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| **UČNI NAČRT PREDMETA / COURSE SYLLABUS** | | | | | | | | | | | | | | | | |
| **Predmet:** | | | Robotski in merilni vgrajeni sistemi | | | | | | | | | | | | | |
| **Course title:** | | | Robotic and Measurement Embedded Systems | | | | | | | | | | | | | |
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| **Študijski program in stopnja**  **Study programme and level** | | | | | **Študijska smer**  **Study field** | | | | | | | **Letnik**  **Academic year** | | **Semester**  **Semester** | | |
| Podiplomski magistrski študijski program druge stopnje Elektrotehnika | | | | | Robotika | | | | | | | 1 | | 1 | | |
| 2nd cycle masters study programme in Electrical Engineering | | | | | Robotics | | | | | | | 1 | | 1 | | |
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| **Vrsta predmeta / Course type** | | | | | | | | | | | Obvezni – strokovni/ Compulsory professional | | | | | |
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| **Univerzitetna koda predmeta / University course code:** | | | | | | | | | | | 64234 | | | | | |
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| **Predavanja**  **Lectures** | **Seminar**  **Seminar** | | | **Vaje**  **Tutorial** | | | **Klinične vaje**  **work** | | | **Druge oblike študija** | | | **Samost. delo**  **Individ. work** | |  | **ECTS** |
| **30** |  | | | **45** | | |  | | |  | | | **75** | |  | **6** |
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| **Nosilec predmeta / Lecturer:** | | | | | Roman Kamnik, Domen Hudoklin | | | | | | | | | | | |
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| **Jeziki /**  **Languages:** | | **Predavanja / Lectures:** | | | | **Slovenščina / Slovene** | | | | | | | | | | |
| **Vaje / Tutorial:** | | | | **Slovenščina / Slovene** | | | | | | | | | | |
| **Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:** | | | | | | | |  | **Prerequisits:** | | | | | | | |
| Vpis v letnik. | | | | | | | |  | Enrolment in the year of the course. | | | | | | | |

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| **Vsebina:** |  | **Content (Syllabus outline):** |
| * Uvod v razvoj sistemov v realnem času in kompleksnih vgrajenih sistemov * obravnava prekinitev * načrtovanje programske opreme vgrajenih sistemov * sinhronizacija programske in strojne opreme * delovanje v realnem času * arhitektura kompleksnega vgrajenega sistema * hiter razvoj časovno kritičnih vgrajenih sistemov * razvoj visoko determinističnih procesov na osnovi FPGA   Teoretična snov je podprta s praktičnimi primeri na strojni opremi zasnovani na ARM, xPC, Compact-RIO arthitekturi. |  | * Introduction into real time and complex embedded systems * dealing with interrupts * embedded systems' software design * software and hardware synchronization * real-time operation * complex embedded system architecture * rapid development of time critical embedded systems * development of highly deterministic processes based on FPGA   Theoretical part is supported by practical examples using hardware based on ARM, and xPC, Compact-RIO architectures. |

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| **Temeljni literatura in viri / Readings:** | | | | | |
| 1. Tammy Noergaard, Embeded Systems Arhitecture - A Comprehensive Guide for Engineers and Programmers, Elsevier, 2005, ISBN 0-7506-7792-9. 2. Jonathan W. Valvano, Embeded Microcomputer Systems – Real Time Interfacing, Brooks/Cole, 2000, ISBN 0-534-36642-2. 3. A. Burns, A. Welling, Real-Time Systems and Programing Languages, Addison-Wesley, 1997, ISBN-13: 978-0201403657. 4. National Instruments, NI LabVIEW for CompactRIO Developer’s Guide, <http://www.ni.com>, 2016 | | | | | |
| **Cilji in kompetence:** | |  | | **Objectives and competences:** | |
| Predmet je namenjen analizi, uporabi in razvoju kompleksnih vgrajenih sistemov na področjih robotike in merilnih sistemov. Slušatelja seznanja s procesi, organizacijo in arhitekturo vgrajenih sistemov ter njihovo medsebojno interakcijo. Glavni poudarek je na različnih aspektih arhitekture programov, njihovem načrtovanju pri vgrajenih sistemih, komunikaciji s periferijo in specifičnega vmesnika za uporabnika. | |  | | The course is focused at analysis, design and application of complex embedded systems in the field of robotics and measurement systems. Auditor is acquainted with the processes, organization and architecture of embedded systems and with their interaction. Focus is given to different aspects of software architecture and design for embedded systems, to communication of the hardware periphery and specific user interfaces. | |
| **Predvideni študijski rezultati:** | | |  | **Intended learning outcomes:** | |
| Znanje in razumevanje:  Sposobnost izvedbe idejne zasnove, analize, ter načrtovanja strojne in programske opreme vgrajenih naprav.  Sposobnost izdelave večopravilne aplikacije v realnem času z različnimi vhodi in izhodi vključno z uporabniškim vmesnikom.  Praktično poznavanje načel delovanja sistemov v realnem času, razvrščanja in zagotavljanja zanesljivosti v splošnem tehničnem okolju. | | |  | Knowledge and understanding:  Capability of realization an analysis and design of embedded system hardware and software  Capability of design a multitasking real-time application using different inputs and outputs including user interface.  Practical knowledge of guidelines in real-time systems operation, arbitration and assurance of reliability in general technical environment. | |
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| **Metode poučevanja in učenja:** | | |  | **Learning and teaching methods:** | |
| Predavanja, navodila za laboratorijske vaje, individualno laboratorijsko delo. Praktične vaje v obliki, ki omogoča nadaljnje poglobljeno individualno delo. Za specifična področja so vabljeni predavatelji specialisti na konkretnem področju. | | |  | Lectures, preparations for lab practices, individual lab work. Practices in a way, which enables further in-depth individual work.  For specific fields, lectures are given by invited lecturers, which are specialist in their field of work. | |
| **Načini ocenjevanja:** | Delež (v %) /  Weight (in %) | | | | **Assessment:** |
| Način: laboratorijske vaje, pisni izpit, ustni izpit.  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 izpitu.  Prispevki k oceni:   * laboratorijske vaje * pisni izpit * ustni izpit | 50 %  45 %  5 % | | | | Type: laboratory exercises, written exam, oral exam.  Negative grades: from 1 to 5, positive grades: from 6 to 10.  Positive evaluation of laboratory exercises is a prerequisite for the exam.  Contributions to the final grade:   * laboratory exercises * written exam * oral examination |
| **Reference nosilca / Lecturer's references:** | | | | | |
| 1. AMBROŽIČ, Luka, GORŠIČ, Maja, GEEROMS, Joost, FLYNN, Louis, LOVA, Molino, KAMNIK, Roman, MUNIH, Marko, VITIELLO, Nicola. Cyberlegs : a user-oriented robotic transfemoral prosthesis with whole-body awareness control. IEEE robotics & automation magazine, Dec. 2014, vol. 21, no. 4, str. 82-93. 2. ŠLAJPAH, Sebastjan, KAMNIK, Roman, MUNIH, Marko. Kinematics based sensory fusion for wearable motion assessment in human walking. Computer methods and programs in biomedicine, Sep. 2014, vol. 116, no. 2, str. 131-144. 3. GORŠIČ, Maja, KAMNIK, Roman, AMBROŽIČ, Luka, VITIELLO, Nicola, LEFEBER, Dirk, PASQUINI, Guido, MUNIH, Marko. Online phase detection using wearable sensors for walking with a robotic prosthesis. Sensors, Feb. 2014, vol. 14, no. 2, str. 2776-2794. 4. BEGUŠ, Samo, BEGEŠ, Gaber, DRNOVŠEK, Janko, HUDOKLIN, Domen. A novel NIR laser-based sensor for measuring the surface moisture in polymers. Sensors and actuators. A, Physical, Jan. 2015, vol. 221, str. 53-59. 5. KENTVED, Anders Bonde, HEINONEN, Martti, HUDOKLIN, Domen. Practical study of psychrometer calibrations. International journal of thermophysics, vol. 33, no. 8/9, Sep. 2012 str. 1408-1421. | | | | | |