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| **UČNI NAČRT PREDMETA / COURSE SYLLABUS** | | | | | | | | | | | | | | | | | |
| **Predmet:** | | | Visokonapetostna tehnika | | | | | | | | | | | | | | |
| **Course title:** | | | High Voltage Engineering | | | | | | | | | | | | | | |
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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 | | | | | **Energetika in mehatronika** | | | | | | | | 3. | | letni | | |
| 1st cycle academic study programme Electrical Engineering | | | | | **Power Engineering and Mechatronics** | | | | | | | | **3.** | | **summer** | | |
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| **Vrsta predmeta / Course type** | | | | | | | | | | | | Obvezni - strokovni/ compulsory professional | | | | | |
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| **Univerzitetna koda predmeta / University course code:** | | | | | | | | | | | | 64165 | | | | | |
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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** |
|  | | | | | | | | | | | | | | | | | |
| **Nosilec predmeta / Lecturer:** | | | | | Igor Papič | | | | | | | | | | | | |
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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):** | | | | | | | |
| Električno polje v visokonapetostni tehniki, metode in postopki za ugotavljanje jakosti električnega polja. Dielektrična trdnost in zdržnost izolacije. Razelektritve v homogenem in nehomogenem polju. Delne razelektritve, razelektritve v naravi, nastanek in vrste strel. Izolacijski materiali, plinasti dielektriki, trdi in tekoči izolacijski materiali. Metode za ugotavljanje stanja izolacije. Razporeditev potenciala vzdolž dolgih struktur, verige izolatorjev, navitja transformatorjev.  Proizvajanje in merjenje visokih izmeničnih napetosti. Proizvajanje in merjenje visokih enosmernih napetosti. Proizvajanje in merjenje visokih udarnih napetosti.  Nastanek prenapetosti, atmosferske prenapetosti, notranje prenapetosti.  Prenapetostni odvodniki in koordinacija izolacije. Modeliranje visokonapetostnih naprav in omrežij ter analiza visokonapetostnih prehodnih pojavov. | | | | | | | |  | | The electric field in high voltage engineering, methods and procedures to determine the electric field. Dielectric strength and insulation withstand. Discharges in homogeneous and inhomogeneous field. Partial discharges, atmospheric discharges, origin and type of lighting strokes. Insulating materials, gaseous dielectrics, solid and liquid insulating materials. Methods for isolation quality assessment. Distribution of potential along the long structures, ceramic type suspension insulators, transformer windings.  Generation and measurement of high AC voltages. Generation and measurement of high DC voltages. Generation and measurement of high impulse voltages. The formation of overvoltage, lightning overvoltage, system overvoltage.  Surge arresters and insulation coordination. Modeling of high voltage devices and networks and analysis of high voltage transients. | | | | | | | |

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| **Temeljni literatura in viri / Readings:** | | | | | |
| 1. M. Babuder, Visokonapetostna tehnika, skripta, Ljubljana 2004. 2. J. Voršič, J. Pihler, Tehnika visokih napetosti in velikih tokov, Univerza v Mariboru, FERI, Maribor 2008. | | | | | |
| **Cilji in kompetence:** | |  | | **Objectives and competences:** | |
| Študent bo spoznal pomen visoke napetosti pri načrtovanju in obratovanju elektroenergetskih omrežij in naprav. Pridobil bo osnovno znanje o visokonapetostni tehniki in metodah preizkušanja elektroenergetske opreme v visokonapetostnem laboratoriju. | |  | | The student will learn the importance of high voltage in the design and operation of electricity networks and devices and will also acquire the basic knowledge of high voltage technology and methods for testing high voltage electric power equipment in the lab. | |
| **Predvideni študijski rezultati:** | | |  | **Intended learning outcomes:** | |
| Znanje in razumevanje:  Študent bo razumel pomen visoke napetosti pri načrtovanju in obratovanju elektroenergetskega omrežja. Poznal bo metode preizkušanja elektroenergetske opreme v visokonapetostnem laboratoriju.  Uporaba:  Predznanje za nadaljevanje študija in uporaba v praksi pri visokonapetostnem preizkušanju opreme.  Refleksija:  Razumevanje povezave med visoko napetostjo, načrtovanjem opreme in strukturo elektroenergetskega omrežja.  Prenosljive spretnosti:  Znanje o postopku izvedbe meritev in izdelavi merilne dokumentacije je splošno uporabno pri izvajanju različnih meritev. | | |  | Knowledge and understanding:  The student will understand the importance of high voltage for planning and operation of the power network. The student will also learn about testing methods for electricity equipment testing in a high voltage laboratory.  Application:  Prerequisites for further study and practical application at high voltage equipment testing.  Reflection:  Understanding the connection between high voltage, equipment design and structure of the power network.  Transferable skills:  Knowledge of measurements procedure and report generation is useful in the frame of various measurements. | |
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| **Metode poučevanja in učenja:** | | |  | **Learning and teaching methods:** | |
| Predavanja, avditorne in laboratorijske vaje. | | |  | Lectures, tutorials and laboratory practice. | |
| **Načini ocenjevanja:** | Delež (v %) /  Weight (in %) | | | | **Assessment:** |
| Pogoj za opravljanje ustnega izpita je pozitivna ocena poročila o opravljenih vajah.  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 | 34%  33%  33% | | | | The prerequisite for the oral exam is a positive assessment of tutorials report.  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 final grade:  laboratory exercises  written exam  oral examination |
| **Reference nosilca / Lecturer's references:** | | | | | |
| 1. HERMAN, Leopold, PAPIČ, Igor, BLAŽIČ, Boštjan. A proportional-resonant current controller for selective harmonic compensation in a hybrid active power filter. IEEE transactions on power delivery, Oct. 2014, vol. 29, no. 5, str. 2055-2065.  2. KOLENC, Marko, PAPIČ, Igor, BLAŽIČ, Boštjan. Minimization of losses in smart grids using coordinated voltage control. Energies, Oct. 2012, vol. 5, no. 10, str. 3768-3787.  3. MAKSIĆ, Miloš, PAPIČ, Igor. Calculating flicker propagation in a meshed high voltage network with interharmonics and representative voltage samples. International journal of electrical power & energy systems, Nov. 2012, vol. 42, no. 1, str. 179-187.  4. BOŽIČEK, Ambrož, BLAŽIČ, Boštjan, PAPIČ, Igor. Performance evaluation of a time-optimal current controller for a voltage-source converter and comparison with a hysteresis controller. IEEE transactions on power delivery, 2011, vol. 26, no. 2, str. 859-868.  5. HROBAT, Primož, PAPIČ, Igor. An oscilloscope method for eliminating the interference and disturbance voltages for the earthing measurements of large earthing systems in substations. Electric power systems research, Feb. 2011, vol. 81, iss. 2, str. 510-517. | | | | | |