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| **UČNI NAČRT PREDMETA / COURSE SYLLABUS** | | | | | | | | | | | | | | | | | |
| **Predmet:** | | | Osnove mehatronike | | | | | | | | | | | | | | |
| **Course title:** | | | Fundamentals of Mechatronics | | | | | | | | | | | | | | |
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| **Študijski program in stopnja**  **Study programme and level** | | | | | **Študijska smer**  **Study field** | | | | | | | | **Letnik**  **Academic year** | | **Semester**  **Semester** | | |
| Univerzitetni študijski program prve stopnje Elektrotehnika | | | | | **Vse smeri, Energetika in mehatronika** | | | | | | | | 3. | | zimski | | |
| 1st cycle academic study programme Electrical Engineering | | | | | **All fields, Power Engineering and Mechatronics** | | | | | | | | **3.** | | **winter** | | |
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| **Vrsta predmeta / Course type** | | | | | | | | | | | | Obvezni in izbirni- strokovni/compulsory and elective professional | | | | | |
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| **Univerzitetna koda predmeta / University course code:** | | | | | | | | | | | | 64128 | | | | | |
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| **Predavanja**  **Lectures** | **Seminar**  **Seminar** | | | **Vaje**  **Tutorial** | | | **Klinične vaje**  **work** | | | | **Druge oblike študija** | | | **Samost. delo**  **Individ. work** | |  | **ECTS** |
| **30** |  | | | **30** | | |  | | | |  | | | **65** | |  | **5** |
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| **Nosilec predmeta / Lecturer:** | | | | | Vanja Ambrožič | | | | | | | | | | | | |
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| **Jeziki /**  **Languages:** | | **Predavanja / Lectures:** | | | | slovenski/ Slovenian | | | | | | | | | | | |
| **Vaje / Tutorial:** | | | | slovenski/ Slovenian | | | | | | | | | | | |
| **Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:** | | | | | | | | |  | **Prerequisits:** | | | | | | | |
| Vpis v letnik. | | | | | | | | |  | Enrolment in the year of the course. | | | | | | | |
| **Vsebina:** | | | | | | | |  | | **Content (Syllabus outline):** | | | | | | | |
| Definicija mehatronike in zasnova sinergične povezave elektronike, mehanike in rečunalniške tehnike. Primeri mehatronskih sistemov. Enačbe gibanja in modeliranje mehanskih sistemov. Mehanske komponente v mehatroniki. Ojačevalniki. Senzorji. Aktuatorji: elektromehanični, pnevmatski in hidravlični sistemi. Principi in snovanje vodenja mehatronskih sistemov. Krmilni sistemi v mehatroniki (programirljivi krmilniki, mikroprocesorski sistemi) in osnove delovanja: arhitektura, programska podpora, komunikacija. Analiza delovanja konkretnega mehatronskega sistema. | | | | | | | |  | | Definition of mechatronics and concept of synergetic interaction between electronics, mechanics and computer engineerinf. Examples of mechatronic systems. Motion equations and modelling of mechanical systems. Mechanical components in mechatronics. Amplifiers. Sensors. Actuators: electromechanic, pneumatic and hydraulic systems. Principles, planning and management of mechatronic systems. Control systems in mechatronics (programmable logic controllers, microprocessor systems) and fundamentals of their operation: architecture, program support, communication. Analysis of operation of particular mechatronic system. | | | | | | | |

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| **Temeljni literatura in viri / Readings:** | | | | | |
| 1. Godfrey C. Onwubolu: Mechatronics - Principles and applications, Elsevier, 2005 2. Rolf Isermann: Mechatronics systems - Fundamentals, Springer, 2005 3. Control and Mechatronics, edited by B. M. Wilamowski and J. D. Irwin, CRC Press, 2011 4. Vanja Ambrožič, David Nedeljković: Uvod u programirljive krmilne sisteme, Fakulteta za elektrotehniko, Ljubljana, 2011 | | | | | |
| **Cilji in kompetence:** | |  | | **Objectives and competences:** | |
| Pridobitev osnovnih inženirskih znanj o električnih in neelektričnih gradnikih mehatronskih sistemov ter o sintezi mehanskih, električnih in računalniških sistemov v zaključeno celoto. | |  | | Acquirement of basic engineering knowledge on electric and non-electric components of mechatronic systems, as well as on the synthesis of mechanical, electrical and computer systems into the final product. | |
| **Predvideni študijski rezultati:** | | |  | **Intended learning outcomes:** | |
| **Znanje in razumevanje:**  Študent bo utrdil dosežena znanja iz mikroračunalniške tehnike, električnih strojev in merilne tehnike s stališča uporabnosti ter hkrati pridobil osnovni vpogled v področja, s katerimi se bo podrobneje seznanil v nadaljnjem šolanju. Na ta način bo osvojil splošna znanja in kulturo, ki je potrebna pri sodobnih multidisciplinarnih pristopih k reševanju inženirskih problemov.  **Uporaba:**  Študent razume in pozna delovanje komponenta mehatronskih sistemov, s poudarkom na procesnih krmilnikih, kjer bo samostojno programiral rešitve posameznih problemov.  **Refleksija:**  Študent bo kritično ocenjeval potrebe pri snovanju mehatronskih sistemov, zmožnosti krmilnega algoritma ter spoznal varnostne zahteve pri snovanju le-tega.  **Prenosljive spretnosti:**  Študent se bo pri izvajanju laboratorijskih vaj navajal na sistematični pristop in ustrezno dokumentiranje. Zaveda se kompleksnosti in multidisciplinarnosti mehatronskega sistema. Znanja, pridobljena pri tem predmetu, bo študent lahko nadgradil in uporabil za realizacijo najzahtevnejših mehatronskih sistemov. | | |  | **Knowledge and understanding:**  The student will consolidate his/her knowledge in microprocessor technics, electrical machines and measurement techniques from a point of view of applicability and thus will gain an insight into areas of studying at higher grades. With it, he/she will get general knowledge and technical culture needed for modern multidisciplinary approaches to solving engineering problems.  **Application:**  The student will get acquainted with components of mechatronic systems, with an emphasis on programmable controllers, where he/she will learn how to program solutions to various problems.  **Reflection:**  The student will critically evaluate requirements for mechatronic systems, possibilities of a control algorithm and will get acquainted with safety demands when programming it.  **Transferable skills:**  Through laboratory work, the student will accustom a systematic approach, appropriate documentation of ideas. He is awared of complexity and multidisciplinary nature of mechatronic systems. The student will be able to upgrade the knowledge, obtained within this course, for the realization of the most demanding mechatronic systems. | |
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| **Metode poučevanja in učenja:** | | |  | **Learning and teaching methods:** | |
| Predavanja (30 ur) ter projekti na vajah (30 ur). | | |  | Lectures (30 hours) and group projects/exercises (30 hours). Foreign students: project/seminar. | |
| **Načini ocenjevanja:** | Delež (v %) /  Weight (in %) | | | | **Assessment:** |
| Za pristop k izpitu mora kandidat imeti uspešno opravljene laboratorijske vaje in izdelano poročilo.  Ocene od 1 do vključno 5 so negativne, ocene od vključno 6 do 10 so pozitivne.  Pozitivna ocena laboratorijskih vaj je pogoj za pristop k pisnem izpitu, pozitivna ocena pisnega izpita pa pogoj za opravljanje ustnega izpita.  Laboratorijske vaje:  pisni in ustni izpit: | 50%  50% | | | | The candidate can take the exam only after accomplished laboratory work and written report on his/her laboratory work.  Negative grades: from 1 to 5, positive grades: from 6 to 10.  Positive evaluation of laboratory exercises is a prerequisite for the written exam; its positive evaluation is a prerequisite for the oral exam.  Laboratory exercises:  Written and oral exam: |
| **Reference nosilca / Lecturer's references:** | | | | | |
| 1. DROBNIČ, Klemen, NEMEC, Mitja, FIŠER, Rastko, AMBROŽIČ, Vanja. Simplified detection of broken rotor bars in induction motors controlled in field reference frame. Control engineering practice, ISSN 0967-0661. [Print ed.], Aug. 2012, vol. 20, no. 8, str. 761-769, ilustr. [COBISS.SI-ID 9208660]  2. MAKUC, Danilo, DROBNIČ, Klemen, AMBROŽIČ, Vanja, MILJAVEC, Damijan, FIŠER, Rastko, NEMEC, Mitja. Parameters estimation of induction motor with faulty rotor. Przeglęad Elektrotechniczny, ISSN 0033-2097, 2012, rok 88, 1a, str. 41-46, ilustr. [COBISS.SI-ID 8870228]  3. NEMEC, Mitja, DROBNIČ, Klemen, NEDELJKOVIĆ, David, FIŠER, Rastko, AMBROŽIČ, Vanja. Detection of broken bars in induction motor through the analysis of supply voltage modulation. IEEE transactions on industrial electronics, ISSN 0278-0046. [Print ed.], Aug. 2010, vol. 57, no. 8, str. 2879-2888, ilustr. [COBISS.SI-ID 7819604]  4. DROBNIČ, Klemen, NEMEC, Mitja, NEDELJKOVIĆ, David, AMBROŽIČ, Vanja. Predictive direct control applied to AC drives and active power filter. IEEE transactions on industrial electronics, ISSN 0278-0046. [Print ed.], Jun. 2009, vol. 56, no. 6, str. 1884-1893, ilustr. [COBISS.SI-ID 7112020]  5. NEMEC, Mitja, DROBNIČ, Klemen, NEDELJKOVIĆ, David, AMBROŽIČ, Vanja. Direct current control of a synchronous machine in field coordinates. IEEE transactions on industrial electronics, ISSN 0278-0046. [Print ed.], Oct. 2009, vol. 56, no. 10, str. 4052-4061, ilustr. [COBISS.SI-ID 7253844], | | | | | |