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| **UČNI NAČRT PREDMETA / COURSE SYLLABUS** | | | | | | | | | | | | | | | | | |
| **Predmet:** | | | Električni stroji | | | | | | | | | | | | | | |
| **Course title:** | | | Electric Machines | | | | | | | | | | | | | | |
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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 | | | | | **Ni smeri** | | | | | | | | 2. | | letni | | |
| 1st cycle academic study programme Electrical Engineering | | | | |  | | | | | | | | **2.** | | **summer** | | |
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| **Vrsta predmeta / Course type** | | | | | | | | | | | | Obvezni – strokovni/compulsory professional | | | | | |
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| **Univerzitetna koda predmeta / University course code:** | | | | | | | | | | | | 64117 | | | | | |
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| **Predavanja**  **Lectures** | **Seminar**  **Seminar** | | | **Vaje**  **Tutorial** | | | **Klinične vaje**  **work** | | | | **Druge oblike študija** | | | **Samost. delo**  **Individ. work** | |  | **ECTS** |
| **45** |  | | | **45** | | |  | | | |  | | | **85** | |  | **7** |
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| **Nosilec predmeta / Lecturer:** | | | | | Damijan Miljavec | | | | | | | | | | | | |
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| **Jeziki /**  **Languages:** | | **Predavanja / Lectures:** | | | | slovenski | | | | | | | | | | | |
| **Vaje / Tutorial:** | | | | slovenski | | | | | | | | | | | |
| **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):** | | | | | | | |
| Skupne osnove električnih strojev: nazivni podatki in vrste obratovanja električnih strojev, magnetno polje, induciranje napetosti, elektromagnetni navor, izgube in izkoristek, segrevanje električnih strojev. Obravnavanje osnovnih električnih strojev: transformatorji, avtotransformatorji, sinhronski stroji, asinhronski stroji in komutatorski stroji. Predstavitev in obravnava sodobnih električnih strojev ter njihova uporaba pri: generaciji električne energije obnovljivih virov energije, avtomatizaciji industrijskih procesov, prevoznih sredstvih – hibridna vozila, robotiki, superprevodnih sistemih, električnih orodjih in mikro-elektromehanskih sistemih. | | | | | | | |  | | A common base of electric machines: the nominal data types and operation of electrical machines, magnetic field, induced voltage, electromagnetic torque, losses and efficiency, heating of electrical machines. Addressing basic electrical machines: transformers, autotransformatorji, synchronous machines, induction machines and commutator machines. Presentation and discussion of modern electrical machines and their use at electricity generation using renewable energy, automation of industrial processes, transport vehicles - hybrid vehicles, robotics, superconducting systems, power tools and micro-electromechanical systems. | | | | | | | |

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| **Temeljni literatura in viri / Readings:** | | | | | |
| 1. Damijan Miljavec, Peter Jereb: Električni stroji – temeljna znanja, Ljubljana, 2008.  2. Stephen J. Chapman, Electric Machinery Fundamentals, McGraw-Hill Higher Education; 5 edition, 2011.  3. Austin Hughes, Bill Drury:Electric Motors and Drives: Fundamentals, Types and Applications, Newnes, 4th Revised edition edition, 2013.  4. Dino Zorbas, Electric Machines, Nelson Engineering, 2014.  5. P. C. Sen, Principles of Electric Machines and Power Electronics, John Wiley & Sons; 3rd Edition, 2013. | | | | | |
| **Cilji in kompetence:** | |  | | **Objectives and competences:** | |
| Cilj predmeta je pridobiti teoretična znanja potrebna za razumevanje osnovnih pojmov o električnih strojih in principov delovanja različnih tipov električnih strojev. Poznavanje osnovnih modelnih vezij in vhodno izhodnih karakteristik električnih strojev. Razumevanje osnovnih preizkusov s področja električnih strojev. Podati smernice razumevanja operativnih problemov v industriji električnih strojev. | |  | | The aim of this course is to gain theoretical knowledge needed to understand the basic concepts of electrical machines and principles of operation of various types of electrical machines. Knowledge of the basic electric machines circuit models and input-output characteristics of electrical machines. Understanding of basic tests in the field of electrical engineering. Provide guidance for understanding the operational problems of electrical machines. | |
| **Predvideni študijski rezultati:** | | |  | **Intended learning outcomes:** | |
| Študent bo razumel osnove elektromehanske pretvorbe energije in temeljne pojme o navoru in mehanskem ravnotežju. Principe delovanja električnih generatorjev in motorjev. Razumevanje osnovnih karakteristik različnih tipov električnih strojev. Soočen bo s problemi izdelave in oblikovanja električnih strojev. Razumel bo enostavne preizkuse elektromehanskih naprav in področja uporabe posameznih električnih strojev. | | |  | The student will understand the basics of electromechanical energy conversion and basic concepts of torque and mechanical equilibrium. Principles of operation of electric generators and motors. Understand the basic characteristics of various types of electrical machines. He will be faced with the problems of construction and design of electrical machines. Understand the simple tests of electromechanical devices and the field of use for individual type of electrical machine. | |
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| **Metode poučevanja in učenja:** | | |  | **Learning and teaching methods:** | |
| Predavanja, avditirne vaje in laboratorijske vaje. Laboratorijske vaje so s povišano nevarnostjo (visoka napetost, vrteči se deli,...)  Predmet je sestavljen iz 45 ur predavanj, 15 ur avditirnih vaj in iz 30 ur laboratorijskih vaj s povišano nevarnostjo. | | |  | Lectures, tutorials and laboratory work.  Laboratory exercises are with heightened risk (high voltage, rotating parts, ...).  The course consists of 45 hours of lectures 15 hours of tutorial and 30 hours of laboratory exercises with heightened risk. | |
| **Načini ocenjevanja:** | Delež (v %) /  Weight (in %) | | | | **Assessment:** |
| 1. 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  ALI  2. Način: laboratorijske vaje, 2 kolokvija  Kandidat lahko opravi pisni izpit tudi z dvema kolokvijema, pri čemer mora na vsakem kolokviju doseči vsaj 50 % možnih točk. Pozitivna ocena laboratorijskih vaj je pogoj za pristop k izpitu.  laboratorijske vaje  Kolokvij 1 in 2  Ustni izpit | 10%  45%  45%  10%  45%  45% | | | | 1. 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  OR  2. Type: laboratory exercises, two colloquiums  The candidate can pass a written exam with two colloquiums; achieving at every midterm at least 50% of the points. Positive evaluation of laboratory exercises is a prerequisite for the exam.  Contributions to final grade:  laboratory exercises  two colloquiums  oral examination |
| **Reference nosilca / Lecturer's references:** | | | | | |
| 1. VUKOTIĆ, Mario, MILJAVEC, Damijan. Design of a permanent-magnet flux-modulated machine with a high torque density and high power factor. *IET electric power applications*, ISSN 1751-8660, 2016, vol. 10, iss. 1, str. 36-44.  2. VIDMAR, Gregor, MILJAVEC, Damijan. A universal high-frequency three-phase electric-motor model suitable for the delta and star winding connections. *IEEE transactions on power electronics*, ISSN 0885-8993, Aug. 2015, vol. 30, no. 8, str. 4365-4376.  3. VIDMAR, Gregor, MILJAVEC, Damijan, AGREŽ, Dušan. Measurement and evaluation of EDM bearing currents by the normalized Joule integral. *Measurement science & technology*, ISSN 0957-0233, 2014, vol. 25, no. 7, str. 1-10.  4. GOTOVAC, Gorazd, LAMPIČ, Gorazd, MILJAVEC, Damijan. Analytical model of permeance variation losses in permanent magnets of the multipole synchronous machine. *IEEE transactions on magnetics*, ISSN 0018-9464, Feb. 2013, vol. 49, no. 2, str. 921-928.  5.MILJAVEC, Damijan, JEREB, Peter*. Električni stroji : temeljna znanja*. 2. izd. Ljubljana: Fakulteta za elektrotehniko, 2008. | | | | | |