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| **UČNI NAČRT PREDMETA / COURSE SYLLABUS** | | | | | | | | | | | | | | | | | |
| **Predmet:** | | | Biološki sistemi | | | | | | | | | | | | | | |
| **Course title:** | | | Biological 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 | | | | | Biomedicinska tehnika | | | | | | | | 1 | | 1 | | |
| 2nd cycle masters study programme in Electrical Engineering | | | | | Biomedical Engineering | | | | | | | | 1 | | 1 | | |
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| **Vrsta predmeta / Course type** | | | | | | | | | | | | Obvezni-strokovni / Compulsory professional | | | | | |
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| **Univerzitetna koda predmeta / University course code:** | | | | | | | | | | | | 64208 | | | | | |
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| **Predavanja**  **Lectures** | **Seminar**  **Seminar** | | | **Vaje**  **Tutorial** | | | **Klinične vaje**  **work** | | | | **Druge oblike študija** | | | **Samost. delo**  **Individ. work** | |  | **ECTS** |
| **45** | **0** | | | **30** | | |  | | | |  | | | **75** | |  | **6** |
|  | | | | | | | | | | | | | | | | | |
| **Nosilec predmeta / Lecturer:** | | | | | Damijan Miklavčič, Tadej Kotnik | | | | | | | | | | | | |
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| **Jeziki /**  **Languages:** | | **Predavanja / Lectures:** | | | | slovenski / Slovenian | | | | | | | | | | | |
| **Vaje / Tutorial:** | | | | slovenski / Slovenian | | | | | | | | | | | |
| **Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:** | | | | | | | | |  | **Prerequisites:** | | | | | | | |
| Vpis v letnik. | | | | | | | | |  | Enrolment in the year of the course. | | | | | | | |
| **Vsebina:** | | | | | | | |  | | **Content (Syllabus outline):** | | | | | | | |
| Teorije nastanka in razvoja življenja. Termodinamika bioloških sistemov. Osnove kemije bioloških sistemov. Samoorganizacija. Molekularna genetika. Zgradba, rast in delitev biološke celice. Celična membrana. Pretvorbe energije v biologiji. Biološki regulacijski sistemi in homeostaza. Pregled fizioloških sistemov pri človeku. Sestava, funkcije in kroženje krvi. Imunski sistem. Pretok snovi v bioloških sistemih. Populacijska dinamika. Deterministični kaos in fraktali v biologiji. | | | | | | | |  | | Theories on the origins and development of life. Thermodynamics of biological systems. Basic chemistry of biological systems. Self-organiza-tion. Molecular genetics. Structure, growth, and division of biological cells. Cell membrane. Ener-gy conversions in biology. Biological regulation and homeostasis. Physiological systems in human. Structure, function and circulation of blood. Immune system. Flow of matter in biological systems. Population dynamics. Deterministic chaos and fractals in biology. | | | | | | | |

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| **Temeljni literatura in viri / Readings:** | | | | | | |
| 1. Vodovnik, Miklavčič, Kotnik. Biološki sistemi. Založba FE, Ljubljana, 1998 2. Miklavčič, Kotnik. Biološki sistemi, 2. izdaja. 2016, v pripravi za tisk | | | | | | |
| **Cilji in kompetence:** | |  | | **Objectives and competences:** | | |
| Predstavitev bioloških sistemov z vidika tehnike, analiza učinkov električnih tokov in elektromagnetnih polj na biološke sisteme. | |  | | To describe biological systems from an engineering perspective, analysis of the effects of electric currents and electromagnetic fields on biological systems. | | |
| **Predvideni študijski rezultati:** | | |  | **Intended learning outcomes:** | | |
| Študent bo poznal značilnosti bioloških sistemov in njihovega delovanja z vidika tehnike, zmožen bo analizirati učinke električnih tokov in elektromagnetnih polj na biološke sisteme | | |  | The student will understand the characteristics of biological systems and their functioning from an engineering perspective, and will be able to analyze the effects of electric currents and electromagnetic fields on biological systems. | | |
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| **Metode poučevanja in učenja:** | | |  | **Learning and teaching methods:** | | |
| Predavanja, individualne naloge, vodeni individualni študij, laboratorijske vaje. | | |  |  | | |
| **Načini ocenjevanja:** | Delež (v %) /  Weight (in %) | | | | **Assessment:** | |
| Način (pisni izpit, ustno izpraševanje, naloge, projekt)  Ocene od 1 do vključno 5 so negativne, ocene od vključno 6 do 10 so pozitivne.  Preverjanje znanja: laboratorijske vaje, domača naloga in ustni izpit; pozitivna ocena laboratorijskih vaj in domače naloge je pogoj za pristop k ustnemu izpitu.  Prispevki k oceni:   * laboratorijsko delo in domače naloge, * ustni izpit | 55%  45% | | | | | Oral examination  Type (examination, oral, homework, laboratory exercises, project)  Negative grades: from 1 to 5  Positive grades: from 6 to 10  Positive evaluation of laboratory exercises and homework is a prerequisite for the final exam.  Contributions to the final grade:   * laboratory work and home work, * oral examination |
| **Reference nosilcev / Lecturers' references:** | | | | | | |
| 1. JARM, Tomaž, ČEMAŽAR, Maja, MIKLAVČIČ, Damijan, SERŠA, Gregor. Antivascular effects of electrochemotherapy : implications in treatment of bleeding metastases. *Expert review of anticancer therapy*, 2010, vol. 10, no. 5, str. 729-746. 2. YARMUSH, Martin L., GOLBERG, Alexander, SERŠA, Gregor, KOTNIK, Tadej, MIKLAVČIČ, Damijan. Electroporation-based technologies for medicine: principles, applications, and challenges. *Annual review of biomedical engineering*, 2014, vol. 16, str. 295-320. 3. SERŠA, Gregor, TEISSIE, Justin, ČEMAŽAR, Maja, SIGNORI, Emanuella, KAMENŠEK, Urška, MARSHALL, Guillermo, MIKLAVČIČ, Damijan. Electrochemotherapy of tumors as in situ vaccination boosted by immunogene electrotransfer. *Cancer immunology and immunotherapy*, 2015, vol. 64, no. 10, str. 1315-1327. 4. ZOREC, Barbara, PRÉAT, Véronique, MIKLAVČIČ, Damijan, PAVŠELJ, Nataša. Active enhancement methods for intra- and transdermal drug delivery: a review. *Zdravniški vestnik*, 2013, letn. 82, št. 5, str. 339-356. 5. MALI, Barbara, JARM, Tomaž, SNOJ, Marko, SERŠA, Gregor, MIKLAVČIČ, Damijan. Antitumor effectiveness of electrochemotherapy: a systematic review and meta-analysis. *European journal of surgical oncology*, 2013, vol. 39, no. 1, str. 4-16. 6. KOTNIK, Tadej, PUCIHAR, Gorazd, MIKLAVČIČ, Damijan. Induced transmembrane voltage and its correlation with electroporation-mediated molecular transport. *The journal of membrane biology*, 2010, vol. 236, no. 1, str. 3-13. 7. KOTNIK, Tadej, KRAMAR, Peter, PUCIHAR, Gorazd, MIKLAVČIČ, Damijan, TAREK, Mounir. Cell membrane electroporation. Part 1, The phenomenon. IEEE electrical insulation magazine, 2012, vol. 28, no. 5, str. 14-23. 8. KOTNIK, Tadej. Lightning-triggered electroporation and electrofusion as possible contributors to natural horizontal gene transfer. *Physics of life reviews*, 2013, vol. 10, no. 3, str. 351-370. 9. YARMUSH, Martin L., GOLBERG, Alexander, SERŠA, Gregor, KOTNIK, Tadej, MIKLAVČIČ, Damijan. Electroporation-based technologies for medicine : principles, applications, and challenges. *Annual review of biomedical engineering*, 2014, vol. 16, str. 295-320. 10. KOTNIK, Tadej, FREY, Wolfgang, SACK, Martin, HABERL MEGLIČ, Saša, PETERKA, Matjaž, MIKLAVČIČ, Damijan. Electroporation-based applications in biotechnology. *Trends in biotechnology*, 2015, vol. 33, no. 8, str. 480-488. | | | | | | |