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| **UČNI NAČRT PREDMETA / COURSE SYLLABUS** | | | | | | | | | | | | | | | | | |
| **Predmet:** | | | Razdelilna in industrijska omrežja | | | | | | | | | | | | | | |
| **Course title:** | | | Power Distribution and Industrial 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 | | | | | Elektroenergetika | | | | | | | | 1 | | 2 | | |
| 2nd cycle masters study programme in Electrical Engineering | | | | | Electrical Power Engineering | | | | | | | | 1 | | 2 | | |
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| **Vrsta predmeta / Course type** | | | | | | | | | | | | Obvezni-strokovni / Compulsory professional | | | | | |
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| **Univerzitetna koda predmeta / University course code:** | | | | | | | | | | | | 64220 | | | | | |
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| **Predavanja**  **Lectures** | **Seminar**  **Seminar** | | | **Vaje**  **Tutorial** | | | **Klinične vaje**  **work** | | | | **Druge oblike študija** | | | **Samost. delo**  **Individ. work** | |  | **ECTS** |
| **45** |  | | | **30** | | |  | | | |  | | | **75** | |  | **6** |
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| **Nosilec predmeta / Lecturer:** | | | | | Grega Bizjak | | | | | | | | | | | | |
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| **Jeziki /**  **Languages:** | | **Predavanja / Lectures:** | | | | **slovensko / Slovene** | | | | | | | | | | | |
| **Vaje / Tutorial:** | | | | **slovensko / 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):** | | | | | | | |
| Osnove razdelilnih in industrijskih omrežij: osnovne konfiguracije, napetostni nivoji, razdelilne in transformatorske postaje, podeželska in mestna omrežja, specifičnosti industrijskih omrežij, praksa v Evropi.  Električna oprema v razdelilnih in industrijskih omrežjih: transformatorji, vezave transformatorjev in ozemljevanje, nadzemna in kabelska omrežja, industrijska omrežja, stikalni aparati in stikalne celice, kompenzacijske naprave, bremena in njihove karakteristike, izbor ustrezne opreme.  Obratovanje razdelilnih in industrijskih omrežij: področni normativi, padci napetosti in regulacija napetosti, vrste in pogostost okvar, vzroki okvar, vpliv parametrov omrežja in načina ozemljevanja na razmere ob okvari, osnovni načini zaščite, zaščita pred udarom strele, specifičnosti industrijskih omrežij.  Varnost za uporabnike: osnovni načini obratovanja in ozemljevanja razdelilnih in industrijskih omrežij s stališča varnosti, ozemljevanje virov, ozemljevanje bremen, izvedba ozemljitev, potencialne nevarnosti za uporabnike, napetost dotika in napetost koraka, zaščitni ukrepi.  Distribuirana generacija: vključevanje distribuiranih in industrijskih virov v razdelilna in industrijska omrežja, vplivi distribuiranih virov na razmere v omrežju, otočno obratovanje z distribuiranimi in industrijskimi viri, zagotavljanje stabilnosti otočno obratujočega omrežja, prilagajanje obremenitve z izklopom bremen, možni problemi povezani z distribuiranimi viri in otočnim obratovanjem. | | | | | | | |  | | Basics of distribution and industrial networks: basic configurations, voltage levels, distributions and transformation stations, rural and metropolitan area networks, practice in Europe.  Electrical equipment in distribution and industrial networks: transformers, transformer connections and earthing, overhead and cable networks, industrial networks, switching devices, switchgear, compensation devices, loads and their characteristics, selection of proper equipment.  Operation of distribution and industrial networks: local standards, voltage drop, voltage regulation, faults in distribution and industrial networks, influence of network parameters and earthing on fault currents, protection devices, lightning protection, and specificities of industrial networks.  Safety for users: basic operating and grounding modes of distribution and industrial networks from the safety viewpoint, earthing of transformers, generators and loads, safety risks for users, touch and step voltage, protection measures.  Distributed generation: integration of distributed and industrial generation units into distribution and industrial networks, influence of distributed generation on network behaviour, island operation with distributed and industrial generation units, stability and reliability of networks in island operation, using load shading, problems connected with networks in island operation mode. | | | | | | | |

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| **Temeljni literatura in viri / Readings:** | | | | | |
| 1. Turan Gönen: Electric Power Distribution System Engineering (Second Eddition), Boca Raton : CRC Press, 2008; 2. Sallam, O. P. Malik: Electric Distribution Systems, IEEE Press, 2011; 3. Tom A. Short, Electric Power Distribution Handbook, Boca Raton [etc.] : CRC Press, cop. 2004; 4. [C. Bayliss, B. Hardy: Transmission and Distribution Electric Engineering](http://cobiss4.izum.si/scripts/cobiss?command=DISPLAY&base=99999&rid=1540132319&fmt=11), Oxford ; Burlington, MA : Newnes, 2007 | | | | | |
| **Cilji in kompetence:** | |  | | **Objectives and competences:** | |
| Pri predmetu študent spozna osnovne značilnostmi razdelilnih in industrijskih omrežij. Na predavanjih se bo seznanil z lastnostmi električne opreme, ki se uporablja v teh omrežjih in se naučil izbrati ustrezno opremo glede na parametre omrežja in bremen. Na vajah pa se bo naučil izvesti ustrezne izračune razmer v omrežju. Študent se bo zavedal tudi nevarnosti za uporabnike teh omrežij ter bo poznal ustrezne zaščitne ukrepe. | |  | | The student will learn about the basic characteristics of distribution and industrial networks. During the lectures he/she will be acquainted with the characteristics of electrical equipment used in these networks and will learn how to select the appropriate equipment according to the network parameters and loads. During exercises he/she will learn how to perform basic calculations of conditions in the network. Students will also be aware of the risks for the users of these networks and will be familiar with appropriate safety measures. | |
| **Predvideni študijski rezultati:** | | |  | **Intended learning outcomes:** | |
| Študent bo poznal delovanje razdelilnih in industrijskih omrežij. Znal bo izbrati ustrezno opremo in bo sposoben sodelovati pri njihovem načrtovanju. S pomočjo ustreznih orodij bo znal izvesti osnovne izračune razmer v razdelilnih in industrijskih omrežjih. | | |  | The student will be familiar with the operation of distribution and industrial networks. He/she will be able to select the appropriate equipment and to participate in distribution and industrial network planning. He/she will also be able to perform basic calculations of conditions in distribution and industrial networks. | |
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| **Metode poučevanja in učenja:** | | |  | **Learning and teaching methods:** | |
| Predavanja, laboratorijske vaje. | | |  | Lectures, exercises | |
| **Načini ocenjevanja:** | Delež (v %) /  Weight (in %) | | | | **Assessment:** |
| Način: laboratorijske vaje, seminar, pisni izpit, ustni izpit.  Ocene od 1 do vključno 5 so negativne, ocene od vključno 6 do 10 so pozitivne.  Pozitivna ocena laboratorijskih vaj in pozitivna ocena seminarja sta pogoj za pristop k izpitu.  Prispevki k oceni:   * Pisni izpit * Ustni izpit * Seminar * Laboratorijske vaje | 25 %  25 %  25 %  25 % | | | | Type: laboratory exercises, seminar paper, written exam, oral exam.  Negative grades: from 1 to 5, positive grades: from 6 to 10.  Positive evaluation of laboratory exercises and of seminar paper are a prerequisite for the exam.  Contributions to the final grade:  Written exam   * Oral exam * Seminar paper * Report of laboratory exercises |
| **Reference nosilca / Lecturer's references:** | | | | | |
| 1. PRELOVŠEK, Mitja, BIZJAK, Grega, KOBAV, Matej Bernard. Public lighting energy consumption in Slovenian municipalities from 2007 to 2011. Elektrotehniški vestnik, ISSN 2232-3228. [English print ed.], 2012, vol. 79, no. 3, str. 87-92. 2. KERIN, Uroš, LERCH, Edwin, BIZJAK, Grega. Monitoring and reporting of security of power system low-frequency oscillations. Electric power components and systems, ISSN 1532-5008. [Print ed.], Jun. 2010, vol. 38, no. 9, str. 1047-1060. 3. KERIN, Uroš, BIZJAK, Grega. Matrix pencil for early detection of low frequency oscillations. International review of electrical engineering, ISSN 1827-6660, Jul.-Aug. 2009, vol. 4, no. 4, str. 654-659. 4. BIZJAK, Grega. Load flow network analysis with problem-based learning approach. International journal of electrical engineering education, ISSN 0020-7209, Apr. 2008, vol. 45, no. 2, str. 144-151. 5. KERIN, Uroš, BIZJAK, Grega, ŽUNKO, Peter. Analiza industrijskih omrežij. Elektrotehniški vestnik, ISSN 0013-5852. [Slovenska tiskana izd.], 2006, letn. 73, št. 5, str. 297-302. | | | | | |