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| **UČNI NAČRT PREDMETA / COURSE SYLLABUS** | | | | | | | | | | | | | | | | | |
| **Predmet:** | | | Seminar iz robotike in merjenj | | | | | | | | | | | | | | |
| **Course title:** | | | Seminar: Robotics and Measurements | | | | | | | | | | | | | | |
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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 | | | | | | | | 2 | | 1 | | |
| 2nd cycle masters study programme in Electrical Engineering | | | | | Robotics | | | | | | | | 2 | | 1 | | |
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| **Vrsta predmeta / Course type** | | | | | | | | | | | | Obvezni-strokovni / Compulsory professional | | | | | |
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| **Univerzitetna koda predmeta / University course code:** | | | | | | | | | | | | 64297 | | | | | |
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| **Predavanja**  **Lectures** | **Seminar**  **Seminar** | | | **Vaje**  **Tutorial** | | | **Klinične vaje**  **work** | | | | **Druge oblike študija** | | | **Samost. delo**  **Individ. work** | |  | **ECTS** |
| 15 | - | | | 60 | | | - | | | | - | | | 75 | |  | 6 |
|  | | | | | | | | | | | | | | | | | |
| **Nosilec predmeta / Lecturer:** | | | | | Marko Munih, Janko Drnovšek | | | | | | | | | | | | |
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| **Jeziki /**  **Languages:** | | **Predavanja / Lectures:** | | | | slovenski / Slovenian  angleški / English | | | | | | | | | | | |
| **Vaje / Tutorial:** | | | | slovenski / Slovenian  angleški / English | | | | | | | | | | | |
| **Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:** | | | | | | | | |  | **Prerequisits:** | | | | | | | |
| Vpis v letnik predmeta | | | | | | | | |  | Enrolment in the year of the course | | | | | | | |
| **Vsebina:** | | | | | | | |  | | **Content (Syllabus outline):** | | | | | | | |
| Študent uporabi znanja pridobljena pri predmetih s področja robotike ter pri predmetih s področja merjenj pri reševanju praktične projektne naloge. Za študente z drugih fakultet se seminar prilagodi. Vsak študent opravlja projektno nalogo samostojno. Naloge so izbrane v skladu z interesi slovenskih podjetij, ki bodisi uvajajo robotske celice ali pa so uporabniki robotov. Merilna problematika je vezana na tekoče raziskovalne projekte, sodelovanje pri industrijskih projektih, tudi tehniško zakonodajo, varnost in kakovost. Študent izvaja projektno nalogo v laboratorijih fakultete, raziskovalnega inštituta ali samega podjetja. Dodeljen mu je delovni mentor in vključen je v tim strokovnjakov iz raziskovalnega in industrijskega okolja. | | | | | | | |  | | Student uses knowledge gained in robotic and in measurement courses. For students from other Faculties the seminar is adequately adapted. Each student is working on the project on its own. The problems are selected according to the interest fields of Slovenian industry, who either introduce the robotic cells or are major robot users. The measurement cases are linked to the current research projects, cooperation in industrial projects, also technical legislation, safety and quality. Student can work on project in faculty labs, research institute or the company itself. Assigned is a working supervisor, included is in the expert team from research and industrial environment. | | | | | | | |

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| **Temeljni literatura in viri / Readings:** | | | | | |
| 1. Članki iz robotskih in merilnih revij:    1. IEEE Transactions on Robotics, International Journal of Robotic Research in drugi.    2. Zborniki konferenc: ICRA, IROS in drugi.    3. Učbeniki, študijsko gradivo in relevantna strokovna literatura s področja merjenj, robotike, tehniški standardi, EU in slovenska zakonodaja. 2. Articles from robotic and measurement journals:    1. IEEE Transactions on Robotics, International Journal of Robotic Research and others    2. Conference proceedings: ICRA, IROS and others.    3. Textbooks, study material and relevant expert literature in the fields of measurement, robotics, technical standards, EU and Slovenian legislation. | | | | | |
| **Cilji in kompetence:** | |  | | **Objectives and competences:** | |
| Cilj seminarja je vključiti študenta v razvojno in raziskovalno delo na področju uvajanja robotov v industrijsko prakso ter v področja merjenj v najširšem smislu. Spodbuja se reševanje problemov, ki niso nujno vezani na področje elektrotehnike, vendar zahtevajo elektrotehniška znanja. Poudarek bo dan tudi sodelovanju z drugimi področji dela na FE. Študent pridobi sposobnost uporabe robotskih znanj v praksi, veščine identifikacije merilne problematike v okviru kompleksnejših procesov, poišče ustrezne rešitve, ter analizira končne izvedbe. Obvlada raziskovalne metode in postopke. Pridobi avtonomnost v strokovnem delu. Privadi se delu v skupini. Razvije komunikacijske sposobnosti. | |  | | The goal is to include student into development and research work in the fields of robot introduction into industry and into fields of measurement in general. Encouraged is problem solving, which is not necessarily linked to the field of electrical engineering, but does require knowledge in electrical engineering. Emphasis will be given to cooperation with other fields of activities at FE. Student is gaining the ability to use robotic knowledge in practice, routine in identification of measurement problems within more complex processes, is searching for suitable solutions and analyzing the final solution. Mastered are research methods and procedures. Gained is autonomy in expert work. Accustomed is to group work. Developed are communication skills. | |
| **Predvideni študijski rezultati:** | | |  | **Intended learning outcomes:** | |
| Znanje in razumevanje:  Sposobnost povezovanja znanja z različnih področij elektrotehnike, robotike, merjenj. | | |  | Knowledge and understanding:  Ability to combine knowledge from various fields of electrical engineering, robotics and measurement. | |
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| **Metode poučevanja in učenja:** | | |  | **Learning and teaching methods:** | |
| Študentu je na začetku semestra dodeljena samostojna projektna naloga. Prav tako mu je dodeljen delovni mentor iz vrst učiteljev, asistentov, raziskovalcev in razvojnikov na fakulteti, raziskovalnem inštitutu ali podjetju. Na začetku se detajlno seznani s problematiko, naredi časovni plan, določi mejnike, planira nepredvidljive dogodke ter predlaga kazalce ovrednotenja končnih rezultatov. Med semestrom študent dvakrat poroča o opravljenem delu, prvič ustno in drugič pisno. Na koncu semestra predstavi rezultate svojega dela na način, ki je uveljavljen na strokovnih konferencah (članek v zborniku, javna predstavitev, izbira najboljših projektov). | | |  | Individual project is assigned to the student at the beginning of semester. The supervisor is selected from the pool of university professors, assistants, researchers and developers at the faculty, research institute or company. Introductory, the problem is presented in detail.  Then the time plan is defined, milestones are specified, planned are possible unpredicted events, and proposed are measures of final result evaluation. During the semester the student is reporting twice about the work done, first orally and second in writing. At the end of semester the results are presented in accordance to the practice established for the conferences (publication in proceeding, public presentation, and selection of the best projects). | |
| **Načini ocenjevanja:** | Delež (v %) /  Weight (in %) | | | | **Assessment:** |
| Pisno poročilo (članek), ustna javna predstavitev.  Skupina učiteljev in asistentov ocenjuje pisno poročilo (članek) in javno predstavitev na način, ki je uveljavljen na strokovnih konferencah (peer review).  Ocenjevalna lestvica: od 6 do 10 pozitivno, od 1 do 5 negativno.  Prispevek k oceni:  Projektna naloga  Predstavitev | 70%  30% | | | | Written report (article), oral public presentation.  The group of teachers and assistants is evaluating the written report (article) and public presentation in a way that is established for conferences (peer review)  Scoring: from 6 to 10 positive, from 1 to 5 negative.  Contributions to final grade:  Project  Presentation |
| **Reference nosilca / Lecturer's references:** | | | | | |
| 1. REJC, Jure, KOVAČIČ, Franc, TRPIN, Anton, TURK, Igor, ŠTRUS, Miran, REJC, Danilo, OBID, Pavle, MUNIH, Marko. The mechanical assembly dimensional measurements with the automated visual inspection system. Expert syst. appl., 2011, vol. 38, no. 8, str. 10665-10675. 2. ČINKELJ, Justin, KAMNIK, Roman, ČEPON, Peter, MIHELJ, Matjaž, MUNIH, Marko. Closed-loop control of hydraulic telescopic handler. Autom. constr., 2010, vol. 19, no. 7, str. 954-963. 3. MIKLAVEC, Andraž, PUŠNIK, Igor, BATAGELJ, Valentin, DRNOVŠEK, Janko. A large aperture blackbody bath for calibration of thermal imagers. Meas. sci. technol., 2013, vol. 2, no. 24, str. 1-8. 4. BOJKOVSKI, Jovan, VELIKI, Tomislav, ZVIZDIĆ, Davor, DRNOVŠEK, Janko. Bilateral comparison of mercury and gallium fixed-point cells using standard platinum resistance thermometer. Int. j. thermophys., 2011, vol. 32, no. 7/8, str. 1544-1552. 5. HITI, Miha, BOJKOVSKI, Jovan, BATAGELJ, Valentin, DRNOVŠEK, Janko. Multizone furnace for analysis of fixed-point realizations in the range from 1,000°C to 1,700°C. Int. j. thermophys., Feb. 2008, vol. 29, no. 1, str. 241-24. | | | | | |