|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **UČNI NAČRT PREDMETA / COURSE SYLLABUS** | | | | | | | | | | | | | | | | | |
| **Predmet:** | | | Načrtovanje elektro-mehanskih izdelkov | | | | | | | | | | | | | | |
| **Course title:** | | | Design of electro-mechanical products | | | | | | | | | | | | | | |
|  | | | | |  | | | | | | | |  | |  | | |
| **Študijski program in stopnja**  **Study programme and level** | | | | | **Študijska smer**  **Study field** | | | | | | | | **Letnik**  **Academic year** | | **Semester**  **Semester** | | |
| Podiplomski magistrski študijski program druge stopnje Elektrotehnika | | | | | Vse smeri | | | | | | | | 1 | | 1 | | |
| 2nd cycle masters study programme in Electrical Engineering | | | | | All study fields | | | | | | | | 1 | | 1 | | |
|  | | | | | | | | | | | | | | | | | |
| **Vrsta predmeta / Course type** | | | | | | | | | | | | Izbirni-splošni /elective general | | | | | |
|  | | | | | | | | | | | |  | | | | | |
| **Univerzitetna koda predmeta / University course code:** | | | | | | | | | | | | 64251 | | | | | |
|  | | | | | | | | | | | | | | | | | |
| **Predavanja**  **Lectures** | **Seminar**  **Seminar** | | | **Vaje**  **Tutorial** | | | **Klinične vaje**  **work** | | | | **Druge oblike študija** | | | **Samost. delo**  **Individ. work** | |  | **ECTS** |
| **45** |  | | | **30** | | |  | | | |  | | | **75** | |  | **6** |
|  | | | | | | | | | | | | | | | | | |
| **Nosilec predmeta / Lecturer:** | | | | | Roman Kamnik, Matjaž Mihelj | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | |
| **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. | | | | | | | |
| **Vsebina:** | | | | | | | |  | | **Content (Syllabus outline):** | | | | | | | |
| Povezava električnih in mehanskih sklopov, načrtovanje, prototipiranje, integracija mehanskih in električnih sistemov; Tehniška dokumentacija: prostorske projekcije, prerezi, šrafure, kotiranje, označevanje površin, tolerance, spoji, ležaji; Načrtovanje mehanizmov: koncept CAD načrtovanja mehanskih sklopov (potek), načrtovanje posameznega elementa, integracija posameznih elementov – definicija prostostnih stopenj med elementi, omejitve gibanja prostostnih stopenj; Simulacije mehanizmov: parametriranje, statika, kinematika, dinamika in animacija; Izdelava prototipov mehanskih sistemov: sestavna risba, rezkanje, struženje, 3d printanje; Načrtovanje električnih vezij 1: komponente, funkcionalne, termične, vibracijske, EMI/EMC zahteve, ozemljevanja, analogni/digitalni signali, načrtovanje sheme, elementa, oblike tiskanine, razporeditve na vezju, povezovanje PCB; Izdelava prototipov električnih sistemov: rezkanje, jedkanje; Tehnike: montaže elementov, tehnologije spajkanja, varnost, ESD zaščita; Integracija mehanskih in električnih sklopov: montaža, električne povezave. | | | | | | | |  | | Integration of electrical and mechanical components/systems, computer aided design, prototyping; Mechanism design: computer aided design of mechanical components, designing individual parts, assembly of parts - definition of degrees of freedom between elements, restrictions of motion; Simulations of mechanisms: parameterization, statics, kinematics, dynamics and animation; Prototyping of mechanical systems: drawings, milling, grinding, 3D printing; Design of electric circuits: components, functional, thermal, vibration, EMI/EMC requirements, grounding, analog/digital signals, design of schematics and elements, positioning of elements on the circuit, PCB routing; Prototyping of electrical systems: milling and etching techniques, soldering technique, safety, ESD protection; Integration of mechanical and electrical assemblies: installation, electrical connections. | | | | | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Temeljni literatura in viri / Readings:** | | | | | |
| 1. J.D. Bethune: Engineering Design Graphics with Autodesk® Inventor®2011, 2011 2. W. Younis: Up and Running with Autodesk Inventor Simulation 2011, 2010 3. C. Waguespack, T. Tremblay: Mastering Autodesk Inventor and Autodesk Inventor LT 2011, Sybex 2010 4. P. Wilson, The Circuit Designer's Companion, Newnes, 2012. 5. C. Coombs, Printed Circuits Handbook, McGraw-Hill Professional, 2007. | | | | | |
| **Cilji in kompetence:** | |  | | **Objectives and competences:** | |
| Predmet seznanja študenta z računalniško podprtim načrtovanjem objektov, konstrukcijsko in prostorsko sintezo ter animacijo in načrtovanjem električnih vezij. Cilj je tudi obvladovanje zahtevnejših programskih sklopov, uporabljenih na konkretni primerih. | |  | | The course aims at teachnig students computer aided design of electrical and mechanical systems. It introduces students with software packages used in computer aided design. | |
| **Predvideni študijski rezultati:** | | |  | **Intended learning outcomes:** | |
| Znanje in razumevanje:  Znanje pojmov načrtovalskih tehnik, zmožnost samostojnega praktičnega dela.  Reševanje konkretnih problemov, samostojno koncipiranje rešitev, iskanje povezav s prakso.  Občutek za načtovanje mehanskih in električnih sistemov v praksi.  Spretnosti zasnove, reševanja in izvedbe problemov, kritična analiza, sinteza, poznavanje računalniških orodij. | | |  | Knowledge and understanding:  Knowledge of computer aided design techniques in electrical and mechanical engineering.  Finding solutions to practical problems related to design of electrical and mechanical (electro-mechanical) components.  Practical feeling for design of mechanical and electrical products.  Skills required for problem solving, design, and implementation of solutions, critical analysis and synthesis, use of software tools. | |
|  | | |  |  | |
| **Metode poučevanja in učenja:** | | |  | **Learning and teaching methods:** | |
| Multimedijsko podprta predavanja, projektno delo, laboratorijske vaje, simulacije. Kombinacija skupnega in individulanega dela ob vodstvu pedagogov, izmenjava mnenj. | | |  | Multimedia supported lectures, project based work, lab courses. Combination of individual and team work under the supervision of mentors. | |
| **Načini ocenjevanja:** | Delež (v %) /  Weight (in %) | | | | **Assessment:** |
| Način: laboratorijske vaje – samostojna izvedba projekta, 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 - projekt * ustni izpit | 70%  30% | | | | Type: laboratory exercises – individual project, 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 final grade:   * laboratory exercises - project * oral exam |
| **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. AMBROŽ, Miha, PREBIL, Ivan, KAMNIK, Roman, MUNIH, Marko. System for interactive scientific driving simulation with haptic information. Advances in engineering software, Mar. 2012, vol. 45, iss. 1, str. 239-251. 4. MIHELJ, Matjaž, PODOBNIK, Janez. Haptics for virtual reality and teleoperation, Springer, 2012. 5. BAJD, Tadej, MIHELJ, Matjaž, MUNIH, Marko. Introduction to robotics, Springer, 2013. | | | | | |