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| **UČNI NAČRT PREDMETA / COURSE SYLLABUS** | | | | | | | | | | | | | | | | | |
| **Predmet:** | | | Modul B: Programiranje vgrajenih sistemov | | | | | | | | | | | | | | |
| **Course title:** | | | Module B: Programming Embedded Systems | | | | | | | | | | | | | | |
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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** | | | | | | | | **3.** | | **letni** | | |
| 1st cycle academic study programme Electrical Engineering | | | | | **all fields** | | | | | | | | **3.** | | **summer** | | |
|  | | | | | | | | | | | | | | | | | |
| **Vrsta predmeta / Course type** | | | | | | | | | | | | Izbirni, splošni / elective, general | | | | | |
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| **Univerzitetna koda predmeta / University course code:** | | | | | | | | | | | | 64137 | | | | | |
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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:** | | | | | Tadej Tuma | | | | | | | | | | | | |
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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):** | | | | | | | |
| Predmet se navezuje na »64136 Načrtovanje vgrajenih sistemov«  1) Osnovni pojmi in problemi: Večopravilnost, izvajanje programa v realnem času, problem hkratnega dostopa do skupnih enot, problem usklajene komunikacije.  2) Načelo časovnega rezinjenja in posledice: Oblikovanje časovnih rezin, ocena zmogljivosti, praktična izvedba na nivoju zbirnika oziroma na nivoju programskega jezika C, večskladovne podatovne strukture, prekinitve, izračun odzivnega časa sistema.  3) Sinhronizacija in arbitraža: Cevovodne podatkovne strukture, medpomnilniki, semaforji, programski atomi. | | | | | | | |  | | This course relies on course »64136 Designing Embedded Systems«  1) Basic paradigm: Multitasking, real time execution, multiple access to resources, inter task communication.  2) The time slicing principle and consequences: time slicing, schedulability analysis, implementation on assembly language and C language level, multiple stack data structures, interrupts, response time analysis.  3) Synchronization and arbitrage: pipeline structures, buffering data, semaphores, program atoms. | | | | | | | |

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| **Temeljni literatura in viri / Readings:** | | | | | |
| 1. PUHAN, Janez, TUMA, Tadej. Uvod v mikrokrmilniške sisteme : zgradba in programiranje. 2. dopolnjena izd. Ljubljana: Založba FE in FRI, cop. 2011. III, 206 str.  2. LPC213x User Manual, Philips, 2012, PDF datoteka.  3. Spletna stran prototipnega razvojnega sistema <http://www.s-arm.si>, 2016. | | | | | |
| **Cilji in kompetence:** | |  | | **Objectives and competences:** | |
| Razumeti problematiko programiranja vgrajenih sistemov: zahteve po sočasnem izvajanju večih opravil in hkrati zahteve po izvajanju v realnem času. Osvojiti osnovne tehnike programiranja časovnih rezin in reševati tipične sinhronizacijske probleme. Pridobiti praktične izkušnje pri delu v laboratoriju na lastni strojni opremi, ki je bila izdelana v okviru vezanega predmeta 64136. | |  | | Understanding the specifics of programming embedded systems: demands of concurrent execution of several tasks in real time. Fundamental time slicing techniques of programming and solving of typical synchronization problems. Developing practical skills during project oriented laboratory work in combination with course 64136. | |
| **Predvideni študijski rezultati:** | | |  | **Intended learning outcomes:** | |
| Sposobnost izdelave preprostega operacijskega sistema za večopravilno delo v realnem času. | | |  | Capability of designing a simple real time multitasking operating system. | |
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| **Metode poučevanja in učenja:** | | |  | **Learning and teaching methods:** | |
| Predavanja, vodena diskusija, laboratorijsko skupinsko delo, samostojno seminarsko delo. | | |  | Lectures, discussion groups, laboratory project work (group and individual). | |
| **Načini ocenjevanja:** | Delež (v %) /  Weight (in %) | | | | **Assessment:** |
| Način: laboratorijske vaje, 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 ustnem izpitu.  Prispevki k oceni:  laboratorijske vaje  ustni izpit | 50%  50% | | | | Type: laboratory exercises, oral exam. Negative grades: from 1 to 5, positive grades: from 6 to 10. Positive evaluation of laboratory exercises is a prerequisite for the oral exam.  Contributions to final grade:  laboratory exercises  oral examination |
| **Reference nosilca / Lecturer's references:** | | | | | |
| 1. TUMA, Tadej, BÜRMEN, Arpad. Circuit simulation with SPICE OPUS : theory and practice, (Modeling and simulation in science, engineering and technology). Boston; Basel; Berlin: Birkhäuser, cop. 2009.  2. PUHAN, Janez, BÜRMEN, Arpad, TUMA, Tadej, FAJFAR, Iztok. Teaching assembly and C language concurrently. Int. J. Electr. Eng. Educ., Apr. 2010, vol. 47, no. 2, str. 120-131,  3. OLENŠEK, Jernej, BÜRMEN, Arpad, PUHAN, Janez, TUMA, Tadej. Automated analog electronic circuits sizing. V: QING, Anyong. Differential evolution : fundamentals and applications in electrical engineering. [Piscataway]: IEEE Press; Singapore: J. Wiley & Sons, cop. 2009, str. [353]-367.  4. BÜRMEN, Arpad, OLENŠEK, Jernej, TUMA, Tadej. Mesh adaptive direct search with second directional derivative-based Hessian update. Computational optimization and applications, ISSN 0926-6003. [Print ed.], Dec. 2015, vol. 62, no. 3, str. 693-715.  5. KORINŠEK, Gašper, DERLINK, Maja, VIRANT-DOBERLET, Meta, TUMA, Tadej. An autonomous system of detecting and attracting leafhopper males using species- and sex-specific substrate borne vibrational signals. Computers and electronics in agriculture, ISSN 0168-1699. [Print ed.], 2016, vol. 123, str. 29-39. | | | | | |