algorithm for managing supermarket's overall peak power demand. IEEE transactions on control systems technology, ISSN 1063-6536. [Print ed.], [in press] 2018, 8 str., doi: 10.1109/TCST.2018.2853739. [COBISS.SI-ID 31573799] – VREČKO, Darko, NERAT, Marko, VRANČIĆ, Damir, DOLANC, Gregor, DOLENC, Boštjan, PREGELJ, Boštjan, MEYER, Fabien, AU, Siu Fai, MAKKUS, Robert, JURIČIĆ, Đani. Feedforward-feedback control of a solid oxide fuel cell power system. International journal of hydrogen energy, ISSN 0360-3199. [Print ed.], 2018, vol. 43, no. 12, str. 6352-6363, doi: 10.1016/j.ijhydene.2018.01.203. [COBISS.SI-ID 31267367] – NERAT, Marko, VRANČIĆ, Damir. A novel fast-filtering method for rotational speed of the bldc motor drive applied to valve actuator. IEEE/ASME transactions on mechatronics, ISSN 1083-4435, 2016, vol. 21, no. 3, str. 1479-1486, doi: 10.1109/TMECH.2015.2505321. [COBISS.SI-ID 29087783] – RAUBAR, Edvin, VRANČIĆ, Damir. Anti-sway system for ship-to-shore cranes. Strojniški vestnik, ISSN 0039-2480, maj 2012, vol. 58, no. 5, str. 338-344, SI 66, ilustr., doi: 10.5545/sv-jme.2010.127. [COBISS.SI-ID 25941543] – SVETEK, Aleš, VRANČIĆ, Damir, KRANČAN, Samo, ŠAPONIA, Zoran. Adaptivni inteligentni ventil. Ventil : revija za fluidno tehniko in avtomatizacijo, ISSN 1318-7279. [Tiskana izd.], jun. 2010, letn. 16, št. 3, str. 252-258, ilustr. [COBISS.SI-ID 11465243] – VRANČIĆ, Damir, STRMČNIK, Stanko, KOCIJAN, Juš, MOURA OLIVEIRA, Paulo. Improving disturbance rejection of PID controllers by means of the magnitude optimum method. ISA transactions, ISSN 0019-0578, 2010, vol. 49, no. 1, str. 47-56. [COBISS.SI-ID 23246887] – VRANČIĆ, Damir, LIESLEHTO, J., STRMČNIK, Stanko. Designing a MIMO PI controller using the multiple integration approach. Process control and quality, ISSN 0924-3089, 2001, vol. 11, str. 455-468. [COBISS.SI-ID 16517159], [JCR, WoS do 3. 12. 2017: št. citatov (TC): 1, čistih citatov (CI): 0] – VRANČIĆ, Damir. Magnitude optimum techniques for PID controllers. V: PANDA, Rames C. (ur.). Introduction to PID colntrollers : theory, tuning and application to frontiers areas. Rijeka: InTech. cop. 2012, str. 75-102. [COBISS.SI-ID 25734695]

- GLAVAN, Miha, VRANČIČ, Damir, GRADIŠAR, Dejan, HUMAR, Iztok, UMBERGER, Mark, LUMBAR, Satja. Sistem in postopek za upravljanje električne moči hladilnega sistema z reguliranjem temperature izdelkov in temperature zraka : patent SI 25557 A. Ljubljana: Urad RS za intelektualno lastnino, 31 maj 2019. [COBISS.SI-ID 31051815]
- PETROVČIČ, Janko, VRANČIČ, Damir. Reducing oscillations in a control system : patent EP 2356522 B1. München: European Patent Office, 6. jan. 2016. [COBISS.SI-ID 22631463] patentna družina: Patentna prijava WO 2010/054657A1, 2010-05-20
- VRANČIČ, Damir, NERAT, Marko, KRANČAN, Samo. Postopek hitrega filtriranja signala rotacijske hitrosti s samodejnim izločanjem periodičnega odmika : patent SI 24580 (A), 2015-06-30. Ljubljana: Urad RS za intelektualno lastnino, 30. jun. 2015. [COBISS.SI-ID 27428391] patentna družina: Patentna prijava P-201300435, 2013-12-19

