MATEMATIČNI MODELI IN OPERACIJSKE RAZISKAVE V BIOZNANOSTIH

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Matematični modeli in operacijske raziskave v bioznanostih
Course title:	Mathematical models and operations research in biosciences
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (v postopku)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037299
Koda učne enote na članici/UL Member course code:	3801

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
10	15	15	0	5	80	5

Nosilec predmeta/Lecturer:	Jaka Žgajnar

Izvajalci predavanj:	Lidija Zadnik Stirn, Jaka Žgajnar
Izvajalci seminarjev:	
Izvajalci vaj:	
Izvajalci kliničnih vaj:	
Izvajalci drugih oblik:	
Izvajalci praktičnega usposabljanja:	

Vrsta predmeta/Course type:	teoretični/theoretical

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Splošni pogoji za vpis na doktorski študij Bioznanosti	General conditions for enrollment in doctoral study

Vsebina:	Content (Syllabus outline):
Predmet je glede na vsebino izrazito metodološki, saj je glavni poudarek na oblikovanju modelov za podporo odločanju v bioznanosti. 1. Pristop k matematičnemu modeliranju in definiranju problemov/modelov • postopek matematičnega modeliranja in pregled pristopov glede na različne probleme v bioznanosti	The subject is regarding the content methodological, since the emphasis is on generating the mathematical models for supporting the decisions in biosciences. 1. General approach to mathematical modeling and defining problems/models • procedures of mathematical modeling and review of approaches that most often appear in biosciences

• odločitveni proces kot ekološko-ekonomsko-socio-tehnični proces v naravnih sistemih • struktura sistema in integracija posameznih kvantitativnih in kvalitativnih metod v celovit model (sistem) upravljanja z naravnimi sistemi (decision support systems – DSS) • izbrana poglavja iz linearne algebre, verjetnostnega računa, diferenčnih in diferencialnih enačb, teorije grafov, zaporedij in vrst (Taylorjeva in Fouriereva vrsta), funkcij dveh spremenljivk (gradient) • vloga in pregled postoptimalnih testov in analiz ter adaptivnosti pri vrednotenju rešitev celovitega modela • vloga in pregled ustreznih računalniških programov (Excel, Expert Choice, MS project, Web-HIPRE, itd) 1. Linearni in nelinearni modeli • faze odločanja, diskretni in zvezni sistemi, linearni modeli, analiza ovojnice podatkov (DEA), odločanje po več kriterijih, večkriterialno linearno programiranje, ciljno programiranje, Kuhn-Tuckerjev izrek • preferenčne relacije, odločanje v popolni negotovosti in s tveganjem, vrste konkuriranja, opis strateške situacije, koncepti nekooperativnih iger, Nashovo ravnovesje, dinamične igre, igre z nepopolnimi informacijam • splošni linearni modeli, dualnost in teorija občutljivosti, celoštevilsko linearno programiranje • nelinearni modeli (Lagrangeovi multiplikatorji, kvadratično in separabilno programiranje) 1. Večfazni procesi • pomen grafov in maksimalni tok skozi graf (Bellmanov princip optimalnosti) • diskretni deterministični in stohastični dinamični modeli • homogene Markovske verige • kombinatorična optimizacija • teorija lokacije • modeli oskrbovalnih sistemov 1. Večparametersko odločanje • metodi ELECTRE in PROMETHEE • hierarhični modeli (AHP, ANP, DEXi) • conjoint analiza (CA) • funkcije koristnosti (MAUT) 1. Metode mehke logike in kvalitativne metode za ocenjevanje netržnih koristi • uvod v mehko logiko, lingvistične spremenljivke in relacije med njimi • mehko linearno programiranje • metode za ocenjevanje koristi in stroškov okolja (direktne – CVM, WTP, WTAC in indirektne metode – TCM) • skupinsko odločanje in družbena izbira, metode vrednotenja alternativ glede na več odločevalcev • ekonometrijsko modeliranje in ocenjevanje njegovih parametrov	• decision process as an ecological-economic-social-technical process in natural systems - biosciences • structure of a system and integration of individual quantitative and qualitative methods in the overall model (system) of system management (decision support systems – DSS) • selected chapters from linear algebra, probability calculation, differential equations, theory of graphs, sequences and series (Taylor's and Fourier's sequences), functions of two variables (gradient) • the role and review of post-optimal testing and analysis, and adaptiveness in evaluating solution of an overall model • the role, overview and use of suitable software (Excel, Expert Choice, MS project, Web-HIPRE, etc.) 1. Linear and nonlinear models • phases of decision-making, discrete and continuous systems, linear models, data envelopment analysis (DEA) , decision-making regarding several criteria, multi-criteria linear programming, goal programming, Kuhn-Tucker solution • preferential relations, decision-making in complete uncertainty and with risks, different competition models, strategic situation, non-cooperative games, Nash equilibrium, dynamic games, games with incomplete information • general linear models, duality and sensitivity, integer linear programming • nonlinear models (Lagrange multipliers, quadratic and separable programming) 1. Multiphase processes • network – basic definitions, maximum flow (Bellman principle of optimality) • discrete deterministic and stochastic dynamic models • homogeneous Markov chain • combinatorial optimization • location problems • supply chain management 1. Multiple parameters decision-making • methods ELECTRE and PROMETHEE • hierarchical models (AHP, ANP, DEXi) • conjoint analysis (CA), • utility functions (MAUT) 1. Fuzzy logic methodology, qualitative methods for non-market valuation • introduction to fuzzy sets, linguistic variables, relations between fuzzy sets • fuzzy linear programming • methods for assessing benefits and costs of the environmental (direct methods – CVM, WTP, WTAC and indirect methods – TCM

• metode za merjenje biodiverzitete (indeksi, parametri)	• group decision-making and social choice, methods for assessing alternatives regarding several decision makers • econometric modeling and assessing the parameters • methods for measuring the biodiversity (indices and parameters)

Temeljna literatura in viri/Readings:

- Powell S.G. in Baker K.R. 2010. Management science. The art of modeling with spreadsheets, ISBN 978-0-470-53067-2.
- Ragsadale C.T. 2010 Spreadsheet Modeling & decision analysis. Edition 6. ISBN- 978-0-538-74631-1
- Winston W. L. 2004. Operations research, application and algorithms. Belmont, Thomson Learning ISBN - 0-534-42362-0; 0-534-42355-8
- Jones D. in Tamiz M., 2010. Practical goal programming. International Series in Operations Research and Management Science. New York, Springer, ISBN - 978-1-4419-5770-2
- Bronson, R. in Naadimuthu, G., 1997. Schaum's Outline of Operations Research. McGrawHill, ISBN- 0-07-008020-8
- Hillier, F.S. in Liebermann, G.J., 2005, Introduction to Operations Research, McGraw-Hill, ISBN - 0-07-123828-X
- Saaty, T.L:, 2006. Fundamentals of Decision Making and priority theory with the Analytic Hieararchy Process. RWS Publications, ISBN - 0-9620317-6-3; 978-0-9620317-6-2.
- Bouyssou, D., Marchant, T., Pirlot, M., 2006. Evaluation and Decision Models with Multiple Criteria; Stepping Stone for the Analyst. Springer, New York, 445 str., ISBN: 0-387-31098-3
- Curwin, J., Slater, R., 2013. Quantitative methods for business decisions. Andover : Cengage Learning . ISBN - 978-1-4080-6019-3
- Ishizaka, A., Nemery, P., 2013. Multi-Criteria Decision Analysis, John Wiley. ISBN - 978-1-119-97407-9
- Weintraub, A., Romero, C., Bjorndal, T., Epstein, R., 2007. Handbook of Operations Research in natural resources, Springer, ISBN - 978-0-387-71814-9; 0-3877-1814-1

Članki iz tekoče znanstvene periodike s področja modeliranja in upravljanja v naravnih sistemih (Forest Science, Forest Ecology and Management, Ecological Modeling, European Journal of Operations Research, Central European Journal of Operations Research,…….) posredovani na predavanjih in vajah.

Cilji in kompetence:	**Objectives and competences:**
Izobraževalni cilji: Temeljni izobraževalni cilj je seznanitev slušatelja z zahtevnejšimi matematičnimi pojmi in odločitvenimi modeli. Cilj je tudi, da slušatelj poglobi, predvsem pa pridobi dodatna znanja s področja linearnih in nelinearnih modelov, večkriterialnih in večfaznih modelov, ter metod za vrednotenje in razvrščanje odločitev pri upravljanju z okoljem. Pridobljeno znanje naj bi zagotovilo razumevanje odnosov med obravnavanimi vsebinskimi kategorijami in metodološkimi orodji, tako da bo slušatelj razumel zmožnost posameznih metod in občutljivost rešitev konkretnih problemov glede na spremembe vhodnih podatkov. ***Kompetence:*** Študent bo obvladal bistveno terminologijo s področja matematičnega modeliranja, seznanjen bo z razvojnimi trendi in raziskovalnimi dosežki na področju modeliranja. Študent bo pridobil specifična znanja, potrebna za uspešno samostojno iskanje dodatnih informacij oziroma širjenje znanja metod modeliranja na področje bioznanosti.	**Educational objectives:** The basic aim is to acquaint students with more demanding mathematical concepts and decision-making models. The purpose is also that the students deepen and obtain additional knowledge in the field of linear and non-linear models, multi-criteria and multi-phase models, and methods for evaluating and classifying decisions in environmental management. The acquired knowledge will assure the understanding of linkages between professional categories and methodological means. The students will understand the ability of particular methods for proper solving professional problems and sensitivity of these methods to changes of input data. ***Competences:*** Students will master the fundamental terminology from the field of mathematical modeling and will be acquainted with the newest research methodology used for solving the problems in the fields of biosciences. They will possess the specific knowledge for self-governmental gaining of further information and the use of mathematical models/methods in biosciences.

Predvideni študijski rezultati:	Intended learning outcomes:
Znanje, razumevanje in uporaba Predviden študijski rezultat je kandidata usposobiti za samostojno raziskovalno delo na področju modeliranja in sprejemanja optimalnih odločitev v bioznanosti ob upoštevanju ekonomskih, ekoloških in socialnih faktorjev. Rezultati teh raziskav bodo pomemben prispevek k temeljnim in aplikativnim raziskavam na področju upravljanja z naravnimi sistemi v Sloveniji kot tudi v svetu. **Refleksija in prenosljive spretnosti** Predmet predstavlja metodološki predmet, ki usposablja študenta za razumevanje teorije metod optimiranja in uporabo le-teh v strokovni praksi – na področju bioznanosti. Usmerja študenta v kritično vrednotenje dobljenih rezultatov in zaključkov. Pridobljene spretnosti pa so: logično sklepanje, natančno formuliranje problemov, kritičen odnos do prebranega in lastnih rezultatov, razumevanje procesov, identifikacija, formulacija in reševanje kvantitativnih modelov, pisno poročanje.	**Knowledge, understanding and usage:** Students' learning outcome is to qualify the candidate for independent research work in the field of modeling and monitoring the optimal decisions in bioscience, taking into account economic, ecological and social factors. The results of such research will make an important contribution to students' basic and applicative research in the field of managing natural resources and other systems in Slovenia and in the world. *Reflections and transferable skills:* This methodological subject qualifies the students for understanding the theory and some abstract issues, like methods of optimization, and their application in praxis. Student is taught to be critical when developing the results and conclusions. Student is able to produce logical conclusions, to perform precise diction, to be critical to written sources, to understand sophisticated models and processes, to identify, formulate and solve some quantitative models and to report the results in written form.

Metode poučevanja in učenja:	Learning and teaching methods:
Izvajanje predmeta bo organizirano s predavanji (10 ur), projektno/seminarsko nalogo (15 ur), laboratorijskimi vajami s pomočjo ustrezne programske opreme (15 ur), konzultacijami (5 ur) in samostojnim delom študenta (80 ur)	Teaching of the subject is organized with lectures (10 hours), project/seminar work (15 hours), laboratory exercises in computer classroom using specific computer programs (15 hours), consultations (5 hours) and student's individual work (80 hours).

Načini ocenjevanja:	Delež/Weight	Assessment:
ustni izpit / Slušatelj mora biti prisoten na seminarjih in vajah in mora uspešno predstaviti samostojen seminarski projekt.	40,00 %	oral examination Students are expected to be present at the seminars and exercises and to present successfully their project/seminar.
seminarski projekt	60,00 %	seminar project

Ocenjevalna lestvica:	Grading system:
5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

Jaka Žgajnar

1. BREČKO, Jure, **ŽGAJNAR, Jaka**. Possible impact of risk management strategies with farm model on a mixed farm type. *Business systems research*. 2022, vol. 13, no. 3, str. 23-35, ilustr. ISSN 1847-9375. https://sciendo.com/article/10.2478/bsrj-2022-0022, DOI: 10.2478/bsrj-2022-0022. [COBISS.SI-ID 134870531], [SNIP]
   kategorija: 1A3 (Z, A', A1/2); uvrstitev: Scopus (d), Scopus, MBP (ERIHPLUS, INSPEC, METADEX, ESCI, DOAJ)
2. PEČNIK, Žan, **ŽGAJNAR, Jaka**. Resilience of dairy farms measured through production plan adjustments = Odpornost kmetij s prirejo mleka z različnimi prilagoditvami proizvodnega načrta. *Journal of Central European Agriculture : JCEA*. [Online ed.]. 2022, vol. 23, no. 1, str. 207-2019, ilustr. ISSN 1332-9049. https://jcea.agr.hr/en/issues/article/3372, DOI: 10.5513/JCEA01/23.1.3372. [COBISS.SI-ID 101000451], [SNIP, WoS, Scopus

3. **ŽGAJNAR, Jaka**, JUVANČIČ, Luka, KAVČIČ, Stane, ERJAVEC, Emil. CAP post 2022 scenarios and income impacts : a case analysis for selected typical farms in Slovenia. *Acta agriculturae Slovenica*. [Spletna izd.]. 2021, letn. 117, št. 2, str. 1-12. ISSN 1854-1941. http://ojs.aas.bf.uni-lj.si/index.php/AAS/article/view/2116/496, DOI: 10.14720/aas.2021.117.2.2116. [COBISS.SI-ID 70224131], [SNIP, Scopus]
4. MARTINOVSKA STOJCHESKA, Aleksandra, JANESKA STAMENKOVSKA, Ivana, KOTEVSKA, Ana, DIMITRIEVSKI, Dragi, **ŽGAJNAR, Jaka**. Assessing technical efficiency of vegetable farms in North Macedonia. *Journal of Central European Agriculture : JCEA*. [Online ed.]. 2021, vol. 22, no. 2, str. 462-470. ISSN 1332-9049. https://jcea.agr.hr/en/issues/article/3129, DOI: 10.5513/JCEA01/22.2.3129. [COBISS.SI-ID 69135363], [SNIP, WoS, Scopus]
5. KOCJANČIČ, Tina, DEBELJAK, Marko, **ŽGAJNAR, Jaka**, JUVANČIČ, Luka. Incorporation of emergy into multiple-criteria decision analysis for sustainable and resilient structure of dairy farms in Slovenia. *Agricultural systems*. [Print ed.]. 2018, vol. 164, str. 71-83, ilustr. ISSN 0308-521X. https://www.sciencedirect.com/science/article/pii/S0308521X1730389X, DOI: 10.1016/j.agsy.2018.03.005. [COBISS.SI-ID 4066952], [JCR, SNIP, WoS do 27. 11. 2022: št. citatov (TC): 13, čistih citatov (CI): 12, čistih citatov na avtorja (CIAu): 3,00, Scopus do 28. 11. 2022: št. citatov (TC): 13, čistih citatov (CI): 12, čistih citatov na avtorja (CIAu): 3,00]kategorija: 1A1 (Z, A", A', A1/2); uvrstitev: SCIE, Scopus, MBP (BIOABS, BIOPREW, CAB, PUBMED)
6. BEĆIROVIĆ, Emir, **ŽGAJNAR, Jaka**. Impact of avaible labour and land area on possibility of risk reduction at berry fruits farms in Bosnia and Herzegovina. *Radovi Poljoprivredno-prehrambenog fakulteta Univerziteta u Sarajevu*. 2018, vol. 63, no. 68/2, str. 60-71, ilustr. ISSN 0033-8583. https://ppf.unsa.ba/casopis/Radovi%2068%202.pdf. [COBISS.SI-ID 4177544] kategorija: 1C (Z); uvrstitev: MBP (CAPLUS, CAB)

Lidija Zadnik Stirn

1. KASTRIN, Andrej, POVH, Janez, **ZADNIK STIRN, Lidija**, ŽEROVNIK, Janez. Methodologies and applications for resilient global development from the aspect of SDI-SOR special issues of CJOR. Central European journal of operations research. Jun. 2021, vol. 29, iss. 2, str. 773–790, ilustr. ISSN 1435-246X. https://link.springer.com/content/pdf/10.1007/s10100-021-00752-7.pdf, DOI: 10.1007/s10100-021-00752-7. [COBISS.SI-ID 66829315], [JCR, SNIP, WoS, Scopus]
   kategorija: 1A1 (Z, A", A', A1/2); uvrstitev: Scopus (d), SCIE, MBP (IBZ, MSN, METADEX, PUBMED, ECONLIT)
2. GROŠELJ, Petra, **ZADNIK STIRN, Lidija**. Evaluation of several approaches for deriving weights in fuzzy group analytic hierarchy process. *Journal of decision systems*. 2018, vol. 27, no. s1, str. 217-226. ISSN 1246-0125. https://doi.org/10.1080/12460125.2018.1460160, https://repozitorij.uni-lj.si/IzpisGradiva.php?id=114173, DOI: 10.1080/12460125.2018.1460160. [COBISS.SI-ID 5063590], [SNIP, WoS do 26. 10. 2022: št. citatov (TC): 18, čistih citatov (CI): 17, čistih citatov na avtorja (CIAu): 8,50, Scopus do 6. 10. 2022: št. citatov (TC): 19, čistih citatov (CI): 18, čistih citatov na avtorja (CIAu): 9,00]
   kategorija: 1A3 (Z, A', A1/2); uvrstitev: Scopus (d), Scopus, MBP (INSPEC, COMPENDEX, ESCI, PSYCINFO)
3. GROŠELJ, Petra, **ZADNIK STIRN, Lidija**. Soft consensus model for the group fuzzy AHP decision making. *Croatian operational research review : CRORR*. [Tiskana izd.]. 2017, vol. 8, no. 1, str. 207-220. ISSN 1848-0225. http://hrcak.srce.hr/ojs/index.php/crorr/article/view/4592. [COBISS.SI-ID 4782502], [SNIP, WoS do 26. 10. 2022: št. citatov (TC): 6, čistih citatov (CI): 5, čistih citatov na avtorja (CIAu): 2,50, Scopus do 12. 1. 2023: št. citatov (TC): 9, čistih citatov (CI): 8, čistih citatov na avtorja (CIAu): 4,00]
   kategorija: 1A4 (Z); uvrstitev: Scopus (d), Scopus, MBP (INSPEC, MSN, METADEX, ESCI, ECONLIT)
4. LIKER, Branko, **ZADNIK STIRN, Lidija**, GORNIK BUČAR, Dominika, HROVATIN, Jasna. Examination of decision factors in the process of buying kitchen furniture using conjoint analysis = Ispitivanje činitelja u procesu donošenja odluke o kupnji kuhinjskog namještaja primjenom združene analize. *Drvna industrija : Znanstveno stručni časopis za pitanja drvne tehnologije*. 2016, vol. 67, no. 2, str. 141- 147. ISSN 0012-6772. http://hrcak.srce.hr/index.php?show=clanak&id_clanak_jezik=236233, DOI: 10.5552/drind.2016.1525. [COBISS.SI-ID 2592393], [JCR, SNIP, WoS do 26. 10. 2022: št. citatov (TC): 2, čistih citatov (CI): 2, čistih citatov na avtorja (CIAu): 0,50, Scopus do 13. 3. 2021: št. citatov (TC): 3, čistih citatov (CI): 3, čistih citatov na avtorja (CIAu): 0,75]
   kategorija: 1A3 (Z); uvrstitev: SCIE, Scopus, MBP (COMPENDEX, CAB)
5. LEBAN, Vasja, PEZDEVŠEK MALOVRH, Špela, **ZADNIK STIRN, Lidija**, KRČ, Janez. Forest biomass for energy in multi-functional forest management : insight into the perceptions of forest-related

professionals. *Forest Policy and Economics : a companion journal to Forest Ecology and Management*. [Print ed.]. 2016, vol. 71, str. 87-93. ISSN 1389-9341. http://dx.doi.org/10.1016/j.forpol.2015.07.005, DOI: 10.1016/j.forpol.2015.07.005. [COBISS.SI-ID 4145574], [JCR, SNIP, WoS do 26. 10. 2022: št. citatov (TC): 17, čistih citatov (CI): 15, čistih citatov na avtorja (CIAu): 3,75, Scopus do 18. 1. 2023: št. citatov (TC): 19, čistih citatov (CI): 18, čistih citatov na avtorja (CIAu): 4,50]
kategorija: 1A1 (Z, A", A', A1/2); uvrstitev: Scopus (d), SCIE, Scopus, MBP (BIOABS, BIOPREW, COMPENDEX, CAB, PAIS)

6. GROŠELJ, Petra, HODGES, Donald G., **ZADNIK STIRN, Lidija**. Participatory and multi-criteria analysis for forest ecosystem management : a case study of Pohorje, Slovenia. *Forest Policy and Economics : a companion journal to Forest Ecology and Management*. [Print ed.]. 2016, vol. 71, str. 80-86. ISSN 1389-9341. http://dx.doi.org/10.1016/j.forpol.2015.05.006, https://repozitorij.uni-lj.si/IzpisGradiva.php?id=127136, DOI: 10.1016/j.forpol.2015.05.006. [COBISS.SI-ID 4098726], [JCR, SNIP, WoS do 26. 10. 2022: št. citatov (TC): 22, čistih citatov (CI): 20, čistih citatov na avtorja (CIAu): 6,67, Scopus do 21. 10. 2022: št. citatov (TC): 30, čistih citatov (CI): 29, čistih citatov na avtorja (CIAu): 9,67]
kategorija: 1A1 (Z, A", A', A1/2); uvrstitev: Scopus (d), SCIE, Scopus, MBP (BIOABS, BIOPREW, COMPENDEX, CAB, PAIS)
7. PEZDEVŠEK MALOVRH, Špela, KURTTILA, Mikko, HUJALA, Teppo, KÄRKKÄINEN, Leena, LEBAN, Vasja, LINDSTAD, Berit Hauger, PETERS, Dörte Marie, RHODIUSA, Regina, SOLBERG, Birger, WIRTH, Kristina, **ZADNIK STIRN, Lidija**, KRČ, Janez. Decision support framework for evaluating the operational environment of forest bioenergy production and use : case of four European countries. *Journal of environmental management*. 2016, vol. 180, str. 68-81, ilustr. ISSN 0301-4797. http://dx.doi.org/10.1016/j.jenvman.2016.05.021, DOI: 10.1016/j.jenvman.2016.05.021. [COBISS.SI-ID 4393638], [JCR, SNIP, WoS do 26. 10. 2022: št. citatov (TC): 14, čistih citatov (CI): 9, čistih citatov na avtorja (CIAu): 0,83, Scopus do 22. 9. 2022: št. citatov (TC): 15, čistih citatov (CI): 12, čistih citatov na avtorja (CIAu): 1,11] kategorija: 1A1 (Z, A', A1/2); uvrstitev: SCIE, Scopus, MBP (IBSS, ASFA, BIOABS, GEOREF, ZR, CAB, MEDLINE, PUBMED)

MATERIALI ZA DEZINFEKCIJO V ZDRAVSTVU

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Materiali za dezinfekcijo v zdravstvu
Course title:	Disinfection materials in health sciences
Članica nosilka/UL Member:	UL ZF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (v postopku)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037270
Koda učne enote na članici/UL Member course code:	3772

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
10	15	10	0	0	90	5

Nosilec predmeta/Lecturer:	Polonca Trebše

Izvajalci predavanj:	Polonca Trebše
Izvajalci seminarjev:	
Izvajalci vaj:	
Izvajalci kliničnih vaj:	
Izvajalci drugih oblik:	
Izvajalci praktičnega usposabljanja:	

Vrsta predmeta/Course type:	teoretični/theoretical

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Splošni pogoji za vpis na doktorski študij	General conditions for enrolment in doctoral studies.

Vsebina:	**Content (Syllabus outline):**
Razvoj in uporaba fotokatalitičnih materialov v zdravstvu (TiO2, uporaba AOMs, desinfekcijski postopki).	Development and application of photocatalytic materials in health sciences (TiO2 materials, AOMs, disinfection procedures).

Temeljna literatura in viri/Readings:

A. Mills, S. K. Lee: A web-based overview of semiconductor photochemistry-based current commercial applications, Journal of Photochemistry and Biology A: Chemistry 152 (2002) 233-247

2. P.Boule, D.Bahnemann, P.Robertson, Environmental Photochemistry Part II (The Handbook of Environmental Chemistry / Reactions and Processes), Springer 2010 3. A. Tiwari, Handbook of antimicrobial coatings, Elsevier 2018. Znanstveni članki/ state of the art scientific papers

Cilji in kompetence:	**Objectives and competences:**
Osnovni cilj predmeta je podati študentom novosti na področju uporabe fotokatalitičnih materialov v zdravstvu. Kompetence: poznavanje pretvorb organskih in anorganskih spojin z različno kemijsko strukturo; poznavanje fotokatalitskih procesov.	The main objective of the course is to convey to students recent advances ob application of photocatalitic materials in health sciences. Competences: knowledge on the transformation of organic and inorganic compounds with different chemical structure and on photocalytic processes.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: fotokatalitskih pretvorb (razumejo procese razgradnje onesnažil v okolju z uporabo polprevodniškega katalizatorja in ultravijoličnega sevanja), in z njimi povezanih naprednih analiznih metod detekcije(spektroskopske, biokemične, kontinuirne avtomatizirane metode).	Knowledge and understanding: photocatalytic trasfrotmations (they understand degradation processes of pollutants in the environment with the application of semiconductors and UV irradiation), on novel analytical methods (spectroscopic, electrochemical, separation, radioanalytical, biochemical, continuous automated methods).

Metode poučevanja in učenja:	**Learning and teaching methods:**
• Predavanja • Individualno delo na projektih • Predstavitve in interpretacije rezultatov projektov ostalim študentom v skupini v seminarski obliki • Diskusija o objavljenih člankih iz izbranih tem (kritično vrednotenje znanstvene literature, predstavitev »case studies«)	• lectures • Individual project work • Presentation and interpretation of results of project work to the other students in open discussion • Journal club – discussion of published research articles on selected topics (critical evaluation of scientific literature, presentation of the "case studies")

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Preverjanje znanja poteka v obliki projektne naloge na realnih primerih iz raziskovalne prakse, v kateri študentje pripravijo rešitve za izbrani predlog raziskovalnega projekta. Projektne naloge oddajo v pisni obliki in jih zagovarjajo v ustni obliki, v diskusiji z nosilcem predmeta in sodelujočimi profesorji ter ostalimi študenti.	50,00 %	During the course students prepare individual projects of real cases from research practice, where students prepare solutions for determined research project proposal. They prepare final project work and defend it in the classroom in discusion with professors and other students.
Študent pripravi tudi seminar iz tematike doktorata v povezavi z eno od vsebin predmeta. Pri tem sodelujeta mentor in nosilec predmeta oz. drugi izvajalci predmeta. Zagovor opravlja študent pred mentorjem in nosilcem in/ali drugim izvajalcem.	50,00 %	Student prepares a doctoral seminar on the topic related to one of the course. In this cooperate menthor and lecturer or/and other professors. Student defend the seminar in front of mentor and lecturer and/or other professors.

Ocenjevalna lestvica:	**Grading system:**
5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

Polonca Trebše

1. TARTARO BUJAK, Ivana, POCRNIĆ, Marijana, BLAŽEK, Karlo, BOJANIĆ, Krunoslav, TREBŠE, Polonca, LEBEDEV, Albert T., GALIĆ, Nives. Radiation-induced degradation of doxazosin : role of reactive species, toxicity, mineralization and degradation pathways. *Journal of water process engineering*. 2023, vol. 51, str. 1-12, DOI: 10.1016/j.jwpe.2022.103401.

2. TARTARO BUJAK, Ivana, BAVCON KRALJ, Mojca, KOSYAKOV, Dmitry, UL'YANOVSKII, Nikolai, LEBEDEV, Albert T., TREBŠE, Polonca. Photolytic and photocatalytic degradation of doxazosin in aqueous solution. *Science of the total environment*. 2020, vol. 740, str. 140131-1-1401316-8, DOI: 10.1016/j.scitotenv.2020.140131.

3. DETENCHUK, Elena Andreevna, TREBŠE, Polonca, MARJANOVIĆ, Aleksandra, KOSYAKOV, Dmitry, UL'YANOVSKII, Nikolai, BAVCON KRALJ, Mojca, LEBEDEV, Albert T. Transformation of resveratrol under disinfection conditions. *Chemosphere*. 2020, vol. 260, str. 1-11, DOI: 10.1016/j.chemosphere.2020.127557.

4. LEBEDEV, Albert T., BAVCON KRALJ, Mojca, POLYAKOVA, Olga V., DETENCHUK, Elena Andreevna, POKRYSHKIN, Sergey Alexandrovich, TREBŠE, Polonca. Identification of avobenzone by-products formed by various disinfectants in different types of swimming pool waters. *Environment international*. 2020, vol. 137, str. 105495-1-105495-8, DOI: 10.1016/j.envint.2020.105495.

5. BAVCON KRALJ, Mojca, DILCAN, Gizem Evrim, SALIHOĞLU, Güray, MAZUR, Dmitry M., LEBEDEV, Albert T., TREBŠE, Polonca. Photocatalytic degradation of chlothianidin : effect of humic acids, nitrates, and oxygen. *Journal of analytical chemistry*. 2019, vol. 74, no. 14, str. 1371-1377. DOI: 10.1134/S1061934819140077.

MEDNARODNA IN EVROPSKA GOZDARSKA POLITIKA

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Mednarodna in evropska gozdarska politika
Course title:	International an EU forest policy
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (v postopku)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code: 0643579

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
10	35	0	0	0	80	5

Nosilec predmeta/Lecturer:	Špela Pezdevšek Malovrh
Izvajalci predavanj:	Špela Pezdevšek Malovrh
Izvajalci seminarjev:	Špela Pezdevšek Malovrh
Izvajalci vaj:	
Izvajalci kliničnih vaj:	
Izvajalci drugih oblik:	
Izvajalci praktičnega usposabljanja:	
Vrsta predmeta/Course type:	teoretični /theoretical

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Splošni pogoji za vpis na doktorski študij.	General conditions for enrolment in doctoral studies.

Vsebina:	Content (Syllabus outline):
Gozdovi imajo z zagotavljanjem gospodarskih, okoljskih in socialnih funkcij pomembno vlogo pri doseganju različnih ciljev na svetovni ravni, vseevropski ravni, ravni EU, in državni ravni. Njihov pomen se zadnja leta izrazito povečuje, tudi z vidika ciljev drugih politik (npr. podnebnih ciljev; ciljev ohranjanja biotske raznovrstnosti) ter globalnih ekoloških problemov. Pri predmetu bodo študentje spoznali:	Forests play an important role in achieving various goals at global, pan-European, EU and national levels by providing economic, ecological and social functions. Their importance has been increasing significantly in recent years, also in relation to the goals of other policies (e.g., climate goals, biodiversity goal, environmental goals, energy goals) as well as global ecological problems. In this course, students will learn about:

• Ekološke (okoljske), ekonomske in družbene razloge za razvoj mednarodne in EU gozdarske politike • Zgodovinski pregled razvoja pobud in procesov mednarodne in EU gozdarske politike • Stališča in interese z gozdom povezanih sektorjev, kot ključni izziv pri gospodarjenju z gozdovi na svetovni in EU ravni • Osnovne podatke o gozdovih in gospodarjenju na svetovni in evropski ravni • Globalne gozdne cilje (cilji strateškega načrta OZN za gozdove 2030) • Prispevek gozdov k ciljem Agende za trajnostni razvoj do leta 2030 (Sustainable Development Goals – SDG) • Kriterije in indikatorje trajnostnega načina gospodarjenja z gozdovi (npr. C&I Forest Europe, FSC in PEFC) • Procese, sporazume, konvencije in protokole na mednarodni in vseevropski ravni povezane z gozdovi in gozdarstvom • Klasifikacijo procesov, sporazumov, konvencij in protokolov na mednarodni in vseevropski ravni povezanih z gozdovi in gozdarstvom • Gozdarstvo na ravni EU (pregled EU zakonodaje in drugih dokumentov povezanih z gozdovi in gozdarstvom) • Akterje in institucije gozdarske politike na mednarodni, vseevropski ter EU ravni • Vplive mednarodnih, vseevropskih in EU političnih procesov/dokumentov na zakonodajo ter gospodarjenje z gozdovi na nacionalni in lokalni ravni s poudarkom na Sloveniji Seminarska naloga: Seminarska naloga se posveča analizi izbranih tematik, ki bodo v času izvajanja predmeta zavzemale osrednje mesto v razpravah na globalni in evropski ravni.	• Ecological (environmental), economic and society reasons for development of international and EU forest policy • Historical overview of development of international and EU forest policy initiatives and processes • Forest- related cross-sectoral perspective and interes as key challenge for forest management at the global and EU levels • Basic data on forests and forest management at the global and EU levels • Global Forest goals and targets of the UN Strategic Plan for Forests 2030 • Contribution of forests to the Agenda on Sustainable Development 2030 (Sustainable Development Goals – SDG) • Criteria and indicators of sustainable forest management (e.g., C&I Forest Europe, FSC and PEFC) • Processes, agreements, conventions and protocols at international and pan-European level related to forests and forestry • Classification of processes, agreements, conventions and protocols at international and pan-European level related to forests and forestry • Forestry at the EU level (review of EU legislation and other documents related to forests and forestry) • Forest policy actors and institutions at the international, pan-European and EU level • Impact of international, pan-European and EU political processes/documents on forest policy and forest management at national and local level, especially in Slovenia Seminar assignment: The seminar assignment is dedicated to the analysis of selected topics that have a central place in the discussions at the global and European level during the implementation of the course.

Temeljna literatura in viri/Readings:

- KROTT M. 2005. Forest Policy Analysis, Springer, Dordrecht, 323 str.
- WALLACE H., WALLACE W., POLLACK M. A. 2020. Policy-making in the European Union, New York. Oxford University Press. 8th Edition: 585 str.
- SENIOR NELLO S. 2005. The European Union: Economics, Policies and History. McGraw-Hill Education, 462 str.
- STERNER T., CORIA J. 2012. Policy Instruments for Environmental and Natural Resource Management. 2nd Edition. RFF Press: 657 str.
- PÜLZL H., HOGL K., KLEINSCHMIT D., WYDRA D., ARTS B., MAYER P., PALAHI M., WINKEL G., WOLSLEHNER B. 2013. European Forest Governance: Issues at Stake and the Way Forward. What Science can tell us 2. EFI, Joensu, 102 str; https://efi.int/sites/default/files/files/publication-bank/2018/efi_wsctu2_2013.pdf
- PÜLZL H., WYDRA D., HOGL K.. 2018. Piecemeal integration: Explaining and understanding 60 years of European Union forest policy making. Forests, 9 (11), 719; https://doi.org/10.3390/f9110719
- SOTIROV M., POKORNY B., KLEINSCHMIT D., KANOWSKI P. 2020. International Forest Governance and Policy: Institutional Architecture and Pathways of Influence in Global Sustainability. Sustainability, 12(17), 7010; https://doi.org/10.3390/su12177010

- JERBELLE, E., PÜLZL, H.. 2021. How are forests framed? An analysis of EU forest policy. Forest Policy and Economics, 127, 102448; https://doi.org/10.1016/j.forpol.2021.102448
- McDERMOTT C.L., ARAN C., WOOD P. 2007. International Forest Policy – the instruments, agreements and processes that shape it. Department of Economic and Social Affairs. 139 str. https://static.un.org/esa/forests/wp-content/uploads/2015/06/Intl_Forest_Policy_instruments_agreements.pdf
- United Nations Forum on Forests Secretariat, 139 str. https://www.un.org/esa/forests/wp-content/uploads/2015/06/Intl_Forest_Policy_instruments_agreements.pdf
- Global Forest goals and targets of the UN Strategic plan for forests 2030. https://www.un.org/esa/forests/wp-content/uploads/2019/04/Global-Forest-Goals-booklet-Apr-2019.pdf

Seznam izbranih člankov in drugih materialov, ki bodo potrebni za seminarsko nalogo bo pripravljen vsako leto sproti, glede na aktualne teme.

Cilji in kompetence:	**Objectives and competences:**
Cilj: Študent bo spoznal glavne probleme povezane z gozdovi in gozdarstvom na mednarodni, vseevropski in EU ravni ter najpomembnejše procese in dokumente gozdarske politike ter njihov vpliv na nacionalno zakonodajo in gospodarjenje z gozdovi v Sloveniji. Kompetence: Študent bo usposobljen za samostojno, uspešno in strokovno razumevanje in obvladovanje kompleksnih problemov povezanih z gospodarjenjem z gozdovi; sposoben razumeti procese, sporazume, konvencije in protokole na mednarodni, vseevropski ter EU ravni v povezavi z gozdovi in gozdarstvom ter njihovo dinamiko, sposoben prepoznati in predlagati potrebne izboljšave gozdne politike v Sloveniji v kontekstu usklajevanja s procesi in politikami na mednarodni, vseevropski ter EU ravni.	Objectives: Students learn about the most important problems related to forests and forestry at international, pan-European and EU level, as well as the most important processes and documents of forest policy and their influence on national legislation and forest management in Slovenia. Competences: Students are able to independently, successfully and professionally understand and manage complex problems related to forest management; understand the processes, agreements, conventions and protocols at international, pan-European and EU level related to forests and forestry and their dynamics, identify and propose the necessary improvements in forest-related policies in Slovenia in the context of coordination with processes and policies at international, pan-European and EU level.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Študent bo razumel in znal celovito obravnavati mednarodne, vseevropske in EU probleme in procese, sporazume, konvencije in protokole povezane z gozdovi in gozdarstvom, ki vplivajo na nacionalno gozdno politiko.	Knowledge and understanding: The student understand and is able to deal comprehensively with international, pan-European and EU problems and processes, agreements, conventions and protocols related to forests and forestry that influence national forest-related policies.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja (izbrane vsebine) oziroma konzultacije Vodeni seminar Vsebine se delno prilagodijo raziskovalnemu interesu kandidata/kandidatke.	Lectures (selected chapters) or consultation Guided seminar The content of the subject is adapted to the profile of PhD students.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Seminarska naloga	100,00 %	Seminar work

Ocenjevalna lestvica:	**Grading system:**
5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

Špela Pezdevšek Malovrh

PEZDEVŠEK MALOVRH, Špela, AVDIBEGOVIĆ, Mersudin. Comparative analysis of regulatory framework related to private forest management in Slovenia and Federation of Bosnia and Herzegovina. Central European Forestry Journal. 2021, vol. 67, iss. 4, str. 197-211, ISSN 2454-0358. https://doi.org/10.2478/forj-2021-0016.

VULETIĆ, Dijana, KRAJTER OSTOIĆ, Silvija, BÁLIKOVÁ, Klára, AVDIBEGOVIĆ, Mersudin, POTOČKI, Kristina, PEZDEVŠEK MALOVRH, Špela, POSAVEC, Stjepan, STOJNIĆ, Srđan, PALETTO, Alessandro. Stakeholders' opinions towards water-related forests ecosystem services in selected southeast European countries (Federation of Bosnia and Herzegovina, Croatia, Slovenia and Serbia). Sustainability. 2021, vol. 13, iss. 21, 16 str., ISSN 2071-1050. https://doi.org/10.3390/su132112001.

NICHIFOREL, Liviu, DEUFFIC, Philippe, THORSEN, Bo Jellesmark, WEISS, Gerhard, HUJALA, Teppo, KEARY, Kevin, LAWRENCE, Anna, AVDIBEGOVIĆ, Mersudin, DOBSINSKA, Zuzana, FELICIANO, Diana, PEZDEVŠEK MALOVRH, Špela, ŠINKO, Milan, et al. Two decades of forest-related legislation changes in European countries analysed from a property rights perspective. Forest Policy and Economics: a companion journal to Forest Ecology and Management. 2020, vol. 115, article 102146, 16 str., ISSN 1389-9341. https://doi.org/10.1016/j.forpol.2020.102146.

PEZDEVŠEK MALOVRH, Špela, PALETTO, Alessandro, POSAVEC, Stjepan, DOBSINSKA, Zuzana, ĐORĐEVIĆ, Ilija, MARIĆ, Bruno, AVDIBEGOVIĆ, Mersudin, KITCHOUKOV, Emil, STIJOVIĆ, Aleksandar, TRAJKOV, Pande, LAKTIĆ, Tomislav. Evaluation of the operational environment factors of nature conservation policy implementation: cases of selected EU and Non-EU countries. Forests. 2019, iss. 12, article 1099, str. 1-24. ISSN 1999-4907. https://doi.org/10.3390/f10121099.

PEZDEVŠEK MALOVRH, Špela, BEĆIROVIĆ, Dženan, MARIĆ, Bruno, NEDELJKOVIĆ, Jelena, POSAVEC, Stjepan, PETROVIĆ, Nenad, AVDIBEGOVIĆ, Mersudin. Contribution of forest stewardship council certification to sustainable forest management of state forests in selected Southeast European countries. Forests. 2019, iss. 8, article 648, 24 str., ISSN 1999-4907. https://doi.org/10.3390/f10080648.

NEDELJKOVIĆ, Jelena, STANIŠIĆ, Mirjana, NONIĆ, Dragan, AVDIBEGOVIĆ, Mersudin, CURMAN, Marta, PEZDEVŠEK MALOVRH, Špela. Climate change governance in forestry and nature conservation: institutional framework in selected SEE countries. Šumarski list. 2019, vol. 143, iss. 9/10, str. 445-459, ISSN 0373-1332. https://doi.org/10.31298/sl.143.9-10.6, DOI: 10.31298/sl.143.9-10.6.

GALLO, Martina, PEZDEVŠEK MALOVRH, Špela, LAKTIĆ, Tomislav, DE MEO, I., PALETTO, Alessandro. Collaboration and conflicts between stakeholders in drafting the Natura 2000 Management Programme (2015-2020) in Slovenia. Journal for nature conservation. 2018, vol. 42, str. 36-44, ISSN 1617-1381. https://doi.org/10.1016/j.jnc.2018.02.003

MEHANSKI SISTEMI V LESARSTVU

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Mehanski sistemi v lesarstvu
Course title:	Mechanical systems in wood industry
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (v postopku)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code: 0643141

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
10	20	0	0	10	85	5

Nosilec predmeta/Lecturer: Gorazd Fajdiga

Izvajalci predavanj:	Gorazd Fajdiga
Izvajalci seminarjev:	
Izvajalci vaj:	
Izvajalci kliničnih vaj:	
Izvajalci drugih oblik:	
Izvajalci praktičnega usposabljanja:	

Vrsta predmeta/Course type: teoretični/theoretical

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Splošni pogoji za vpis na doktorski študij	General conditions for enrollment in doctoral study

Vsebina:	Content (Syllabus outline):
Študent spozna: • Osnove s področja obremenitev strojnih delov, napetostnega stanja strojnih delov, trdnosti inženirskih gradiv (statična, dinamična), hrapavosti površin, tribologije in poškodb.	The student learns: • Fundamentals in the field of loading of machine parts, stress state of machine parts, strength of engineering materials (static,

• Izbrane strojne elemente za nerazstavljive zveze (zvarni, lotni in lepljeni spoji), razstavljive zveze (vijačne zveze, sorniki, zveze gredi in pesta), elastične elemente (vzmeti), transmisijske rotacijske elemente (osi in gredi, ležaji, tesnila, sklopke) • Mehanska gonila (jermenska, verižna in zobniška gonila) • Osnove inženirskih računalniških simulacij (osnove metode končnih elementov, robni pogoji, primeri uporabe) • Pomen in vzdrževanje strojev in naprav • Osnove avtomatike, merilne sisteme (meritev mehanskih spremenljivk, merjenje časa in frekvenc, merjenje temperature, merjenje vlažnosti lesa), sisteme za odločanje (krmiljenje, regulacija), izvršne sisteme; osnove robotike) • Pnevmatske in hidravlične sisteme (osnove, komponente) • Lesnoobdelovalne stroje (osnove s področja konstruiranja strojev, vrste lesnoobdelovalnih strojev, pogone na obdelovalnih strojih, splošne karakteristike strojev za odrezovanje lesa).	dynamic), surface roughness, tribology and damage. • Selected machine elements for inseparable connections (welded, soldered and glued), separable connections (screw joints, bolts, shaft and hub connections), elastic elements (springs), rotating transmission elements (axles and shafts, seals, bearings, clutches). • Mechanical drives (belt drives, chain drives and gear drives) • Fundamentals of engineering computer simulations (fundamentals of the finite element method, boundary conditions, application cases) • Importance and maintenance of machines and equipment • Basics of automation, measurement systems (measurement of mechanical quantities, measurement of time and frequencies, measurement of temperature, measurement of wood moisture), decision systems (control, regulation), executive systems; basics of robotics) • Pneumatic and hydraulic systems (basics, components) • Woodworking machines (basics in the field of machine design, types of woodworking machines, drives of woodworking machines, general characteristics of wood cutting machines).

Temeljna literatura in viri/Readings:

Ren Z., Glodež S.: Strojni elementi I.del, 2016
Ren Z., Glodež S.: Strojni elementi: Uvod v gonila, torna, jermenska in verižna gonila, 2015
Medič M.: Lesarsko strojništvo, 2001
R. Karba: Gradniki sistemov vodenja, 1994

Cilji in kompetence:	**Objectives and competences:**
Cilji: Osvojiti osnovno znanje s področja teorije, uporabe, izbire in analize osnovnih strojnih elementov, lesnoobdelovalnih strojev in ostalih pomembnih naprav uporabljenih pri obdelavi lesa. Študent razvije sposobnost za samostojno delo, kritično razmišljanje, komuniciranje in načrtovanje inženirskega dela. Kompetence: Pridobljeno znanje omogoča samostojno kreativno reševanje osnovnih inženirskih problemov na področju mehanskih sistemov in obravnavo	Objectives: To acquire a basic knowledge of the theory, application, selection and analysis of basic machine elements, woodworking machinery and other major equipment used in woodworking. The student will develop the ability to work independently, to think critically, to communicate, and to plan technical work. Competences: The acquired knowledge enables the independent creative solution of basic engineering problems in the field of mechanical systems and the treatment

strojnih elementov, strojev in naprav uporabljenih pri obdelavi lesa.	of machine elements, machines and equipment used in wood processing.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Poznavanje osnovnih strojnih elementov, razumevanje njihovega delovanja in uporabnosti ter postopkov za njihovo montažo, demontažo in vzdrževanje. Poznavanje lastnosti in delovanja lesnoobdelovalnih strojev in drugih naprav pri obdelavi lesa. Razumevanje in sposobnost uporabe računalniških simulacij za enostavne trdnostne analize osnovnih strojnih elementov.	Knowledge and understanding: Knowledge of basic machine elements, understanding of their operation and usability, and procedures for their assembly, disassembly, and maintenance. Knowledge of the characteristics and operation of woodworking machinery and other equipment used in woodworking. Understanding and ability to use computer simulations for simple strength analysis of basic machine elements.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja (10 ur), Seminar (20 ur), Ostalo (10 ur).	Lectures (10 h), Seminar (20 h), Others (10 h).

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Izdelava in zagovor seminarja.	100,00 %	Seminar work and its presentation.

Ocenjevalna lestvica:	**Grading system:**
5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

Fajdiga Gorazd

1. KLEMENC, Jernej, FAJDIGA, Gorazd. Statistical modelling of the fatigue bending strength of Norway spruce wood. Materials. 2022, vol. 15, iss. 2, str. 1-15, ilustr. ISSN 1996-1944. https://www.mdpi.com/1996-1944/15/2/536, DOI: 10.3390/ma15020536. [COBISS.SI-ID 93092867]
2. FAJDIGA, Gorazd, ŠUBIC, Barbara, KOVAČIČ, Aljaž. Bending stiffness of hybrid wood-metal composite beams : an experimentally validated numerical model. Forests. [Online ed.]. 2021, vol. 12, iss. 7, 1-16 str., ilustr. ISSN 1999-4907. https://www.mdpi.com/1999-4907/12/7/918/htm, DOI: 10.3390/f12070918. [COBISS.SI-ID 71832323]
3. LIPOVEC ZUPANC, Enej, FAJDIGA, Gorazd, HUMAR, Miha. Primerjava mehanskih lastnosti recentnega in 400 let starega lesa evropskega macesna = Comparison of mechanical properties of recent and 400-year-old European larch wood. Les. [Tiskana izd.]. 2021, letn. 70, št. 2, str. 31-40, ilustr. ISSN 0024-1067. http://www.les-wood.si/index.php/leswood/article/view/132/89, DOI: 10.26614/les-wood.2021.v70n02a01. [COBISS.SI-ID 78746371]
financer: ARRS, P2-0182, P4-0015, 0481-09; Woolf-OP20.03520
4. FAJDIGA, Gorazd, RAJH, Denis, VIDIC, Drago, GOSPODARIČ, Bojan. The Development of pneumatic fatigue test rig for wood-based specimens. Forests. [Online ed.]. 2020, vol. 11, iss. 11, 17 str., ilustr. ISSN 1999-4907. https://www.mdpi.com/1999-4907/11/11/1187, DOI: 10.3390/f11111187. [COBISS.SI-ID 36773379]
5. FAJDIGA, Gorazd, RAJH, Denis, NEČEMER, Branko, GLODEŽ, Srečko, ŠRAML, Matjaž. Experimental and numerical determination of the mechanical properties of spruce wood. Forests. [Online ed.]. 2019, vol. 10, iss. 12, 1-12 str., ilustr. ISSN 1999-4907. https://www.mdpi.com/1999-4907/10/12/1140, DOI: 10.3390/f10121140. [COBISS.SI-ID 3150985]

6. STRAŽE, Aleš, FAJDIGA, Gorazd, GOSPODARIČ, Bojan. Nondestructive characterization of dry heat-treated fir (Abies Alba Mill.) timber in view of possible structural use. Forests. [Online ed.]. 2018, vol. 9, iss. 12, article 776, ilustr. ISSN 1999-4907. https://www.mdpi.com/1999-4907/9/12/776, DOI: 10.3390/f9120776. [COBISS.SI-ID 2986633]

MERITVE FIZIKALNO-KEMIJSKIH IN BIOLOŠKIH LASTNOSTI TAL

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Meritve fizikalno-kemijskih in bioloških lastnosti tal
Course title:	Measurement of physical, chemical and biological properies of soil
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (v postopku)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037248
Koda učne enote na članici/UL Member course code:	3750

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
20	20	20	0	0	190	10

Nosilec predmeta/Lecturer:	Vesna Zupanc

Izvajalci predavanj:	Helena Grčman, Vesna Zupanc
Izvajalci seminarjev:	
Izvajalci vaj:	
Izvajalci kliničnih vaj:	
Izvajalci drugih oblik:	
Izvajalci praktičnega usposabljanja:	

Vrsta predmeta/Course type:	teoretični/theoretical

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Splošni pogoji za vpis na doktorski študij	General conditions for enrolment in doctoral studies.

Vsebina:	Content (Syllabus outline):

Temeljna literatura in viri/Readings:

Pregledni znanstveni članki področja / Review articles from specific fields[DV1]

Priporočena literatura / Suggested reading

Alef K., Nannipieri P. 1995. Methods in Applied Soil Microbiology and Biochemistry. Academic Press,San Diego (izbrana poglavja / selected chapters)

Naldu R. 2008. Chemical bioavailability. Elsevier, Amsterdam (izbrana poglavja / selected chapters)
Wilson N. 1995. Soil Water and Ground Water Sampling. London, Lewis Publishers: 188 s. (izbrana poglavja / selected chapters)
Rowell. D.L. 1994. Soil Science. Methods and application. Longman Scientific & Techical,: 350 s. (izbrana poglavja / selected chapters)
Dean, J.R. 2007.Bioavailability, bioaccessibility and mobility of environmental contaminants. John Wiley & Sons.Ltd., Chichester, (izbrana poglavja / selected chapters)
Jacob H. Dane, Clarke Topp 2002. Methods of Soil Analysis. Part 4. Physical Methods (Soil Science Society of America Book Series, Vol. 5), (izbrana poglavja / selected chapters)
William A. Jury, Robert Horton 2004. Soil Physics. Sixth Edition. (izbrana poglavja / selected chapters)
Jacob Bear 1988. Dynamics of fluids in porous media, Dover publications, Inc. New York (izbrana poglavja / selected chapters)
[DV1]Literatura, ki je bila prej navedena kot temeljna, je premaknjena v priporočeno.

Cilji in kompetence:	**Objectives and competences:**
Kakovost tal je pomemben pogoj za trajnostno (npr. kmetijsko) rabo tal ter pri raziskavah tal kot naravnega vira. Slušatelj spozna metode za določevanja tistih fizikalno-kemijskih in bioloških lastnosti tal ter talne raztopine, ki so pomembni pokazatelji procesov v tleh in funkcioniranja tal. Slušatelj pridobi praktične izkušnje z merilnimi metodami.	Soil quality is important pre-condition for the sustainable (e.g., agricultural) use of soil as non-renewable natural resource. Students are familiarised with methods of determining physical, chemical and biological properties of soil and soil solution as important indicators of soil processes and functioning of soil. Students acquire practical measurement skills.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Slušatelj se nauči izbrati in pravilno uporabiti primerno metodo za merjenje in ugotavljanje lastnosti tal, procesov, funkcioniranja in indikatorjev kakovosti tal pri raziskavah trajnostne rabe tal v kmetijstvu, oceni tveganja in remediaciji onesnaženih tal, pri ekoloških, eko-toksikoloških in drugih raziskavah talnega ekosistema. Slušatelj se nauči rezultate meritev kritično vrednotiti in jih interpretirati v povezavi z drugimi pridobljenimi in danimi podatki.	Knowledge and understanding: Students are taught to select and use appropriate methods for assessing given soil properties, processes, functions and quality indicators in relation with sustainable soil use in agriculture, risk assessment and remediation of polluted soils, and in ecological, eco-toxicological and other research of soil ecosystems. They are taught to evaluate results critically and interpret results with respect and in connection with other available and obtained data.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, seminarji, laboratorijske vaje, samostojno delo	Lectures, seminars, laboratory exercises, individual work.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Ustni izpit iz predavanj in vaj	50,00 %	Oral examination from lectures and exercises
Ocena seminarja v povezavi s samostojnim delom	50,00 %	Assessment of seminar connected with the student's individual work

Ocenjevalna lestvica:	**Grading system:**
5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

Domen Leštan:

1. UDOVIČ, Metka, DROBNE, Damjana, LEŠTAN, Domen. An in vivo invertebrate bioassay of Pb, Zn and Cd stabilization in contaminated soil. Chemosphere, ISSN 0045-6535. [Print ed.], 2013, vol. 92, issue 9, str. 1105-1110. http://dx.doi.org/10.1016/j.chemosphere.2013.01.054, doi: 10.1016/j.chemosphere.2013.01.054. [COBISS.SI-ID 7458425]

2. JELUŠIČ, Maša, GRČMAN, Helena, VODNIK, Dominik, SUHADOLC, Marjetka, LEŠTAN, Domen. Functioning of metal contaminated garden soil after remediation. Environmental pollution, ISSN 0269-7491. [Print ed.], 2013, vol. 174, str. 63-70. http://dx.doi.org/10.1016/j.envpol.2012.10.027. [COBISS.SI-ID 7368313]

3. VOGLAR, Grega E., LEŠTAN, Domen. Equilibrium leaching of toxic elements from cement stabilized soil. Journal of hazardous materials, ISSN 0304-3894. [Print ed.], 2013, vol. 246-247, str. 18-25. http://dx.doi.org/10.1016/j.jhazmat.2012.11.058, doi: 10.1016/j.jhazmat.2012.11.058. [COBISS.SI-ID 7367801]

4. POCIECHA, Maja, LEŠTAN, Domen. Recycling of EDTA solution after soil washing of Pb, Yn, Cd and As contaminated soil. Chemosphere, ISSN 0045-6535. [Print ed.], 2012, vol. 86, issue 8, str. 843-846. http://dx.doi.org/10.1016/j.chemosphere.2011.11.004, doi: 10.1016/j.chemosphere.2011.11.004. [COBISS.SI-ID 6904441]

5. UDOVIČ, Metka, LEŠTAN, Domen. EDTA and HCl leaching of calcareous and acidic soils polluted with potentially toxic metals: Remediation efficiency and soil impact. Chemosphere, ISSN 0045-6535. [Print ed.], 2012, vol. 88, issue 6, str. 718-724. http://dx.doi.org/10.1016/j.chemosphere.2012.04.040, doi: 10.1016/j.chemosphere.2012.04.040. [COBISS.SI-ID 7132025]

6. POCIECHA, Maja, LEŠTAN, Domen. Novel EDTA and process water recycling method after soil washing of multi-metal contaminated soil. Journal of hazardous materials, ISSN 0304-3894. [Print ed.], 2012, vol. 201-202, str. 273-279, ilustr. http://dx.doi.org/10.1016/j.jhazmat.2011.11.092, doi: 10.1016/j.jhazmat.2011.11.092. [COBISS.SI-ID 6927993]

Zupanc Vesna:

1. ZUPANC, Vesna, KASTELEC, Damijana, LEŠTAN, Domen, GRČMAN, Helena. Soil physical characteristics after EDTA washing and amendment with inorganic and organic additives. Environmental pollution, ISSN 0269-7491. [Print ed.], 2014, vol. 186, str. 56-62. [COBISS.SI-ID 7833977]
2. MABIT, Lionel, DORNHOFER, Patcharin, MARTIN, Paul, TOLOZA, Arsenio, ZUPANC, Vesna. Depth distribution of selected geogenic radionuclides (40K, 226Ra, 232Th) and anthropogenic 137Cs in an undistributed forest soil in East Slovenia. Indian Journal of Pure & Applied Physics, ISSN 0019-5596, 2012, vol. 50, no. 1, str. 45-48. [COBISS.SI-ID 6985081]
3. ZUPANC, Vesna, BURNIK ŠTURM, Martina, LOJEN, Sonja, KACJAN-MARŠIĆ, Nina, ADU-GYAMFI, Joseph, BRAČIČ-ŽELEZNIK, Branka, URBANC, Janko, PINTAR, Marina. Nitrate leaching under vegetable field above a shallow aquifer in Slovenia. Agriculture, ecosystems & environment, ISSN 0167-8809. [Print ed.], 2011, vol. 144, issue 1, str. 167-174, ilustr. http://dx.doi.org/10.1016/j.agee.2011.08.014, doi: 10.1016/j.agee.2011.08.014. [COBISS.SI-ID 6820217]
4. MABIT, Lionel, MARTIN, Paul, JANKONG, Patcharin, TOLOZA, Arsenio, PADILLA-ALVAREZ, Roman, ZUPANC, Vesna. Establishment of control site baseline data for erosion studies using radionuclides: a case study in East Slovenia. Journal of Environmental Radioactivity, ISSN 0265-931X. [Print ed.], 2010, vol. 101, no. 10, str. 854-863. http://dx.doi.org/10.1016/j.jenvrad.2010.05.008, doi: 10.1016/j.jenvrad.2010.05.008. [COBISS.SI-ID 6323321]
5. ZUPANČIČ JUSTIN, Maja, PAJK, Nastja, ZUPANC, Vesna, ZUPANČIČ, Marija. Phytoremediation of landfill leachate and compost wastewater by irrigation of Populus and Salix : Biomass and growth response. Waste management, ISSN 0956-053X. [Print ed.], 2010, letn. 30, str. 1032-1042, doi: 10.1016/j.wasman.2010.02.013. [COBISS.SI-ID 26762969]
6. ZUPANC, Vesna, ZUPANČIČ JUSTIN, Maja. Changes in soil characteristics during landfill leachate irrigation of Populus deltoides. Waste management, ISSN 0956-053X. [Print ed.], 2010, vol. 30, issue 11, str. 2130-2136. http://dx.doi.org/10.1016/j.wasman.2010.05.004, doi: 10.1016/j.wasman.2010.05.004. [COBISS.SI-ID 6323577]

MERITVE V KMETIJSTVU

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Meritve v kmetijstvu
Course title:	Measurement in agriculture
Članica nosilka/UL Member:	UL FS

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (v postopku)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037331
Koda učne enote na članici/UL Member course code:	3834

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
10	0	0	0	30	85	5

Nosilec predmeta/Lecturer:	Jože Kutin

Izvajalci predavanj:	Jože Kutin
Izvajalci seminarjev:	
Izvajalci vaj:	
Izvajalci kliničnih vaj:	
Izvajalci drugih oblik:	
Izvajalci praktičnega usposabljanja:	

Vrsta predmeta/Course type:	teoretični/theoretical

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Splošni pogoji za vpis na doktorski študij	General conditions for enrolment in doctoral studies.

Vsebina:	Content (Syllabus outline):
• Uvod v eksperimentalno raziskovalno delo: osnovni koraki v procesu eksperimentiranja; vplivni dejavniki na eksperimentalni proces. • Osnove statističnega načrtovanja poskusov: Klasični in statistično načrtovani poskus; Temeljni koncepti načrtovanja poskusov; Posebnosti in omejitve faktorsko načrtovanih poskusov.	• introduction to experimental research work: basic steps in process of experimentation; influence factors on experimental process • basics of statistical design of experiments: classic and statistically designed experiments; basic concepts of experimental design; particularities and limitations of factorial designed experiments. • measurement process as source of experimental information: influence factors; basic metrological

• Merilni proces kot vir eksperimentalnih informacij: vplivni dejavniki; temeljni meroslovni pojmi; organiziranost meroslovne infrastrukture; zagotavljanje meroslovne sledljivosti. • Merilni signal kot nosilec informacij o merjeni veličini: Analogni in digitalni, periodični in aperiodični, deterministični in naključni merilni signali; Motnje v merilnih signalih; Zajemanje in pretvorba merilnih signalov. • Merilna zaznavala za električno merjenje mehanskih veličin: Glavne vrste merilnih zaznaval in njihove meroslovne, statične in dinamične značilnosti ter omejitve (piezoelektrična, piezouporovna, termoelektrična, uporovna, magnetouporovna, induktivna, potenciometrična, optična, ultrazvočna, Hallova merilna zaznavala). • Neposredne in posredne metode za merjenje: Mehanske napetosti, sil, navorov, momentov in deformacij; Premikov in razdalj; Kota zasuka in mehanske moči; Mehanskih nihanj in pospeškov; Vrtilne hitrosti in frekvence. Tlaka; Temperature. Hitrosti in pretoka tekočin. • Uporaba programske opreme v eksperimentalnem delu: Osnove digitalne obdelave merilnih signalov; Virtualna instrumentacija in druga programska oprema; Validacija programske opreme. • Meroslovno ovrednotenje merilnega sistema in eksperimentalnega procesa: Analiza merilne negotovosti (standardna, sestavljena in razširjena merilna negotovost); Ovrednotenje in prikaz merilnih rezultatov. • Seminarske vaje: Timsko delo na področju načrtovanja eksperimentov, razvoja in validacije različnih merilnih sistemov za mehanske veličine ter vrednotenja merilnih rezultatov. • Laboratorijske vaje: Načrtovanje eksperimentov in merilnih sistemov, eksperimentalni praktikum na izbranih primerih merjenj in poskusov.	terms; organization of metrological infrastructure; assurance of metrological traceability • measurement signal as a carrier of information about measurand: analog and digital, periodic and aperiodic, deterministic and random measurement signals; noise in measurement signals; acquisition and conversion of measurement signals. • sensors for electrical measurements of mechanical quantities: main types of sensors and their metrological, static and dynamic characteristics and limitations (piezoelectric, piezoresistant, thermoelectric, resistant, magnetoresistant, inductive, potentiometric, optical, ultrasonic, Hall sensors). • direct and indirect methods for measurements of: mechanical stress, forces, moments and deformations; displacements and distance; rotation angle and mechanical power; mechanical vibrations and acceleration; rotational speed and frequency; pressure; temperature; fluid velocity and flow rate. • application of software in experimental work: basics of digital processing of measurement signals; virtual instrumentation and other software; validation of software. • metrological evaluation of measurement system and experimental process: analysis of measurement uncertainty (standard, combined and expanded measurement uncertainty); evaluation and presentation of measurement results. • Seminar: team work related to design of experiments, development and validation of various measurement systems for mechanical quantities, and evaluation of measurement results. • Laboratory practice: design of experiments and measurement systems, experimental practice focused on selected measurements and experiments.

Temeljna literatura in viri/Readings:

- Montgomery, D.C.: Design and analysis of experiments. Wiley, 2009 [COBISS.SI-ID 11603483]
- Holman, J.P.: Experimental methods for engineers. McGraw-Hill, 2001 [COBISS.SI-ID 4627739]
- Kirkup, L., Frenkel, R. B.: An introduction to uncertainty in measurement using the GUM. Cambridge University Press, 2006 [COBISS.SI-ID 666619]
- Figliola, R. S., Beasley, D. E.: Theory and design for mechanical measurements. Wiley, 2011 [COBISS.SI-ID 35307013]
- Morris, A. S.: Measurement & instrumentation principles. Butterworth-Heinemann, 2001 [COBISS.SI-ID 2266708]
- Hashemian, H. M.: Sensor performance and reliability. ISA, 2005 [COBISS.SI-ID 10583323]
- Montgomery, D. C., Runger, G. C.: Applied statistics and probability for engineers. Wiley, 2014 [COBISS.SI-ID 16830747]

Cilji in kompetence:	**Objectives and competences:**
Temeljni cilji učnega predmeta je seznaniti in naučiti študente: s temeljnimi koncepti načrtovanja poskusov	The fundamental goal of the course is to familiarise students: with basic concepts of design of

ter z meroslovno analizo in ovrednotenjem rezultatov eksperimentalnega dela, s fizikalno-teoretičnimi izhodišči sodobnih merilnih tehnologij, z zajemanjem, obdelavo in prikazom merjenih veličin, z merjenjem temeljnih mehanskih veličin, ki so posebej značilne za kmetijsko tehniko in mehanizacijo, z uveljavljenimi merilnimi metodami, z osnovami virtualne instrumentacije in digitalne obdelave signalov.	experiments and metrological analysis and evaluation of results of experimental work, with physical and theoretical background of modern measurement technologies, with acquisition, processing and display of measurement quantities, with measurement of basic mechanical quantities that are common for agricultural engineering and mechanization, with well-known measurement methods, with fundamentals of virtual instrumentation and digital signal processing.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Pridobljena znanja v študijskem procesu bodo zagotavljala, da bo študent sposoben samostojno: načrtovati eksperimentalni proces; izbrati ustrezno merilno opremo in konfigurirati merilni sistem; uporabljati različne standardizirane ter v praksi uveljavljene merilne metode; izmeriti temeljne mehanske veličine, ki so značilne za kmetijsko tehniko in mehanizacijo; meroslovno ovrednotiti eksperimentalno dobljene rezultate.	With the acquired knowledge during the course, the student will be able to autonomously deal with the following topics: design of experimental process; selection of appropriate measurement equipment and configuration of measurement systems; use of different standardized or other well established measurement methods; perform measurements of basic mechanical quantities that are common for agricultural engineering and mechanization; metrological evaluation of experimentally obtained results.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, ki vključujejo reševanje in razpravo o izbranih teoretičnih ter praktično uporabnih primerih. Interaktivna predavanja, skupinsko delo, virtualni eksperimenti.	Lectures, including solving and discussion on selected theoretical and practical cases. Interactive lectures, team work, virtual experiments.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Pogoj za pristop k opravljanju izpita je pozitivna ocena iz seminarskih in laboratorijskih vaj. Izpiti so pisni in ustni.	100,00 %	The basic condition for attending the examination is a positive mark in seminar and laboratory practice. Examinations are written and oral.

Ocenjevalna lestvica:	**Grading system:**
5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

Jože Kutin

BOBOVNIK, Gregor, KUTIN, Jože. Correlation of the leakage flow rate with pressure changes in a clearance-sealed piston prover. Flow measurement and instrumentation. Aug. 2020, vol. 74, str. 1-7

BOBOVNIK, Gregor, MUŠIČ, Tim, KUTIN, Jože. Liquid level detection in standard capacity measures with machine vision. Sensors. Apr. 2021, vol. 21, iss. 8, str. 1-13

BOBOVNIK, Gregor, ŽIBRET, Primož, KUTIN, Jože. Characterization of a piston prover gas flow standard in variable ambient temperature conditions. Measurement : Journal of the International Measurement Confederation. Jun. 2021, vol. 177, str. 1-9

KUTIN, Jože, SVETE, Andrej. On the theory of the frequency response of gas and liquid pressure measurement systems with connecting tubes. Measurement science & technology. 2018, vol. 29, no. 12, str. 1-11.

RUPNIK, Klemen, BAJSIČ, Ivan, KUTIN, Jože. Modelling of a thermal dispersion mass flow meter. Flow measurement and instrumentation. 2018, vol. 59, str. 37-44, ilustr. ISSN 0955-5986.

SVETE, Andrej, BAJSIČ, Ivan, KUTIN, Jože. Investigation of polytropic corrections for the piston-in-cylinder primary standard used in dynamic calibrations of pressure sensors. Sensors and actuators. A, Physical, May 2018, vol. 274, str. 262-271

SVETE, Andrej, HERNÁNDEZ CASTRO, Francisco Javier, KUTIN, Jože. Effect of the dynamic response of a side-wall pressure measurement system on determining the pressure step signal in a shock tube using a time-of-flight method. Sensors. Mar. 2022, vol. 22, iss. 6, str. 1-15

SVETE, Andrej, KUTIN, Jože. Experimental validation of an improved mathematical model for pneumatic pressure measurement systems with connecting tubes. Measurement science & technology. 2020, vol. 31, no. 1, str. 1-10

ŽIBRET, Primož, BOBOVNIK, Gregor, KUTIN, Jože. Time-correction model based on diverter speed for a pVTt gas flow primary standard. Sensors. May 2022, vol. 22, iss. 11, str. 1-12

METODE EKOLOŠKEGA MODELIRANJA

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Metode ekološkega modeliranja
Course title:	Methods of ecological modelling
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (v postopku)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037344
Koda učne enote na članici/UL Member course code:	3847

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
10	10	25	0	0	80	5

Nosilec predmeta/Lecturer:	Marko Debeljak

Izvajalci predavanj:	Marko Debeljak
Izvajalci seminarjev:	
Izvajalci vaj:	
Izvajalci kliničnih vaj:	
Izvajalci drugih oblik:	
Izvajalci praktičnega usposabljanja:	

Vrsta predmeta/Course type:	teoretični/theoretical

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Splošni pogoji za vpis na doktorski študij.	General conditions for enrolment to a PhD study programme.

Vsebina:	Content (Syllabus outline):
Vsebina predmeta ja izrazito metodološka, kjer je glavni poudarek na: - sistemskem pristopu k razumevanju ekosistemov in uporabo sistemskega razmišljanja pri definiranju problemov, - temeljnih principih ekološkega modeliranja, - izgradnji mehanističnih modelov, modelov iz velikih zbirk podatkov in modelov za podporo odločanja.	The course is highly methodological oriented where the main focus is on: - a system approach to understanding ecosystems and application of systems thinking for definition of the problems, - fundamental principles of ecological modelling,

V prvem delu predmeta se slušatelji seznanijo s temeljnimi principi sistema in sistemskega razmišljanja, ki jim omogoča celosten vpogled v strukturo in delovanje obravnavanega sistema (ekosistema). Velik poudarek je na pravilni opredelitvi in definiciji problema in v njegovem pravilnem formuliranju v obliki cilja, ki ga poskušajo v nadaljevanju doseči z metodami ekološkega modeliranja. V drugem vsebinskem sklopu je poudarek na konceptih ekološkega modeliranja, ki so podani v obliki potrebnih korakov in pravil za dosego metodološke objektivnosti izgradnje ekološkega modela. V zadnjem sklopu predmeta so obravnavane tri temeljne skupine ekoloških modelov: mehanistični napovedni modeli, napovedni in klasifikacijski modeli iz podatkov in kvalitativni odločitveni modeli. Vsebino predmeta je tako zajeta v naslednjih šest sklopih: 1. Uvod v ekološko modeliranje, 2. Sistem, 3. Koncepti ekološkega modeliranja, 4. Mehanistični modeli, 5. Modeli iz podatkov in 6. Modeli za podporo odločanja.	- construction of mechanistic models, models from large datasets and qualitative models for decision support. In the first part of the course, students are introduced to the fundamental principles of systems and systems thinking, which allows them to gain a comprehensive insight into the structure and functioning of the studied system (e.g., ecosystem). The main focus is on the correct definition and proper formulation of the problems and their solutions by application of the ecological modelling methods. The second part of the course is focused on the concepts of ecological modelling, which are given in the form of steps and rules required to achieve the methodological correctness of building an ecological model. The last part of the course addresses three basic groups of ecological models: mechanistic prediction models, prediction and classification models constructed from data, and qualitative decision models. The content of the course consists from the following six sections: 1. Introduction to ecological modelling, 2. A system, 3. Concepts of ecological modelling, 4. Mechanistic models, 5. Models from large datasets and 6. Qualitative decision support models.

Temeljna literatura in viri/Readings:

Jørgensen, S.E., Bendoricchio, G., 2011. Fundamentals of ecological modelling : applications in environmental management and research . 4th ed., Elsevier

Witten H.I., Frank E., Hall M.A., 2011. Data mining : practical machine learning tools and techniques. 3rd. ed., Morgan Kaufmann

Bohanec M. 2012. Odločanje in modeli. 1. ponatis. Ljubljana, DMFA

Cilji in kompetence:	**Objectives and competences:**
Osnovni cilj tega sklopa predavanj je študentom podati znanje o sodobnih metodah ekološkega modeliranja za potrebe razumevanja strukture in delovanja ekosistemov in za objektivno napovedovanje njihovega obnašanja. Študenti bodo pridobili metodološka znanja potrebna za izgradnjo kvalitativnih in kvantitativnih ekoloških modelov, ki jim bodo omogočala pridobivanje novih znanj o obnašanju preučevanega ekosistema (modeli za razlago), sposobni bodo napovedati njegovo obnašanje (napovedni modeli) in graditi modele za upravljanje teh sistemov (modeli za podporo odločanja).	The main of objective of the course is to provide students with knowledge about modern methods of ecological modelling that will enable them to understand the structure and functioning of ecosystems and to make reliable predictions of their behaviour. Students will acquire methodological skills needed to build a qualitative and quantitative ecological models that will allow them to gain new knowledge about the behaviour of the studied ecosystems (models for explanation), to predict their behaviour (predictive models) and to build models for the management of these systems (decision support models).

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje:	Knowledge and understanding:

Študenti bodo sposobni uporabljati obravnavane metode in orodja ekološkega modeliranja na praktičnih primerih.	Students will be able to apply studied modelling methods and tools on particular research cases.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predmet sestavljajo predavanja, vaje in seminar. Vsakem vsebinskemu sklopu predavanj sledijo računalniške vaje o uporabi specifičnih orodij za ekološko modeliranje (STELLA, WEKA, DEXi). Študenti rezultate predstavijo v seminarski nalogi.	The course consists of lectures, exercises and seminar work. Each part of the lecture is followed by exercises about the application of particular modelling tools (e.g., STELLA, WEKA, DEXi). Students present their results in a seminar work.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
- Uspešna predstavitev seminarske naloge.	60,00 %	- Successful presentation of a seminar work.
- Pisni izpit.	40,00 %	- Written exam.

Ocenjevalna lestvica:	**Grading system:**
5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

Debeljak Marko

1. DERGAN, Tanja, IVANOVSKA, Aneta, KOCJANČIČ, Tina, IANNETTA, Pietro, DEBELJAK, Marko. 'Multi-SWOT' multi-stakeholder-based sustainability assessment methodology : applied to improve Slovenian legume-based agri-food chains. Sustainability. 2022, vol. 14, no. 22, str. 15374-1-15374-26. ISSN 2071-1050. https://www.mdpi.com/2071-1050/14/22/15374, DOI: 10.3390/su142215374. [COBISS.SI-ID 130411779]
2. ROZMAN, Renata, TOME, Davorin, DEBELJAK, Marko. A multi-level system for planning compensatory habitats as a new tool to prevent biodiversity loss in protected areas due to development plans. Periodicum biologorum : an interdisciplinary international journal of the Societas Scientiarum Naturalium Croatica established 1885. 2021, vol. 123, no. 1/2, str. 7-18. ISSN 0031-5362. DOI: 10.18054/pb.v123i1-2.7161. [COBISS.SI-ID 112291075]
3. ZWETSLOOT, Marie, DEBELJAK, Marko, et al. Soil multi-functionality : synergies and trade-offs across European climatic zones and land uses. European journal of soil science. [Print ed.]. [in press] 2020, 43 str. ISSN 1351-0754. DOI: 10.1111/ejss.13051. [COBISS.SI-ID 31289347]
4. WALL, David P., DELGADO, Antonio, O'SULLIVAN, Lilian, CREAMER, Rachel, IVANOVSKA, Aneta, KUZMANOVSKI, Vladimir, HENRICKSEN, Christian B., DEBELJAK, Marko. A decision support model for assessing the water regulation and purification potential of agricultural soils across Europe. Frontiers in sustainable food systems. 2020, vol. 4, str. 115-1-115-11. ISSN 2571-581X. DOI: 10.3389/fsufs.2020.00115. [COBISS.SI-ID 21854979]
5. DEBELJAK, Marko, IVANOVSKA, Aneta, KUZMANOVSKI, Vladimir, et al. A field-scale decision support system for assessment and management of soil functions. Frontiers in environmental science. 2019, vol. 7, str. 115-115-14. ISSN 2296-665X. DOI: 10.3389/fenvs.2019.00115. [COBISS.SI-ID 32549671]
6. SANDÉN, Taru, IVANOVSKA, Aneta, SPIEGEL, Heide, KUZMANOVSKI, Vladimir, SABY, Nicolas, PICAUD, Calypso, HENRIKSEN, Christian B. H., DEBELJAK, Marko. Development of an agricultural primary productivity decision support model : a case study in France. Frontiers in environmental science. 2019, vol. 7, str. 58-1-58-13. ISSN 2296-665X. DOI: 10.3389/fenvs.2019.00058. [COBISS.SI-ID 32342311],
7. IVANOVSKA, Aneta, SPIEGEL, Heide, DEBELJAK, Marko, SANDÉN, Taru. Using data mining techniques to model primary productivity from international long-term ecological research (ILTER) agricultural experiments in Austria. Regional environmental change. 2019, vol. 19, no. 3, str. 325-337. ISSN 1436-3798. DOI: 10.1007/s10113-018-1361-3. [COBISS.SI-ID 31437607
8. DEBELJAK, Marko, FICKO, Andrej, BRUS, Robert. The use of habitat and dispersal models in protecting European black poplar (Populus nigra L.) from genetic introgression in Slovenia. Biological Conservation. [Print ed.]. apr. 2015, vol. 184, str. 310-319, ilustr. ISSN 0006-3207. http://dx.doi.org/10.1016/j.biocon.2015.02.004, DOI: 10.1016/j.biocon.2015.02.004. [COBISS.SI-ID 28412711]

METODE EKSTRAKCIJE IN ANALIZE SEKUNDARNIH METABOLITOV V RASTLINAH

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Metode ekstrakcije in analize sekundarnih metabolitov v rastlinah
Course title:	Extraction and analitical methods of plants secondary metabolites
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (v postopku)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037306
Koda učne enote na članici/UL Member course code:	3808

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
10	30	0	0	5	80	5

Nosilec predmeta/Lecturer:	Robert Veberič

Izvajalci predavanj:	Maja Mikulič Petkovšek, Robert Veberič
Izvajalci seminarjev:	
Izvajalci vaj:	
Izvajalci kliničnih vaj:	
Izvajalci drugih oblik:	
Izvajalci praktičnega usposabljanja:	

Vrsta predmeta/Course type:	teoretični/theoretical

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
splošni pogoji za vpis na doktorski študij	Basic preconditions for doctoral studies

Vsebina:	Content (Syllabus outline):
Predstavljena bo razdelitev sekundarnih metabolitov pri čemer bo poudarek na fenolih in karotenoidih ter spoznavanje njihovih lastnosti (topnost v različnih topilih, obstojnost pri različnih temperaturah, pH, svetlobi), ki so pomembne za ekstrakcijo in analizo. Predstavljena bo vloga posameznih skupin sekundarnih metabolitov v rastlinah in njihova ekološka funkcija (atraktanti, repelenti, alelopatske	The classification of secondary metabolites will be presented with an emphasis on phenols and carotenoids as well as information on their properties (solubility in various solvents, stability at different temperatures, pH levels, and light). All these factors are important for extraction and further analysis. The role of individual groups of secondary metabolites and their ecological function (attractants, repellents,

snovi, zaščita pred okoljskimi dejavniki,…). Na uporabnih primerih bo predstavljena vsebnost sekundarnih metabolitov v različnih organih rastlin kot so plodovi, listi, cvetovi, kakor tudi spreminjanje njihove vsebnosti med rastno dobo ter njihova aktivnost. Pregledale se bodo sinteznih poti pomembnejših sekundarnih metabolitov ter možnosti kako s tehnološkimi ukrepi ali okoljskimi dejavniki vplivati na spremembo vsebnosti teh snovi v rastlinah. Za pomembnejše skupine sekundarnih metabolitov bodo predstavljene izbrane metode ekstrakcije in njihova analiza na različnih aparaturah kot so spektrofotometer, HPLC, MS, itd. ter ugotavljanje aktivnosti nekaterih ključnih encimov sinteznih poti. Prav tako bo predstavljen pomen sekundarnih metabolitov za kakovost živil rastlinskega izvora.	alelopathic compounds, protection against environmental factors ...) will be discussed. The content of secondary metabolites will be practically determined in different plant organs such as fruits, leaves, flowers and the changes during the growing season compared with their activity. The major synthesis paths of secondary metabolites will be reviewed and the influence of technological measures or environmental factors on the levels of secondary metabolites explained. Selected extraction methods will be presented for major groups of secondary metabolites and analytical procedures performed on different machines such as spectrophotometers, HPLC, MS, etc. The activity of certain key enzymes of synthesis paths will be determined. The importance of secondary metabolites for the quality of food of plant origin will be discussed.

Temeljna literatura in viri/Readings:

Buchanan, B. B., 2015. Biochemistry & molecular biology of plants. Chichester ; Oxford ; Hoboken (NJ) : Wiley Blackwell, cop. 1264 str. ISBN - 978-0-470714-22-5
Michael W. 2010. Biochemistry of Plant Secondary Metabolism (Annual Plant Reviews S.). Sheffield Academic Press, 464 str. ISBN 978-1405183970
Revijalni članki s področja, tekoča periodika, druga učna gradiva…
Articles from scientific journals, current magazines, other readings …

Cilji in kompetence:	**Objectives and competences:**
Cilj je suvereno poznavanje skupin sekundarnih snovi v rastlinah in njihovih lastnosti ter načini ekstrakcije in analize.	The aim of the course is advanced knowledge on plant's secondary metabolites, their properties, extraction and analytical methods.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Študent razume posebnosti različnih skupin sekundarnih metabolitov in je sposoben uporabiti ustrezna metode, jih ustrezno modificirati ali ustvariti nove glede na skupino snovi in rastlinski material za ekstrakcijo.	Knowledge and understanding: Students understand the characteristics of specific groups of secondary metabolites and are able to choose the correct extraction method, apply modifications or perform new ones appropriate for plant tissue and group of secondary metabolites.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, izdelava seminarske naloge	Lectures, seminar work.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Seminar, zagovor seminarja	100,00 %	Seminar work and its presentation.

Ocenjevalna lestvica:	**Grading system:**
5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

prof. dr. Robert VEBERIČ
1. DRAGIŠIĆ MAKSIMOVIĆ, Jelena, MILIVOJEVIĆ, Jasminka M., DJEKIC, Ilija, RADIVOJEVIĆ, Dragan, VEBERIČ, Robert, MIKULIČ PETKOVŠEK, Maja. Changes in quality characteristics of fresh

blueberries : Combined effect of cultivar and storage conditions. Journal of food composition and analysis. 2022, art. no. 104597, vol. 111, str. 1-9, ilustr. ISSN 0889-1575. [COBISS.SI-ID 107285251],
2. MEDIČ, Aljaž, JAKOPIČ, Jerneja, HUDINA, Metka, SOLAR, Anita, VEBERIČ, Robert. Identification and quantification of major phenolic constituents in Juglans regia L. leaves : healthy vs. infected leaves with Xanthomonas campestris pv. juglandis using HPLC- MS/MS. Journal of King Saud University. Science : Elektronski vir. [Online ed.]. 2022, vol. 34, iss. 3, 9 str., art. 101890, ilustr. ISSN 2213-686X. https://www.sciencedirect.com/science/article/pii/S1018364722000714?via%3Dihub, DOI: 10.1016/j.jksus.2022.101890. [COBISS.SI-ID 96667651],
3. MUTAVSKI, Zorana, NASTIĆ, Nataša, ŽIVKOVIĆ, Jelena, ŠAVIKIN, Katarina, VEBERIČ, Robert, MEDIČ, Aljaž, PASTOR, Kristian, JOKIĆ, Stela, VIDOVIĆ, Senka. Black elderberry press cake as a source of bioactive ingredients using green-based extraction approaches. Biology. 2022, vol. 11, iss. 10, art. 1465, 15 str., ilustr. ISSN 2079-7737. https://www.mdpi.com/2079-7737/11/10/1465, DOI: 10.3390/biology11101465. [COBISS.SI-ID 124868355],
4. MEDIČ, Aljaž, JAKOPIČ, Jerneja, HUDINA, Metka, SOLAR, Anita, VEBERIČ, Robert. Identification and quantification of major phenolic constituents in Juglans regia L. leaves : healthy vs. infected leaves with Xanthomonas campestris pv. juglandis using HPLC- MS/MS. Journal of King Saud University. Science : Elektronski vir. [Online ed.]. 2022, vol. 34, iss. 3, 9 str., art. 101890, ilustr. ISSN 2213-686X. https://www.sciencedirect.com/science/article/pii/S1018364722000714?via%3Dihub, DOI: 10.1016/j.jksus.2022.101890. [COBISS.SI-ID 96667651],
5. GROHAR, Mariana Cecilia, MEDIČ, Aljaž, IVANČIČ, Tea, VEBERIČ, Robert, JOGAN, Jernej. Color variation and secondary metabolites' footprint in a taxonomic complex of Phyteuma sp. (Campanulaceae). Plants. 2022, vol. 11, iss. 21, 2894, str. 1-15, ilustr. ISSN 2223-7747. https://www.mdpi.com/2223-7747/11/21/2894, DOI: 10.3390/plants11212894. [COBISS.SI-ID 128980483],
6. MEDIČ, Aljaž, ZAMLJEN, Tilen, HUDINA, Metka, SOLAR, Anita, VEBERIČ, Robert. Seasonal variations of naphthoquinone contents (juglone and hydrojuglone glycosides) in Juglans regia L. *Scientia horticulturae*. [Print ed.]. 2022, vol. 300, art. 111065, 10 str. ISSN 0304-238. https://www.sciencedirect.com/science/article/pii/S030442382200190X, DOI: 10.1016/j.scienta.2022.111065. [COBISS.SI-ID 101611779],

izr. prof. dr. Maja MIKULIČ PETKOVŠEK
1. MIKULIČ PETKOVŠEK, Maja, KORON, Darinka, RUSJAN, Denis. The impact of food processing on the phenolic content in products made from juneberry (Amelanchier lamarckii) fruits. *Journal of food science*. 2020, vol. 85, iss. 2, str. 386-393. ISSN 0022-1147. DOI: 10.1111/1750-3841.15030. [COBISS.SI-ID 9455481],
2. MIKULIČ PETKOVŠEK, Maja, VEBERIČ, Robert, HUDINA, Metka, MIŠIČ, Eva. HPLC-DAD-MS identification and quantification of phenolic components in japanese knotweed and american pokeweed extracts and their phytotoxic effect on seed germination. *Plants*. 2022, vol. 11, iss. 22, art. 3053, 16 str., ilustr. ISSN 2223-7747. https://www.mdpi.com/2223-7747/11/22/3053, DOI: 10.3390/plants11223053. [COBISS.SI-ID 132510979]
3. ŠOLA, Ivana, POLJUHA, Danijela, MIKULIČ PETKOVŠEK, Maja, DAVOSIR, Dino, PINTERIĆ, Marija, BILIĆ, Josipa, VEBERIČ, Robert, HUDINA, Metka, RUSAK, Gordana. Biopotential of underutilized Rosaceae inflorescences : LC-DAD-MS phytochemical profiles associated with antioxidant, antidiabetic, anti-inflammatory and antiproliferative activity in vitro. *Plants*. 2022, vol. 11, no. 3 (270), str. 1-19, ilustr. ISSN 2223-7747. https://www.mdpi.com/2223-7747/11/3/271, DOI: 10.3390/plants11030271. [COBISS.SI-ID 94414339]
4. GAČNIK, Saša, VEBERIČ, Robert, HUDINA, Metka, MARINOVIC, Silvija, HALBWIRTH, Heidi, MIKULIČ PETKOVŠEK, Maja. Salicylic and methyl salicylic acid affect quality and phenolic profile of apple fruits three weeks before the harvest. *Plants*. 2021, vol. 10, iss. 9, str. 1-15, ilustr. ISSN 2223-7747. https://www.mdpi.com/2223-7747/10/9/1807, DOI: 10.3390/plants10091807. [COBISS.SI-ID 74702595]
5. ŠENICA, Mateja, MIKULIČ PETKOVŠEK, Maja. Changes in beneficial bioactive compounds in eight traditional herbal liqueurs during one-month maceration process. *Journal of the science of food and agriculture*. [Print ed.]. 2020, vol. 100, iss. 1, str. 343-353. ISSN 0022-5142. DOI: 10.1002/jsfa.10044. [COBISS.SI-ID 9357689]
6. ŠENICA, Mateja, MLINŠEK, Gregor, VEBERIČ, Robert, MIKULIČ PETKOVŠEK, Maja. Which plant part of purple coneflower (Echinacea purpurea (L.) Moench) should be used for tea and which for tincture?. *Journal of medicinal food*. 2019, vol. 22, iss. 1, str. 102-108. ISSN 1096-620X. DOI: 10.1089/jmf.2018.0026. [COBISS.SI-ID 9055609]

METODE RAZISKOVANJA PSIHOLOŠKEGA PROFILA PRI ŽIVALIH

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Metode raziskovanja psihološkega profila pri živalih
Course title:	Assessment methods of psychological profile in animals
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (v postopku)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code: 0643582

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
0	10	10	0	5	100	5

Nosilec predmeta/Lecturer:	Manja Zupan Šemrov
Izvajalci predavanj:	Manja Zupan Šemrov
Izvajalci seminarjev:	Manja Zupan Šemrov
Izvajalci vaj:	
Izvajalci kliničnih vaj:	
Izvajalci drugih oblik:	
Izvajalci praktičnega usposabljanja:	
Vrsta predmeta/Course type:	individualno raziskovalni /individual research

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Splošni pogoji za vpis na doktorski študij	General conditions for enrollment in doctoral studies.

Vsebina:	Content (Syllabus outline):
Teoretičen del predmeta bo razdeljen na pet delov; - Zgodovinsko ozadje psiholoških poskusov na živalih (začetki psihološkega raziskovanja živali, pomembni poskusi in raziskovalci, problematika raziskovalnega področja) - Psihologija osebnosti (osnovni koncepti in pojmi, metode raziskovanja osebnosti in lastnosti osebnosti pri različnih živalskih vrstah s poudarkom na vedenjskih testih osebnosti)	The theoretical part of the course is divided into five parts; - Historical background of animal psychological research (beginnings of animal psychological research, important experiments and researchers, problems in this research field) - Personality psychology (basic concepts and terminology, methods of personality research and

- Socialna psihologija (metode raziskovanja znotraj socialne psihologije pri različnih živalskih vrstah s poudarkom na testih obnašanja za merjenje konceptov kot so navezanost in pro-socialno obnašanje) - Kognitivna psihologija (metode raziskovanja mentalnih procesov pri različnih živalskih vrstah, s poudarkom na pripomočkih in testih obnašanja za ocenjevanje zmožnosti reševanja problemov in raziskovanje spomina) - Psihofiziologija (pomembni kardiovaskularni in nevroendokrini fiziološki parametri, metode za merjenje fizioloških sprememb kot posledica psiholoških dogodkov; npr. termokamera, merilec srčnega utripa) Praktičen del predmeta bo vključeval oblikovanje poskusa v tematiki, pomembni za individualno delo študenta/ke. Delo bo vključevalo pripravo načrta poskusa in uporabo metodoloških pristopov in pripomočkov (npr. programska oprema za kodiranje obnašanja), predstavljenih v teoretičnem delu. Za prostor in opremo bo poskrbel nosilec predmeta.	personality traits in different animal species, with emphasis on behavioural personality tests) - Social psychology (research methods within social psychology in various animal species with emphasis on behavioural tests to measuring concepts such as attachment and pro-social behaviour) - Cognitive psychology (methods for studying mental processes in various animal species, with emphasis on instruments and behavioural tests for assessing problem-solving skills and evaluating memory) - Psychophysiology (important cardiovascular and neuroendocrine physiological parameters, methods for measuring physiological changes as a result of psychological events; e.g., thermocamera, heart rate monitor) The practical part of the course involves the design of an experiment on a topic relevant to the student's individual work. The work includes the design of an experimental plan and the use of the methodological approaches and equipment presented in the theoretical part (e.g., behaviour coding software). The room and equipment will be provided by the lecturer.

Temeljna literatura in viri/Readings:

Carere, C., Maestripieri, D. 2013. Animal Personalities: Behavior, Physiology, and Evolution. University of Chicago Press: 507 str., ISBN-10: 0226921972 , ISBN-13: 978-0226921976

Rayment, D.J., De Groef, B., Peters, R.A., Marston, L.C. 2015. Applied personality assessment in domestic dogs: Limitations and caveats. Applied Animal Behaviour Science, 163: 1–18. doi: 10.1016/j.applanim.2014.11.020

Stamps, J., Groothuis, T.G. 2010. The development of animal personality: relevance, concepts and perspectives. Biological reviews of the Cambridge Philosophical Society, 85(2): 301–325. doi: 10.1111/j.1469-185X.2009.00103.x

Wynne, C.D.L., Udell, M. 2020. Animal Cognition: Evolution, Behavior and Cognition. Bloomsburry Academic: 393 str., ISBN-10: 113761126X, ISBN-13: 978-1137611260

Cilji in kompetence:	**Objectives and competences:**
Cilj predmeta je poznavanje psiholoških konceptov in različnih metodoloških pristopov, ki se uporabljajo za raziskovanje psihološkega profila živali. Glavni poudarek je na uporabi testov obnašanja, kombiniranju metodoloških pristopov in interdisciplinarnemu raziskovanju.	The objective of the course is to become familiar with psychological concepts and various methodological approaches to the study of the psychological profile of animals. Emphasis is placed on the use of behavioural testing, combination of methodological approaches, and interdisciplinary research.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Razumevanje psihološkega raziskovanja pri živalih v teoriji in praksi ter kompetentnost za pripravo in izvedbo interdisciplinarnega psihološkega poskusa na izbrani vrsti živali.	Understanding of psychological research on animals in theory and practice and competence to prepare and conduct an interdisciplinary psychological experiment on the selected animal species.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Seminar, konzultacije, praktično delo.	Seminar, consultations, practical work.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
- individualni projekt	80,00 %	Individual project

- ustni izpit	20,00 %	Oral Exam

Ocenjevalna lestvica:	**Grading system:**
5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

Manja Zupan Šemrov

1. DEBELJAK, Nataša, KOŠMERLJ, Aljaž, ALTIMIRAS, Jordi, **ZUPAN ŠEMROV, Manja**. Relationship between anatomical characteristics and personality traits in Lipizzan horses. *Scientific reports*. 2022, vol. 12, art. 12618, str. 1-13, doi: 10.1038/s41598-022-16627-z [COBISS.SI-ID 116335619], IF (2021): RO (19/74), multidisciplinary sciences, x= 4.997
2. GOBBO, Elena, **ZUPAN ŠEMROV, Manja**. Dogs exhibiting high levels of aggressive reactivity show impaired self-control abilities. *Frontiers in veterinary science*. 2022, vol. 9, art. 869068, str. 1-10, doi: 10.3389/fvets.202869068. [COBISS.SI-ID 102304515], IF (2021): RO (13/145), veterinary sciences, x=3.471
3. GOBBO, Elena, **ZUPAN ŠEMROV, Manja**. Neuroendocrine and cardiovascular activation during aggressive reactivity in dogs. *Frontiers in veterinary science*. 2021, vol. 8. art. 683858, str. 1-12, doi: 10.3389/fvets.2021.683858. [COBISS.SI-ID 73062915], IF (2020): RO (9/146), veterinary sciences, x=412
4. ROKAVEC, Neža, **ZUPAN, Manja**. Psychological and physiological stress in hens with bone damage. *Frontiers in veterinary science*, ISSN 2297-1769, 2020, vol. 7, art. no. 589274, str. 1-10, doi: 10.3389/fvets.2020.58927 [COBISS.SI-ID 42687747], IF (2020): ZC (9/146), veterinary sciences, x=3.412
5. GOBBO, Elena, **ZUPAN, Manja**. Dogs' sociability, owners' neuroticism and attachment style to pets as predictors of dog aggression. *Animals,* 2020, vol. 10, no. 2, str. 1-15, e 315, doi: 10.3390/ani1002031 [COBISS.SI-ID 4355208], IF (2020): AD (13/63), agriculture, dairy & animal science, x= 2.752
6. **ZUPAN, Manja**, REHN, Therese, OLIVEIRA, Daiana de, MALOVRH, Špela, KEELING, Linda J. Individual play patterns stimulated by a familiar object are group-driven. *Scientific reports,* 2019, vol. 9, str. 1-8, [e]6092, doi: 10.1038/s41598-019-42382-9. [COBISS.SI-ID 4205192], IF (2019): RO (17/71), multidisciplinary sciences, x=3.998

METODE V EKOFIZIOLOGIJI RASTLIN IN EKOLOGIJI KOPENSKIH EKOSISTEMOV

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Metode v ekofiziologiji rastlin in ekologiji kopenskih ekosistemov
Course title:	Methods in plant ecophysiology and ecology of terrestrial ecosystems
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (v postopku)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037249
Koda učne enote na članici/UL Member course code:	3751

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
20	0	20	0	50	160	10

Nosilec predmeta/Lecturer:	Dominik Vodnik

Izvajalci predavanj:	Klemen Eler, Helena Šircelj, Dominik Vodnik
Izvajalci seminarjev:	
Izvajalci vaj:	
Izvajalci kliničnih vaj:	
Izvajalci drugih oblik:	
Izvajalci praktičnega usposabljanja:	

Vrsta predmeta/Course type:	teoretični/theoretical

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
splošni pogoji za vpis na doktorski študij	general conditions for enrolment in doctoral studies

Vsebina:	Content (Syllabus outline):
Predmet obravnava najpomembnejše metodološke pristope v proučevanju odziva (1) posameznih rastlinskih osebkov in (2) kopenskih ekosistemov na glavne okoljske, posebej abiotske dejavnike. Predstavljene metode so ovrednotene s stališča njihove objektivnosti, časovne in prostorske reprezentativnosti ter zahtevnosti za izvedbo.	The subject deals with most important methodological approaches used to study the response of 1) individual plants and 2) terrestrial ecosystems to main, mainly abiotic environmental factors. The introduced methods are evaluated with respect to their objectivity, temporal and spatial representativity and applicability.

Na ravni rastline so predstavljene metode za spremljanje fiziološkega in biokemijskega odziva rastlin na razpoložljivost svetlobe, vode in hranil, na temperaturni režim, na onesnažila v tleh, zraku in vodi, idr. Predstavljene metode na tem nivoju vrednotijo okoljske dejavnike z meritvami fotosinteze, dihanja rastline, rasti, listne površine, vodnega potenciala, vsebnosti pigmentov, antioksidantov in drugih primarnih in sekundarnih metabolitov. Na ekosistemski ravni so predstavljene metode, ki obravnavajo tokove snovi in energije skozi kopenske ekosisteme ter dejavnike, ki na to vplivajo. Težišče je na spremljanju (1) komponent ogljikovega cikla (bruto in neto primarna produkcija in dihanje ekosistema, neto ekosistemska produkcija, dihanje tal in njegove komponente, dekompozicija), (2) vodne bilance (evaporacija in transpiracija, odtok, intercepcija, razpoložljivost vode v tleh) ter (3) bilance mineralnih hranil (depozicija iz atmosfere, izpiranje, fiksacija N2, denitrifikacija). Med bolj detajlno predstavljenimi metodami so: meritve fotosinteze lista z IRGA analizatorji, HPLC in spektrofotometrične analize rastlinskih vzorcev, mikrometeorološke metode (eddy coovariance), meritve plinov s premičnimi komorami, stabilni izotopi (ogljik, kisik, vodik, dušik), transpiracijski tok v steblih/deblih, meritve listne površine z LAI analizatorji in fotografijo, vegetacijski indeksi in drugi biometrični postopki.	On the plant level different physiological and biochemical methods, aimed to study the response to light-, water- and nutrient-availability and to air-, soil- and water pollutants, are presented. These methods reveal the action of environmental factors on the level of photosynthesis, respiration, growth, leaf area, water potential, the content of pigments, antioxidants, and other primary and secondary metabolites. On the ecosystemic level, methods used in the studies of fluxes of matter and energy in the ecosystems and methods aimed to study the effects of different envrionmental factors on these fluxes, are presented. Here, the subject focuses on evaluation of 1) different components of the carbon cycle (gross and net primary production, ecosystem respiration, net ecosystem production, soil respiration and its components, decomposition), 2) water balance (evaporation and transpiration, drain off, interception, soil water availability) and 3) the balance of mineral nutrients (atmospheric deposition, leaching N2 fixation, denitrification). Methods presented in detail include: gas exchange measurements based on the use of IRGAs, HPLC and spectrophotometric analyses of plant samples; micrometeorological methods (eddy covariance), chamber-techniques used to measure fluxes of gases in the field, stable isotope techniques (carbon, oxygen, hydrogen, nitrogen); sap-flow techniques, leaf area index measurements (ceptometers, hemispheric photography); vegetation indexes and other biometric procedures.

Temeljna literatura in viri/Readings:

Znanstveni članki področja / Scientific articles from the field

Priporočena literatura /Suggested reading

Reigosa Roger M. J. 2001. Handbook of Plant Ecophysiology Techniques. Kluwer Academic Publishers, Dordrecht, 452 s., ISBN 0-7923-7053-8
Sánchez-Moreiras, A. M., Reigosa, M. J. 2018. Advances in Plant Ecophysiology Techniques. Springer, 497 s., ISBN 978-3-319-93232-3.
von Willert D.J., Matyssek R., Herppich W. 1995. Experimentelle Pflanzenökologie – Grundlagen und Anwendungen. Gerog Thieme Verlag Stuttgart, New York, 344s., ISBN 3-13-134401-6
Larcher, W. 2002. Physiological Plant Ecology. Ecophysiology and Stress Physiology of Functional Groups. četrta izdaja, Springer, Berlin: 506 s. ISBN 3-540-43516-6
Flexas J., Loreto F., Medrano H. 2012. Terrestrial Photosynthesis in a Changing Environment. Cambridge University Press, Cambridge, 728 s.ISBN 978-0-521-89941-3
Chapin III, F.S., Matson, P.A., Vitousek, P. 2012. Principles of Terrestrial Ecosystem Ecology, 2nd ed. Springer, Berlin: 529 p. ISBN 978-1-4419-9502-5
Sala, O.E., Jackson, R.B., Mooney, H.A., Howarth, R.W. (Eds.). 2000. Methods in Ecosystem Science. Springer, New York: 421 p. ISBN: 978-0-387-98743-9
Waxmundska-Hajnos, M., Sherma, J.2010. High performance liquid chromatography in phytochemical analyses. CRC Press, 975 s. ISBN: 978-1-4200-9260-8

Cilji in kompetence:	**Objectives and competences:**
Cilji predmeta so študentu približati znanstveno-raziskovalno delo na področju ekofiziologije rastlin	Aims of the class: to make the student familiar with scientific research work in the field of the

ter ekosistemske ekologije ter ga seznaniti z naborom raziskovalnih metod, ki se pri tem delu uporabljajo.	ecophysiology of plants and ecosystem ecology and to introduce avaliable research methods which can be used in this work.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Študent pozna nabor najpomembnejših metod, ki se uporabljajo v ekofiziologiji in ekologiji kopenskih ekosistemov, njihov glavni namen ter prednosti in slabosti. Za določen namen raziskovanja zna izbrati ustrezne metode, jih ovrednotiti s stališča objektivnosti, ponovljivosti in uporabnosti. Zna jih uporabiti v raziskavah odziva rastlin in ekosistemov v eksperimentalnih ali naravnih razmerah. Sposoben je načrtovanja raziskovalnega dela ter sinteze in analize dokaj širokega spektra znanj na področju rastlinske ekofiziologije in ekosistemske ekologije ter sorodnih ved.	Knowledge and understanding: The student gets to know basic methods used in ecophysiology and the ecology of terrestrial ecosystems; their applicability, advantages and disadvantages. He/she is able to select appropriate methods for a given research problem/question and can critically evaluate their objectivity, repeatibility and applicability. He/she is able to apply these methods when studying responses on plant or ecosystem level, both in experimental and environmental conditions. Student can plan research work, he/she is able to make synthesis and analyses of broad spectra of knolwdges from the field of plant ecophysiology, ecosystem ecology and related fields of science.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Študenti se na predavanjih in laboratorijskih vajah seznanijo z osnovami metod. Te kasneje uporabijo v okviru projektnega dela, ki ga izvedejo na terenu ali v kontroliranih razmerah v laboratoriju oz.rastlinjaku. Rezultate projekta predstavijo.	With lectures and lab exercises students are introduecd to basics of different methods. Later they use selected methods in their project work, which can be performed in the field or under controlled conditions (lab, greenhouse). They present the results of the project.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Izpit	50,00 %	Exam
Projektno delo	50,00 %	Project work

Ocenjevalna lestvica:	**Grading system:**
5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

DOMINIK VODNIK

1. MUROVEC, Jana ; ERŽEN, Jan Jurij ; FLAJŠMAN, Marko ; **VODNIK, Dominik** Analysis of morphological traits, cannabinoid profiles, THCAS gene sequences, and photosynthesis in wide and narrow leaflet high-cannabidiol breeding populations of medical Cannabis. *Frontiers in Plant Science* [Elektronski vir]. - ISSN 1664-462X. - Vol. 13, art. no. 786161, 15 str.COBISS.SI-ID 99091459
2. GRIČAR, Jožica ; JEVŠENAK, Jernej ; HAFNER, Polona ; PRISLAN, Peter ; FERLAN, Mitja; LAVRIČ, Martina ; **VODNIK, Dominik** ; ELER, Klemen. Climatic regulation of leaf and cambial phenology in *Quercus pubescens* : their interlinkage and impact on xylem and phloem conduits. *Science of the Total Environment*. - ISSN 0048-9697. – 202 Vol. 802, art. 149968, str. 1-13. COBISS.SI-ID 75293699
3. VODNIK, Dominik ; VOGRIN, Žiga ; ŠIRCELJ, Helena ; GROHAR, Mariana Cecilia ; MEDIČ, Aljaž ; CAROVIĆ-STANKO, Klaudija ; SAFNER, Toni ; LAZAREVIĆ, Boris Phenotyping of basil (*Ocimum basilicum* L.) illuminated with UV-A light of different wavelengths and intensities. *Scientia Horticulturae*. - ISSN 0304-4238. – 2022. Vol. 309, art. 111638, 10 str. COBISS.SI-ID 129026307
4. GRIČAR, Jožica ; HAFNER, Polona ; LAVRIČ, Martina ; FERLAN, Mitja ; OGRINC, Nives ; KRAJNC, Bor ; ELER, Klemen ; **VODNIK, Dominik** Post-fire effects on development of leaves and secondary vascular tissues in *Quercus pubescens*. *Tree Physiology* [Elektronski vir]. - ISSN 1758-4469. – 2020. Vol. 40, iss. 6, str. 796-809. COBISS.SI-ID 5648294

5. VODNIK, Dominik ; GRIČAR, Jožica ; LAVRIČ, Martina ; FERLAN, Mitja ; HAFNER, Polona ; ELER, Klemen. Anatomical and physiological adjustments of pubescent oak (*Quercus pubescens* Willd.) from two adjacent sub-Mediterranean ecosites. *Environmental and Experimental Botany*. - ISSN 0098-8472. – 2019. Vol. 165, str. 208-2018
6. VODNIK, Dominik ; THOMALLA, A. ; FERLAN, Mitja ; LEVANIČ, Tom ; ELER, Klemen; OGRINC, Nives ; WITTMANN, Christiane ; PFANZ, Hardy. Atmospheric and geogenic CO2 within the crown and root of spruce (Picea abies L. Karst.) growing in a mofette area. *Atmospheric Environment*. - ISSN 1352-2310. – 2018. Vol. 182, str. 286-295. COBISS.SI-ID 5047718

KLEMEN ELER
1. GRIČAR, Jožica ; JEVŠENAK, Jernej ; HAFNER, Polona ; PRISLAN, Peter ; FERLAN, Mitja; LAVRIČ, Martina ; VODNIK, Dominik ; ELER, Klemen. Climatic regulation of leaf and cambial phenology in Quercus pubescens : their interlinkage and impact on xylem and phloem conduits. Science of the Total Environment. - ISSN 0048-9697. – 2022. Vol. 802, art. 149968, str. 1-13. COBISS.SI-ID 75293699
2. VODNIK, Dominik ; GRIČAR, Jožica ; LAVRIČ, Martina ; FERLAN, Mitja ; HAFNER, Polona ; ELER, Klemen. Anatomical and physiological adjustments of pubescent oak (Quercus pubescens Willd.) from two adjacent sub-Mediterranean ecosites. Environmental and Experimental Botany. - ISSN 0098-847 – 2019. Vol. 165, str. 208-2018
3. ELER, Klemen, KERMAVNAR, Janez, MARINŠEK, Aleksander, KUTNAR, Lado. Short-term changes in plant functional traits and understory functional diversity after logging of different intensities : a temperate fir-beech forest experiment. Annals of forest research. 2018, vol. 61, iss. 2, str. 223-241
4. ČOP, Jure, ELER, Klemen. Effect of fertiliser application and cutting regime on temporal differentiation of mesic semi-natural grassland vegetation. Italian journal of agronomy. 2019, vol. 14, no. 3, str. 153-161
5. MRAK, Tanja, ELER, Klemen, BADEA, Ovidiu, HOSHIKA, Yasutomo, CARRARI, Elisa, PAOLETTI, Elena, KRAIGHER, Hojka. Elevated ozone prevents acquisition of available nitrogen due to smaller root surface area in poplar. Plant and soil. [Print ed.]. 2020, vol. 450, iss. 1-2, str. 585-599
6. KERMAVNAR, Janez, ELER, Klemen, MARINŠEK, Aleksander, KUTNAR, Lado. Initial understory vegetation responses following different forest management intensities in Illyrian beech forests. Applied vegetation science : official organ of the International Association for Vegetation Science. [Tiskana izd.]. Jan. 2019, vol. 22, iss. 1, str. 48-60, ilustr. ISSN 1402-2001

HELENA ŠIRCELJ
1. VOŠNJAK, Matej, **ŠIRCELJ, Helena**, VODNIK, Dominik, USENIK, Valentina. Physio-biochemical responses of sweet cherry leaf to natural cold conditions. *Plants*. 2022, vol. 11, iss. 24, 3507, 11 str., ilustr. ISSN 2223-7747. https://www.mdpi.com/2223-7747/11/24/3507, DOI: 10.3390/ plants11243507. [COBISS.SI-ID 133908227], [JCR, SNIP]
2. VODNIK, Dominik, VOGRIN, Žiga, **ŠIRCELJ, Helena**, GROHAR, Mariana Cecilia, MEDIČ, Aljaž, CAROVIĆ-STANKO, Klaudija, SAFNER, Toni, LAZAREVIĆ, Boris. Phenotyping of basil (Ocimum basilicum L.) illuminated with UV-A light of different wavelengths and intensities. *Scientia horticulturae*. [Print ed.]. 2023, vol. 309, art. 111638, 10 str. ISSN 0304-4238.
https://www.sciencedirect.com/science/article/pii/S0304423822007531, DOI: 10.1016/j.scienta.2022.111638. [COBISS.SI-ID 129026307], [JCR, SNIP, Scopus]
3. KACJAN-MARŠIĆ, Nina, ŠTOLFA, Petra, VODNIK, Dominik, KOŠMELJ, Katarina, MIKULIČ PETKOVŠEK, Maja, KUMP, Bojka, VIDRIH, Rajko, KOKALJ SINKOVIČ, Doris, PISKERNIK, Saša, FERJANČIČ, Blaž, DRAGUTINOVIĆ, Maja, VEBERIČ, Robert, HUDINA, Metka, **ŠIRCELJ, Helena**. Physiological and biochemical responses of ungrafted and grafted bell pepper plants (Capsicum annuum L. var. grossum (L.) Sendtn.) grown under moderate salt stress. *Plants*. 2021, vol. 10, no. 2, str. 1-19 (314). ISSN 2223-7747.
4. ŠIRCELJ, Helena, VIDRIH, Rajko, VEBERIČ, Robert, MIKULIČ PETKOVŠEK, Maja. Evaluation of bioactive constituents in European bladdernut (Staphylea pinnata L.) seed kernels. *Journal of food composition and analysis*. 2019, vol. 78, str. 33-41, ilustr. ISSN 0889-1575. DOI: 10.1016/j.jfca.2019.01.017. [COBISS.SI-ID 9162873], [JCR, SNIP, WoS, Scopus]
5. KACJAN-MARŠIĆ, Nina, VODNIK, Dominik, MIKULIČ PETKOVŠEK, Maja, VEBERIČ, Robert, **ŠIRCELJ, Helena**. Photosynthetic traits of plants and the biochemical profile of tomato fruits are influenced by grafting, salinity stress and growing season. *Journal of agricultural and food chemistry*. 2018, vol. 66, no. 22, str. 5439-5450. ISSN 0021-8561. DOI: 10.1021/acs.jafc.8b00169. [COBISS.SI-ID 8978041],
6. ŠIRCELJ, Helena, MIKULIČ PETKOVŠEK, Maja, VEBERIČ, Robert, HUDINA, Metka, SLATNAR, Ana. Lipophilic antioxidants in edible weeds from agricultural areas. *Turkish journal of agriculture and forestry*.

[Tiskana izdaja]. 2018, vol. 42, no. 1, str. 1-10. ISSN 1300-011X. DOI: 10.3906/tar-1707-25. [COBISS.SI-ID 8864377]

METODE ZA OCENO STANJA LESA IN LIGNOCELULOZNIH MATERIALOV V ZGODOVINSKIH IN NOVEJŠIH ZGRADBAH

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Metode za oceno stanja lesa in lignocelulozni materialov v zgodovinskih in novejših zgradbah
Course title:	Methods for the assessment of the condition of timber and lignocellulosic materials in historic and new buildings
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (v postopku)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code: 0643577

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
0	10	15	0	0	100	5

Nosilec predmeta/Lecturer:	Boštjan Lesar
Izvajalci predavanj:	Boštjan Lesar
Izvajalci seminarjev:	Boštjan Lesar
Izvajalci vaj:	
Izvajalci kliničnih vaj:	
Izvajalci drugih oblik:	
Izvajalci praktičnega usposabljanja:	
Vrsta predmeta/Course type:	individualno raziskovalni /individual research

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Splošni pogoji za vpis na doktorski študij	General conditions for admission to the doctoral programme

Vsebina:	Content (Syllabus outline):
Velik delež premične in nepremične kulturnozgodovinske dediščine je v celoti ali delno izdelan iz lesa. Poleg tega v zadnjem obdobju les kot material pridobiva pomen tudi v gradbenih aplikacijah.	A large part of the movable and immovable cultural heritage is made entirely or partly of wood. In addition, wood as a material has recently become increasingly important in the construction industry. Wood and other lignocellulosic materials in buildings are exposed to abiotic and biotic decomposition

Les in ostali lignocelulozni materiali v zgradbah so izpostavljeni delovanju abiotskih in biotskih dejavnikom razkroja. Glivni razkroj je predvsem posledica povišane vlažnosti, med tem ko je delovanje lesnih insektov teže napovedati. Zaradi delovanja omenjenih dejavnikov razkroja, na lesu in drugih lignocelulozni materialih pogosto pride do poškodb, ki lahko vodijo celo do porušitve objektov. Eden ključnih dejavnikov za porušitev lesenih objektov je poleg ognja ravno glivni razkroj. Študenti se najprej seznanijo z vzroki za pojav poškodb lesa v zgradbah ter najpogostejšimi poškodbami. Za odkrivanje napak in oceno stanja lesa v zgradbah in drugi premični kulturni dediščini uporabljamo različne tehnike. Podrobno bomo spoznali; vizualno ocena stanja z uporabo noža, analizo prisotnosti spor, elementno analizo XRF, teste z ne destruktivno metodo določanja modula elastičnosti, oceno gostote z izvlekom vijaka, uporovno vrtanje. Vse te metode so primerne za oceno stanja v kulturnozgodovinskih kot tudi novejših zgradbah. Slušatelji natančno spoznajo vse omenjene metode pri praktičnih vajah in jih na praktičnih primerih preizkusijo. Seznani se z uporabo IR kamere in njeno uporabo za detekcijo puščanja vode, toplotnih mostov in analize kakovosti toplotnega ovoja. Poleg tega se spoznajo s pravilnim ne invazivnim vzorčenjem materiala za nadaljnje laboratorijske analize. Od laboratorijskih analiz se osredotočimo na različne mikroskopske tehnike ter metode za določanje osnovnih fizikalnih lastnosti. V zgradbah kjer se pojavijo poškodbe zaradi povišane vlažnosti in delovanja gliv izvajamo vzorčenje zraka ter določamo število spor. Velika količina spor v zraku namreč negativno vpliva na zdravje ljudi v takšnih zgradbah. V nadaljevanju se osredotočimo na tehnike sanacije poškodb lesa in lignocelulozni materialov v zgradbah, dostopne biocidne proizvode in tehnike nanašanja in nebiocidne tehnike represivne zaščite lesa, kot so segrevanje, obdelava z mikrovalovi. Spoznamo najnovejše trende kontinuiranega spremljanja vlažnosti lesa v zgradbah ter njihov pomen pri hitrem (pravočasnem) odkrivanju napak ter zmanjšanju stroškov sanacij.	factors. Decay by fungi is mainly caused by increased moisture content, while the effect of wood-boring insects is more difficult to predict. As a result of these decomposition factors, wood and other lignocellulosic materials are often damaged, which can even lead to building collapse. In addition to fire, fungal decay is one of the major factors in the collapse of timber buildings. Students will first learn about the causes of wood damage in buildings and the most common types of damage. Various techniques are used to identify defects and assess the condition of wood in buildings and other immovable cultural heritage. Specifically, we will learn: visual condition assessment with a knife, spore presence analysis, XRF elemental analysis, non-destructive elastic modulus testing, density determination by screw extraction, resistance drilling. All of these methods are suitable for condition assessment of both cultural historical and recent structures. Students learn all these methods in detail and try them out on practical examples. They learn about the use of the camera IR and its application for water leak detection, thermal bridges and quality analysis of the thermal envelope. They will also learn the correct non-invasive collection of material samples for further laboratory analysis. For laboratory analysis, we focus on various microscopic techniques and methods for determining basic physical properties. In buildings where damage occurs due to increased misture content and fungal activity, we perform air sampling and determine the number of spores. This is because high levels of spores in the air have a negative impact on the health of the occupants of such buildings. Below, we focus on techniques for remediating wood and lignocellulosic damage in buildings, available biocidal products and application techniques, and non-biocidal techniques for repressive protection of wood, such as heating, microwave treatment. Learn about the latest trends in continuous moisture monitoring of wood in buildings and its importance for rapid (timely) detection of defects and reduction of remediation costs.

Temeljna literatura in viri/Readings:

Unger A, Schniewind AP, Unger W (2001) Conservation of wood artifacts : a handbook. Springer, Berlin; London

Reinprecht, L. (2016). Wood Deterioration, Protection and Maintenance. In Wood Deterioration, Protection and Maintenance. JohnWiley & Sons, Ltd. https://doi.org/10.1002/9781119106500

Zabel R. A., Morell J.J. (1999): WOOD MICROBIOLOGY, Decay and Its Prevention, Elsevier: izbrana poglavja

Revijalni članki s področja, tekoča periodika ter druga učna gradiva

Du C, Li B, Yu W (2021) Indoor mould exposure: Characteristics, influences and corresponding associations with built environment—A review. Journal of Building Engineering 35

Sharapov E, Brischke C, Militz H, Smirnova E (2019) Prediction of modulus of elasticity in static bending and density of wood at different moisture contents and feed rates by drilling resistance measurements. European Journal of Wood and Wood Products 77:833–842. https://doi.org/10.1007/s00107-019-01439-2

Cilji in kompetence:	**Objectives and competences:**
Cilji: • Spozna vzroke poškodb na zgradbah in jih zna detektirati. • Pridobi praktična znanja za delo z različnimi tehnikami za oceno stanja lesa v novih in kulturnozgodovinskih zgradbah. • Zna preveriti ali je bil v zgradbi uporabljen z biocidi in/ali s površinskimi premazi obdelan les. • Spozna tehnike kontinuiranega spremljana vlažnosti v objektih in jih zna uporabiti v zgradbah ter sanacijah. Kompetence: • Študent zna oceniti stanje lesa v zgradbah ter zna načrtovati sanacijo novih in kulturnozgodovinskih zgradb, kot posledico delovanja gliv in insektov.	Objectives : - Know the causes of building damage and how to detect them. - Acquire practical skills to work with various techniques to assess the condition of wood in new and historic buildings. - Knows how to check if wood treated with biocides and/or finishes has been used in a building. - Knows techniques to continuously monitor humidity in buildings and can apply them to buildings and renovations. Competencies: - The student is able to assess the condition of wood in buildings and plan for the restoration of new and historic buildings due to fungal and insect attack.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Poznavanje in razumevanje vzrokov za razkroj lesa in lignoceluloznih kompozitov v zgradbah. Seznanjen je z različnimi tehnikami sanacije poškodovanih zgradb. Razume različne pristope sanacije novejših in kulturnozgodovinskih zgradb. Študent spozna in razume vplive povišane vlažnosti lesa v zgradbah, in možnosti za kontinuirano spremljene vlažnosti, na kitičnih mestih v zgradbah.	Knowledge and understanding: Knowledge and understanding of the causes of decomposition of wood and lignocellulosic composites in buildings. Familiar with various techniques for remediation of damaged buildings. Understanding of the different approaches to rehabilitation of recent and historic buildings. The student will learn and understand the effects of elevated wood moisture in buildings and the potential for continuous moisture monitoring on weak points in buildings.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Vaje, konzultacije, praktične demonstracije, seminarji in individualno projektno delo.	Tutorials, consultations, practical demonstrations, seminars and individual project work.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Predstavitev individualnega projekta in odgovori na vprašanja	100,00 %	Project presentation and answers to question

Ocenjevalna lestvica:	**Grading system:**
5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

Boštjan Lesar

1. HUMAR, Miha, BALZANO, Angela, KRŽIŠNIK, Davor, LESAR, Boštjan. Assessment of wooden foundation piles after 125 years of service. *Forests*. [Online ed.]. 2021, vol. 12, iss. 2, 1-14 str. ISSN 1999-4907. https://www.mdpi.com/1999-4907/12/2/143, DOI: 10.3390/f12020143.

2. HUMAR, Miha, KRŽIŠNIK, Davor, LESAR, Boštjan, DUJIČ, Bruno. Monitoring a building made of CLT in Ljubljana : Elektronski vir. *Wood material science & engineering*. 2020, vol. 15, no. 6, str. 335-342, ilustr. ISSN 1748-0280. https://www.tandfonline.com/doi/full/10.1080/17480272.2020.1712740, DOI: 10.1080/17480272.2020.1712740.
3. HUMAR, Miha, LESAR, Boštjan. Spremljanje vlažnosti lesene strehe golobarske žičnice - preliminarni rezultati = Monitoring the moisture content of roofing elements on the golobar cable yarding - preliminary results. *Acta Silvae et Ligni*. [Tiskana izd.]. 2020, [št.] 122, str. 19-28, ilustr. ISSN 2335-3112. https://doi.org/10.20315/ASetL.122.2, http://dirros.openscience.si/IzpisGradiva.php?id=12345, DOI: 10.20315/ASetL.122.2.
4. KRŽIŠNIK, Davor, BRISCHKE, Christian, LESAR, Boštjan, THALER, Nejc, HUMAR, Miha. Performance of wood in the Franja partisan hospital : Elektronski vir. *Wood material science & engineering*. 2019, vol. 14, no. 1, str. 24-32, ilustr. ISSN 1748-0280. http://www.tandfonline.com/doi/full/10.1080/17480272.2018.1438512, DOI: 10.1080/17480272.2018.1438512.
5. KRŽIŠNIK, Davor, LESAR, Boštjan, THALER, Nejc, HUMAR, Miha. Micro and material climate monitoring in wooden buildings in sub-Alpine environments. *Construction & building materials*. [Print ed.]. 2018, vol. 166, str. 188-195. ISSN 0950-0618. https://www.sciencedirect.com/science/article/pii/S0950061818301417, DOI: 10.1016/j.conbuildmat.2018.01.118.
6. KRŽIŠNIK, Davor, LESAR, Boštjan, THALER, Nejc, GRBEC, Samo, HUMAR, Miha. Risk assessment of mould growth on spruce wood during transport in an intermodal container : Elektronski vir. *Maderas. Ciencia y tecnología*. 2018, vol. 20, iss. 4, str. 621-626, ilustr. ISSN 0718-221X. http://revistas.ubiobio.cl/index.php/MCT/article/view/3222/3153.
7. HUMAR, Miha, LESAR, Boštjan, KRŽIŠNIK, Davor. Ocena stanja lesenega kipa japonski festival Tanake Eisakuja = Assessment of the condition of japanese festival, a wooden sculpture by Tanaka Eisaku. *Acta Silvae et Ligni*. [Tiskana izd.]. 2022, [št.] 127, str. 1-12, ilustr. ISSN 2335-3112. https://doi.org/10.20315/ASetL.127.1, https://dirros.openscience.si/IzpisGradiva.php?id=15125, https://repozitorij.uni-lj.si/IzpisGradiva.php?id=137093, DOI: 10.20315/ASetL.127.1.
8. HUMAR, Miha, LESAR, Boštjan, ŽAGAR, Andreja, BALZANO, Angela, KRŽIŠNIK, Davor. Ocena razkrojenosti lesa v Podzemni slemenski utrdbi Goli vrh = Evaluation of the wood degradation in the underground fort Goli vrh. *Les*. [Tiskana izd.]. jun. 2019, letn. 68, št. 1, str. 61-70, ilustr. ISSN 0024-1067. http://www.les-wood.si/index.php/leswood/article/view/45/38
9. LESAR, Boštjan, HUMAR, Miha. Anorganska onesnažila v odsluženih oknih = Inorganic pollutants in used windows. *Les*. [Tiskana izd.]. 2020, letn. 69, št. 2, str. 49-57, ilustr. ISSN 0024-1067. http://www.les-wood.si/index.php/leswood/article/view/95, https://repozitorij.uni-lj.si/IzpisGradiva.php?id=124417

METODE ZA ŠTUDIJ ŽIVIH CELIC

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Metode za študij živih celic
Course title:	Methods in Live Cell Imaging
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (v postopku)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037357
Koda učne enote na članici/UL Member course code:	3860

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
10	10	0	0	15	90	5

Nosilec predmeta/Lecturer:	Peter Veranič

Izvajalci predavanj:	Peter Veranič
Izvajalci seminarjev:	
Izvajalci vaj:	
Izvajalci kliničnih vaj:	
Izvajalci drugih oblik:	
Izvajalci praktičnega usposabljanja:	

Vrsta predmeta/Course type:	teoretični/theoretical

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Študent potrebuje osnovno znanje celične biologije, biokemije in molekularne genetike. Študent je moral opraviti izpit iz celične biologije v dodiplomskemštudiju.	The applicant student should have the basic knowledge in cell biology, biochemistry and molecular genetics. The student must have passed the examine of the course of Cell biology at the under graduate level.

Vsebina:	**Content (Syllabus outline):**
Uvod v sodobne metode, ki omogočajo morfološko analizo živih celic. Poudarek je na svetlobnomikroskopskih metodah, ki omogočajo dolgotrajno vzdrževanje in opazovanje celic pod mikroskopom (pomen temperature pH, vlažnosti,	Introduction of current methods, which enable observation and analysis of events appearing in live cells. The emphasis is on methods of light microscopy, which enable long-term maintaining and observation of cells in a microscope (temperature, pH

slikanje v časovnem zaporedju, analiza gibanja). Mehanizem in uporaba fluorescenčne označbe (GFP, DiI, Koleratoksin...) pri študiju celičnega gibanja, preraščanja in vitro poškodovanega področja, vpostavljanja medceličnih stikov, celične diferenciacije, dinamiki molekul membran, medcelične komunikacije, odzivanja na toksine...). Vzpodbujanje fluorescence povzroča tvorbo prostih radikalov, kar povzroča bledenje fluorokromov. Pregled metod, ki zmanjšajo fototoksičnost med opazovanjem fluorescenčno označenih celic (mikroskop z vrtečim se diskom, CLEM, antioksidanti). Razlaga artefaktov kot posledica fototoksičnosti.	and humidity controlled environment, time laps imaging, relocation of cells with collocate grids…). The mechanisms and the use of fluorescence labels (GFP, DiI, choleratoxin…), will be introduced to follow cell migration, transformation during regrowth of in vitro injuries, intercellular contact formation, rearrangement of molecules during cell differentiation, molecular dynamics in membranes, intercellular communication, cell response to drugs and toxins…) During excitation of fluorochromes the free radicals are produced, which can damage cells and cause fading of labelled structures. A survey of methods for decreased phototoxicity will be given (spinning disc microscopy, CLEM, antioxidative agents) and of possible artefacts as a result of phototoxicity.

Temeljna literatura in viri/Readings:

1. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., Walter, P. (2008) Molecular biology of the cell, 5th edition.
2. revijalni članki s področja, tekoča periodika, druga učna gradiva

Cilji in kompetence:	**Objectives and competences:**
- poznavanje metod celične biologije (fluorescenčno označevanje, sekvenčno slikanje, ...) - sposobnost interpretacije procesov v živi celici (spreminjanje arhitekture citoskeleta, vezikularnega transporta, dinamike membranskih molekul) - razumevanje celične dinamike in vitro (epitelijsko mezenhimska transformacija, vzpostavljanje medceličnih stikov...) - razumevanje razlogov za artefakte zaradi fototoksičnosti...)	• acquaintance to methods of cell biology (time lapse imaging, fluorescence labelling of molecules in live cells) • ability of interpretation of processes in live cells (reorganisation of cytoskeleton in migrating cells, vesicular transport and molecular dynamics in membranes) • understanding of the cell dynamics in *in vitro* conditions (epithelio – mesenchymal transition, intercellular contact formation…) • understanding the reasons for the artefacts caused by fototoxisity as a result of illumination of photochromes

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: študent: - razume dinamika celičnih struktur - pozna mehanizme delovanje celice - pozna metode označevanja celic - pozna razloge fototoksičnosti	Knowledge and understanding: The student - understands the dinamics of cell structures - is familiar with basic mechanisms of cell functioning - is familiar with methods of live cell labelling - is familiar with reasons of photodamage and resulted artefacts

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja teoretičnih principov in praktičnega dela v laboratoriju, priprava bioloških vzorcev, analiza mikrografij, seminarsko delo, konzultacije	Lectures on theoretical principles, practical work in laboratory, preparation of biological specimens, microscopy, analysis of micrographs, seminar work, consultations

Načini ocenjevanja: **Delež/Weight** **Assessment:**

izpit	50,00 %	Examination
predstavitve seminarja	50,00 %	seminar presentation

Ocenjevalna lestvica:	**Grading system:**
5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

Peter Veranič

1. KURET, Tadeja, ERDANI-KREFT, Mateja, ROMIH, Rok, VERANIČ, Peter (avtor, korespondenčni avtor). Cannabidiol as a promising therapeutic option in IC/BPS : in vitro evaluation of its protective effects against inflammation and oxidative stress. *International journal of molecular sciences*. 2023, vol. 24, iss. 5, str. [1]-20, ilustr. ISSN 1422-0067. https://www.mdpi.com/1422-0067/24/5/5055, DOI: 10.3390/ijms24055055. [COBISS.SI-ID 144226307],

2. PANEVSKA, Anastasija, ČEGOVNIK, Nastja, FORTUNA, Klavdija, VUKOVIČ, Alen, GRUNDNER, Maja, MODIC, Špela, BAJC, Gregor, SKOČAJ, Matej, MRAVINEC BOHTE, Martina, POPOŠEK, Larisa Lara, ŽIGON, Primož, RAZINGER, Jaka, VERANIČ, Peter, RESNIK, Nataša (avtor, korespondenčni avtor), SEPČIĆ, Kristina. A single point mutation expands the applicability of ostreolysin A6 in biomedicine. *Scientific reports*. 2023, vol. 13, str. 1-13, ilustr. ISSN 2045-2322. https://www.nature.com/articles/s41598-023-28949-7, DOI: 10.1038/s41598-023-28949-7. [COBISS.SI-ID 141225731],

3. RESNIK, Nataša, BARAGA, Diana, GLAŽAR, Polona, ZEMLJIČ JOKHADAR, Špela, DERGANC, Jure, SEPČIĆ, Kristina, VERANIČ, Peter, ERDANI-KREFT, Mateja (avtor, korespondenčni avtor). Molecular, morphological and functional properties of tunnelling nanotubes between normal and cancer urothelial cells : new insights from the in vitro model mimicking the situation after surgical removal of the urothelial tumor. *Frontiers in cell and developmental biology*. 2022, vol. 10, str. 1-20, ilustr. ISSN 2296-634X. https://doi.org/10.3389/fcell.2022.934684, DOI: 10.3389/fcell.2022.934684. [COBISS.SI-ID 135025923],

4. KURET, Tadeja, PESKAR, Dominika, ERDANI-KREFT, Mateja, ERMAN, Andreja, VERANIČ, Peter (avtor, korespondenčni avtor). Comprehensive transcriptome profiling of urothelial cells following TNFα stimulation in an in vitro interstitial cystitis/bladder pain syndrome model. *Frontiers in immunology*. Aug. 2022, vol. 13, str. 1-16, ilustr. ISSN 1664-3224. https://www.frontiersin.org/articles/10.3389/fimmu.2022.960667/full, DOI: 10.3389/fimmu.2022.960667. [COBISS.SI-ID 118210307],

5. PAVLIN, Mojca, LOJK, Jasna, STROJAN, Klemen, HAFNER BRATKOVIČ, Iva, JERALA, Roman, LEONARDI, Adrijana, KRIŽAJ, Igor, DRNOVŠEK, Nataša, NOVAK, Saša, VERANIČ, Peter, BREGAR, Vladimir Boštjan. The relevance of physico-chemical properties and protein corona for evaluation of nanoparticles immunotoxicity - in vitro correlation analysis on THP-1 macrophages. *International journal of molecular sciences*. Jun.-1 2022, iss. 11, 6197, str. 1-23, ilustr. ISSN 1422-0067. https://www.mdpi.com/1422-0067/23/11/6197, DOI: 10.3390/ijms23116197. [COBISS.SI-ID 109968387],

6. PREDOJEVIĆ, Luka, KEŠE, Darja, ŽGUR-BERTOK, Darja, ŽELEZNIK RAMUTA, Taja, VERANIČ, Peter, ERDANI-KREFT, Mateja, STARČIČ ERJAVEC, Marjanca. A biomimetic porcine urothelial model for assessing Escherichia coli pathogenicity. *Microorganisms*. 2022, vol. 10, iss. 4, str. 1-16, art. 783, ilustr. ISSN 2076-2607. https://www.mdpi.com/2076-2607/10/4/783/htm, DOI: 10.3390/microorganisms10040783. [COBISS.SI-ID 104312323],

METODOLOGIJA EKONOMSKIH IN DRUŽBOSLOVNIH ZNANOSTI V BIOZNANOSTIH

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Metodologija ekonomskih in družboslovnih znanosti v bioznanostih
Course title:	Methodology of economic and social sciences in biosciences
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (v postopku)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037300
Koda učne enote na članici/UL Member course code:	3802

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
20	30	20	0	10	170	10

Nosilec predmeta/Lecturer:	Emil Erjavec

Izvajalci predavanj:	Emil Erjavec
Izvajalci seminarjev:	
Izvajalci vaj:	
Izvajalci kliničnih vaj:	
Izvajalci drugih oblik:	
Izvajalci praktičnega usposabljanja:	

Vrsta predmeta/Course type:	teoretični/theoretical

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Splošni pogoji za vpis na doktorski študij	General requirements for admission to doctoral programme

Vsebina:	Content (Syllabus outline):
1. *Načela in organizacija raziskovalnega dela* • pristop in teoretična platforma raziskovalnega delu na področju; • formulacija raziskovalnega problema in načrt raziskovalnega dela. • pridobivanje podatkov in izbira metode • organizacija raziskovalnega dela;	1. *The principles and organization of research* • Theory and design of researchin the social and economic sciences • formulation of research problem and planing of the research work. • the acquisition of data and the choice of methods • organisation of research;

• načela znanstvenega poročanja in predstavljanja; 1. *Ekonometrična analiza podatkov* • linearna regresija • multivariatna analiza • modeli časovnih vrst • modeli z diskretnimi odvisnimi spremenljivkami 1. *Operacijske raziskave in matematično modeliranje* • optimizacijski problem • matematično modeliranje • linearno programiranje • osnove teorije odločanja • ciljno programiranje in večkriterijsko odločanje • Markovske verige • sektorsko modeliranje: deterministični in stohastični modeli 1. *Kvalitativne metode* • pristopi in tehnike kvalitativnih metod (analiza vsebine besedil, individualni in skupinski intervjuji); • alternativni pristopi v kvalitativnih raziskavah: akcijsko raziskovanje, teorija akterjev in omrežij 'actor-network theory'	• the principles of scientific reporting and presentation; 1. *Econometric data analysis* • linear regression • multivariate analysis • time series models, • models with discrete dependent variables, 1. *Operational research and mathematic modeling* • optimization problem • mathematic modeling • linear programming • the base of decision-making theory • objective and multicriterial programming • Markow chains • Sector modeling: deterministic and stochastic models 1. *Qualitative research methods* • approaches and techniques of qualitative methods (analysis of the content of the text, individual and group interviews); • alternative approaches to qualitative research: action research, theory of actors and the networks ' actor-network theory '

Temeljna literatura in viri/Readings:

- Taylor, S.J. 2015. Introduction to qualitative research methods. Willey; Hoboken
- Ethridge, D. 2004. Research methodology in applied economics. 2.izd., Blackwell: Ames
- Gujarati, N. 2012. Basic Econometrics. 12th ed. McGraw Hill, Boston
- Zadnik Stirn, L. 2001. Metode operacijskih raziskav za poslovno odločanje. Littera Picta, Ljubljana

Cilji in kompetence:	**Objectives and competences:**
Cilj predmeta je usposobitev za načrtovanje raziskovalnega dela in poglobitev znanja o temeljnih kvantitativnih in kvalitativnih metodah na področju ekonomskih in družboslovnih raziskav v bioznanostih. Kandidat je sposoben za konceptualizacijo, organizacijo in vrednotenje raziskovalnega dela na področju ekonomskih in družboslovnih raziskav v bioznanostih. Kandidati lahko spoznane metode aplicirajo na različnih raziskovalnih vprašanjih in so sposobni nadaljnjega samostojnega poglabljanja metodološkega znanja.	The objective of the course is to enable the planning of research and deepen the knowledge of fundamental quantitative and qualitative methods in the field of economic and social research in biosciences. The candidate is able to the conceptualization, organization and evaluation of the research in the area of economic and social sciences in the biosciences. Candidates are able to use the basic research methods on the various research questions and are able to further deepening of the methodological knowledge.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Predviden študijski rezultat je usposobitev kandidata za pristop k raziskovalnemu delu in izbiri metod na širšem področju ekonomskih in družboslovnih raziskav v bioznanostih.	Knowledge and understanding: The students are gaining a knowledge on research concepts and methods in the wider field of economic and social science research in the biosciences.

Metode poučevanja in učenja:	**Learning and teaching methods:**
• Predavanja	• Lectures

• Vaje • Seminar	• Tutorial • Seminar

Načini ocenjevanja:	Delež/Weight	Assessment:
- 4 seminarji	100,00 %	- 4 seminars

Ocenjevalna lestvica:	Grading system:
5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

Emil Erjavec

1. ŠUMRADA, Tanja, KMECL, Primož, ERJAVEC, Emil. Do the EU's Common agricultural policy funds negatively affect the diversity of farmland birds? : evidence from Slovenia. *Agriculture, Ecosystems & environment*. 2021, vol. 306, art. 107200, str. 1-14, [JCR, SNIP, WoS, Scopus]
2. ERJAVEC, Emil, VOLK, Tina, REDNAK, Miroslav, CIAIAN, Pavel, LAZDINIS, Marius. Agricultural policies and European Union accession processes in the Western Balkans : aspirations versus reality. *Eurasian geography and economics*. 2021, vol. 62, no. 1, str. 46-75, ilustr. ISSN 1538-7216. [JCR, SNIP, WoS]
3. KRANJAC, David, ZMAIĆ, Krunoslav, GRGIĆ, Ivo, SALAMON, Petra, ERJAVEC, Emil. Accession impact and outlook for Croatian and EU crop and livestock markets. *Spanish journal of agricultural research*. 2020, vol. 18, no. 1, str. 1-13, [JCR, SNIP, WoS, Scopus]
4. RAC, Ilona, ERJAVEC, Karmen, ERJAVEC, Emil. Does the proposed CAP reform allow for a paradigm shift towards a greener policy?. *Spanish journal of agricultural research*. 2020, vol. 18, no. 3, str. 1-14, [JCR, SNIP, WoS, Scopus]
5. ERJAVEC, Karmen, ERJAVEC, Emil. The noble or sour wine : European Commission's competing discourses on the main CAP reforms. *Sociologia ruralis : journal of the European society for rural sociology*. [Print ed.]. 2020, vol. 60, no. 3, str. 661-679. [JCR, SNIP, WoS, Scopus]
6. ŠUMRADA, Tanja, LOVEC, Marko, JUVANČIČ, Luka, RAC, Ilona, ERJAVEC, Emil. Fit for the task? Integration of biodiversity policy into the post-2020 Common Agricultural Policy : illustration on the case of Slovenia. *Journal for nature conservation*. 2020, vol. 54, art. no. 125804, str. 1-11, [JCR, SNIP, WoS, Scopus]
7. ERJAVEC, Emil, VOLK, Tina, REDNAK, Miroslav, RAC, Ilona, ZAGORC, Barbara, MOLJK, Ben, ŽGAJNAR, Jaka. Interactions between European agricultural policy and climate change : a Slovenian case study. *Climate policy*. 2017, vol. 17, no. 8, str. 1014-1030. ISSN 1469-3062. [JCR, SNIP, WoS]
8. ERJAVEC, Karmen, ERJAVEC, Emil. Greening the CAP - just a fashionable justification? : a discourse analysis of the 2014-2020 CAP reform documents. *Food Policy*. [Print ed.]. 2015, vol. 51, str. 53-62. [JCR, SNIP, WoS]
9. ERJAVEC, Emil, LOVEC, Marko. Research of European Union's Common Agricultural Policy : disciplinary boundaries and beyond. *European review of agricultural economics*. 2017, vol. 44, no. 4, str. 732-754. [JCR, SNIP, WoS]
10. ERJAVEC, Emil, VOLK, Tina, RAC, Ilona, KOŽAR, Maja, PINTAR, Marjeta, REDNAK, Miroslav. Agricultural support in selected Eastern European and Eurasian countries. *Post-communist economies*. 2017, vol. 29, no. 2, str. 216-231. [JCR, SNIP, WoS, Scopus]

MIKOREMEDIACIJA

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Mikoremediacija
Course title:	Mycoremediation
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (v postopku)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037316
Koda učne enote na članici/UL Member course code:	3818

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
10	5	15	0	5	90	5

Nosilec predmeta/Lecturer:	Davor Kržišnik

Izvajalci predavanj:	Davor Kržišnik
Izvajalci seminarjev:	
Izvajalci vaj:	
Izvajalci kliničnih vaj:	
Izvajalci drugih oblik:	
Izvajalci praktičnega usposabljanja:	

Vrsta predmeta/Course type:	teoretični/theoretical

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Končan univerzitetni ali drugostopenjski bolonjski študij iz širšega področja naravoslovja, matematike in računalništva oziroma ožjega področja Vede o živi naravi (klasifikacija po Klasius-u).	Completed university studies or bologna masters in natural sciences, mathematics and computer studies or the narrower field of life sciences (Klasius classification).

Vsebina:	**Content (Syllabus outline):**
Predstavljene bodo naslednje vsebine: Glive, kot indikatorji onesnaženosti okolja. Ekologija mikoremediacije. Glivni metabolizem in potencial gliv za biorazgradnjo nevarnih odpadkov, kot so: kem. zaščiten les, pesticidi in druge toksične snovi. Pomen gliv in glivnih encimov pri ravnanju z	**The following contents will be presented and discussed:** Fungi as environmental indicators. Ecology of mycoremediation. Fungal metabolisms and their biodegradable potential for waste impregnated wood, pesticides and others toxic chemicals. The importance

odpadki na odlagališčih, čiščenju odpadnih industrijskih vod, kakor tudi industriji celuloze in papirja. Razbarvanje in razgradnja barvil, vključno z melaminom na predmetih kulturne dediščine z glivami. Razgradnja plastike, goriv, ostankov eksploziv in drugih sintetičnih odpadnih materialov. Pomen mikoriznih gliv za remediacijo zemljišč. Uporaba gliv za biosorpcijo in bioakumulacijo težkih kovin.	of fungi and fungal enzymes in waste management on landfills, wastewaters as well as pulp and paper industry. Fungal decolourization and degradation of dyes, including melamine on cultural heritage. Decomposition of plastic, fuels, residues of explosives and other synthetic waste materials. Mycorrhizal fungi in rhizosphere remediation. Application of fungi in biosorption and bioaccumulation of heavy metals.

Temeljna literatura in viri/Readings:

Polizeli T.M. and Rai M., 2013: **Fungal Enzymes**. CRC Press London, ISBN: 978-1-4665-9454-8, 445 str.
Singh H., 2006: **MYCOREMEDIATION – Fungal Bioremediation**. John Wiley & Sons, Inc., Hoboken, New Jersey. ISBN-13: 978-0-471-75501-2, 592 str.
Hakeem, K. R., Bhat, R. A., & Qadri, H., 2020: **Bioremediation and biotechnology: Sustainable approaches to pollution degradation** [Book]. Elsevier Scopus. https://doi.org/10.1007/978-3-030-35691-0
Aktualni pregledni in znanstveni članki s področja mikoremediacije./Current review and scientific articles in the field of the mycoremediation.

Cilji in kompetence:	**Objectives and competences:**
Študent se bo poglobil v ožjo okoljsko raziskovalno problematiko, ki jo bo lahko nadgrajeval v svoji doktorski disertaciji. Predmet ni namenjen ekstenzivni poglobitvi teoretičnega znanja, pač pa je cilj predstavitev določenih problemov in obvladovanje specifičnih metod in tehnik, ki lahko pripomorejo k rešitvi okoljskih problemom. Namenjen je tudi poznavanju pregleda predhodnih raziskav s področja bodoče doktorske disertacije študenta.	Students will get deeper insight into environment research problems which he or she will upgrade in her/his doctoral thesis. The contents are not intended to extensively deepen the theoretical knowledge but should introduce specific problems, indicate methods and techniques with which can be addressed the environmental problems. Students should get familiar with previous research in the field of their doctoral thesis.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Zastavljen pristop bi se moral odraziti v pravilnem načrtovanju raziskav in poskusov, ki vodijo k potrditvi ali zavrnitvi hipotez, zastavljenih v temi doktorske disertacije.	Knowledge and understanding: Such an approach should result in the proper planning of research experiments which can test the hypotheses raised in the doctoral thesis.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Neposredna predavanja nosilca, priprava in vodenje Journal clubov; priprava problemskih seminarskih nalog, diskusij, razprav ... Pregled in poprava rešitev problemskih nalog. Individualne konzultacije.	Frontal ex-cathedra teaching and preparation and supervision of Journal clubs; preparation of problem seminars, discussion and consultation. Assessment and correction of problem tasks. Individual study with consultation.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
- Predstavitev problemske seminarske naloge	50,00 %	- Presentation of problem solution,
- sodelovanje na journal club-ih.	50,00 %	- participation at journal clubs and/or seminars.

Ocenjevalna lestvica: **Grading system:**

5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

Davor Kržišnik

KRŽIŠNIK, Davor, GONÇALVES, José. Environmentally conscious technologies using fungi in a climate-changing world. Earth. 2023, vol. 4, iss. 1, str. 69-77, ilustr. ISSN 2673-4834. https://www.mdpi.com/2673-4834/4/1/5, https://repozitorij.uni-lj.si/IzpisGradiva.php?id=144282, DOI: 10.3390/earth4010005.

REPIČ, Rožle, PONDELAK, Andreja, **KRŽIŠNIK, Davor**, HUMAR, Miha, KNEZ, Nataša, KNEZ, Friderik, SEVER ŠKAPIN, Andrijana. Environmentally friendly protection of European beech against fire and fungal decay using a combination of thermal modification and mineralisation. Wood material science & engineering. Jul. 2023, str. 1-12. ISSN 1748-0280.
https://www.tandfonline.com/doi/full/10.1080/17480272.2023.2223508,
https://dirros.openscience.si/IzpisGradiva.php?id=16695, DOI: 0.1080/17480272.2023.2223508.

KOCBEK, Eva, GARCIA, Hector A., HOOIJMANS, Christine M., MIJATOVIĆ, Ivan, **KRŽIŠNIK, Davor**, HUMAR, Miha, BRDJANOVIC, Damir. Effects of the sludge physical-chemical properties on its microwave drying performance. Science of the total environment. [Online ed.]. 2022, vol. 828, 1 spletni vir (1 datoteka pdf ([15] str.)), ilustr. ISSN 1879-1026.
https://www.sciencedirect.com/science/article/pii/S0048969722012347?via%3Dihub,
https://repozitorij.uni-lj.si/IzpisGradiva.php?id=138125, DOI: 10.1016/j.scitotenv.2022.154142.

HUMAR, Miha, LESAR, Boštjan, **KRŽIŠNIK, Davor**. Vpliv podnebnih sprememb na dinamiko glivnega razkroja lesa v Sloveniji = Influence of climate change on the dynamics of the fungal decay of wood in Slovenia. Acta Silvae et Ligni. [Tiskana izd.]. 2021, [št.] 125, str. 53-59, ilustr. ISSN 2335-3112.
https://doi.org/10.20315/ASetL.125.5, http://dirros.openscience.si/IzpisGradiva.php?id=14267,
http://www.dlib.si/details/URN:NBN:SI:doc-W2OAKX9F,
https://dirros.openscience.si/IzpisGradiva.php?id=14267, DOI: 10.20315/ASetL.125.5.

DUARTE, Sonia, NUNES, Lina, **KRŽIŠNIK, Davor**, HUMAR, Miha, JONES, Dennis. Influence of zwitterionic buffer effects with thermal modification treatments of wood on symbiotic protists in Reticulitermes grassei Clément. Insects. 2021, vol. 12, iss. 2, str. 1-14, ilustr. ISSN 2075-4450.
https://www.mdpi.com/2075-4450/12/2/139, https://repozitorij.uni-lj.si/IzpisGradiva.php?id=135043, DOI: 10.3390/insects12020139.

DE ANGELIS, Marco, ROMAGNOLI, Manuela, VEK, Viljem, POLJANŠEK, Ida, OVEN, Primož, THALER, Nejc, LESAR, Boštjan, **KRŽIŠNIK, Davor**, HUMAR, Miha. Chemical composition and resistance of Italian stone pine (Pinus pinea L.) wood against fungal decay and wetting. Industrial crops and products. 2018, vol. 117, str. 187-196, ilustr. ISSN 0926-6690.
https://www.sciencedirect.com/science/article/pii/S0926669018302255, DOI: 10.1016/j.indcrop.2018.03.016.

MIKRO/NANO TEHNOLOGIJE IN STRUKTURE

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Mikro/nano tehnologije in strukture
Course title:	Micro/nano technologies and structures
Članica nosilka/UL Member:	UL FE

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (v postopku)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037321
Koda učne enote na članici/UL Member course code:	3823

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
10	25	0	0	0	90	5

Nosilec predmeta/Lecturer:	Samo Penič

Izvajalci predavanj:	Samo Penič
Izvajalci seminarjev:	
Izvajalci vaj:	
Izvajalci kliničnih vaj:	
Izvajalci drugih oblik:	
Izvajalci praktičnega usposabljanja:	

Vrsta predmeta/Course type:	teoretični/theoretical

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Splošni pogoji za vpis na doktorski študij	General conditions for enrollment in doctoral study

Vsebina:	Content (Syllabus outline):
Osnove mikro/nano tehnologij in struktur – definicije, principi, klasifikacije. Osnovne mikro/nano strukture: senzorji, aktuatorji, mikroreaktorji, mikrofluidni čipi, »lab-on-chip« sistemi, mikro/nano pozicionerji in druge podobne strukture. Pregled mikro/nano tehnologij: mikroobdelava, mikroelektronske tehnologije, depozicije, jedkanje, LIGA, žrtvovani film, laserske aplikacije, zatesnitev	Fundamentals of micro/nano technologies and structures – definitions, principles, classifications. Basic micro/nano structures: sensors, actuators, microreactors, microfluidic chips, lab-on-chip systems, micro/nano positioners and other similar structures. Review of micro/nano technologies: micromachining, microelectronic technologies, deposition, etching, LIGA, sacrified film, laser

odprtin, bondiranje substratov, zapiranje v ohišja, izdelava 3D struktur, nanocevke itd. Analogna obdelava signalov: osnove vezij, vezja z operacijskimi ojačevalniki (instrumentacijski ojačevalnik, seštevalni ojačevalnik, nabojni ojačevalnik), izvori (tok, napetost, band gap reference), filtri, komparatorji in Schmittov prožilnik, analogni pretvorniki (tok/napetost /naboj/frekvenca) itd. Digitalna obdelava signalov: osnovni sklopi, diskretizacija signala, vzorčno-zadrževalna vezje, digitalno-analogni in analogno-digitalni pretvorniki in drugo. Pregled mikro/nano struktur in aplikacij: Senzorji (bio/kemični senzorji, piezoresistivni senzorji, piezoelektrični senzorji, piroelektrični senzorji, kapacitivni senzorji, resonančni senzorji, termoelektrični senzorji, radiacijski senzorji, magnetni senzorji, senzorji z optičnimi vlakni, itd.), aktuatorji (termični, kapacitivni, piezoelektrični, itd.), mikrofluidični čipi, mikroreaktorji, lab-on-chip, Mikro/Nano pozicionerji itd. Napredne mikro/nano tehnologije in strukture. Simulacijska orodja za analizo in načrtovanje (SPICE simulacije, metoda končnih elementov in večfizikalne simulacije, metoda Monte Carlo)	application, opening sealing, substrate bonding, sensor chip encapsulation/packaging, 3D structures fabrication, nanotubes etc. Analog signal conditioning: basic circuits, operational amplifier circuits (instrumentation amplifier, summing amplifier, charge amplifier), sources (current, voltage, band gap references), filters, comparators and Schmitt trigger, analog converters (current/voltage/charge/frequency) etc. Digital signal conditioning: basic building blocks, signal discretisation, sample&hold circuits, digital-to-analog and analog-to-digital converters etc. Review of micro/nano structures and applications: Sensors (Bio/Chemical sensors. Piezoresistive sensors. Piezoelectric sensors. Pyroelectric sensors. Capacitive sensors. Resonant sensors. Thermoelectric sensors. Radiation sensors. Magnetic sensors. Optical fiber sensors, etc.), Actuators (thermal, capacitive, piezoelectric etc.), Microfluidic chips, Microreactors, Lab-on-chip, Micro/Nano positioners etc. Advanced micro/nano technologies and structures. Simulation tools for analysis and design (SPICE simulacije, finite element method and multiphysics simulations, Monte Carlo method)

Temeljna literatura in viri/Readings:

- S.Amon, **SENZORJI IN AKTUATORJI 1. del: Osnove senzorike** , Založba UL FE, 2013 (knjiga na spletu)
- S.Amon, **SENZORJI IN AKTUATORJI 2. del: Pregled senzorjev in aktuatorjev** Založba UL FE, 2013 (knjiga na spletu)
- J. Fraden, Handbook of Modern Sensors, AIP Press, 1997.
- E. Gusev, E. Garfunkel, A. Dideikin, Advanced Materials and Technologies for Micro Nano-Devices, Sensors and Actuators, Springer, 2010.
- A. Iglič, V. Kralj-Iglič, D. Drobne: Nanostructures in biological systems : theory and applications. Singapore: Pan Stanford; Boca Raton: CRC Press, 2015. ISBN 978-981-4303-43-9. https://doi.org/10.1201/b18607. [COBISS.SI-ID 11076436]
- Ekwall, Britt, and Mikkel Cronquist. *Micro electro mechanical systems (MEMS): Technology, fabrication processes and applications*. Nova Science Publ., 2011.

Cilji in kompetence:	**Objectives and competences:**
Osnovni namen predmeta je posredovati udeležencem pregled novih pristopov, principov, tehnologij, struktur in aplikacij na področju mikro/nano tehnologij in struktur.	The aim of the course is to give participants a comprehensive overview of new approaches, principles, technologies, structures and applications in the field of micro/nano technologies and structures.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Predvideni študijski rezultati predmeta vključujejo obvladovanje osnovnih pojavov, dizajnov, realizacij in aplikacij ter osnovnih elektronskih vezij na področju mikro/nano tehnologij in struktur.	Learning outcomes of the course include a comprehensive overview of basic effects, designs, realizations and applications, together with basic electronic circuits, in the field of micro/nano technologies and structures.

Metode poučevanja in učenja:	**Learning and teaching methods:**

Osnovna teoretska znanja so podana v obliki predavanj, medtem ko so praktična znanja podana v obliki laboratorijskega dela, seminarjev in projektov.	Basic theory and subject overview is addressed by lectures, while practical knowledge and experience are gained through laboratory work, seminars and projects.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Projekt/seminar	30,00 %	Project/Seminar
pisni izpit	30,00 %	written exam
ustni izpit	40,00 %	oral exam

Ocenjevalna lestvica:	**Grading system:**
5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

Doc. dr. Samo Penič

- S. Penič, L. Mesarec, M. Fošnarič, L. Mrówczyńska, H. Hägerstrand, V. Kralj-Iglič, A. Iglič. Budding and fission of membrane vesicles: a mini review. Frontiers in Physics, ISSN. 2020, doi: 10.3389/fphy.2020.00342
- GRAZIANO, Brian R., TOWN, Jason P., SITARSKA, Ewa, NAGY, Tamas L., FOŠNARIČ, Miha, PENIČ, Samo, IGLIČ, Aleš, KRALJ-IGLIČ, Veronika, GOV, Nir S., DIZ-MUÑOZ, Alba, WEINER, Orion D. Cell confinement reveals a branched-actin independent circuit for neutrophil polarity. *PLoS biology*, ISSN 1545-7885. [Online ed.], 2019, vol. 17, iss. 10, str. 1-34, ilustr. https://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.3000457, doi: 10.1371/journal.pbio.3000457. [COBISS.SI-ID 5728875], [JCR, SNIP]
- FOŠNARIČ, Miha, **PENIČ, Samo**, IGLIČ, Aleš, KRALJ-IGLIČ, Veronika, DRAB, Mitja, GOV, Nir S. Theoretical study of vesicle shapes driven by coupling curved proteins and active cytoskeletal forces. *Soft matter*, ISSN 1744-6848, 2019, vol. 15, 26, str. 5319-5330, doi: 10.1039/c8sm02356e. [COBISS.SI-ID 5646187],
- **PENIČ, Samo**, IGLIČ, Aleš, BIVAS, Isak, FOŠNARIČ, Miha. Bending elasticity of vesicle membranes studied by Monte Carlo simulations of vesicle thermal shape fluctuations. *Soft matter*, ISSN 1744-683X, 7 Jul. 2015, vol. 11, no. 25, str. 5004-5009, ilustr. http://pubs.rsc.org/en/content/articlepdf/2015/sm/c5sm00431d?page=search, doi: 10.1039/C5SM00431D. [COBISS.SI-ID 11044180]
- RESNIK, Drago, VRTAČNIK, Danilo, ALJANČIČ, Uroš, MOŽEK, Matej, **PENIČ, Samo**, AMON, Slavko. Influence of mechanical stress on adhesion properties of DC magnetron sputtered Ti/NiV/Ag layers on n+Si substrate. *Microelectronic engineering*, ISSN 0167-9317. [Print ed.], Jul. 2008, vol. 85, no. 7, str. 1603-1607, ilustr. [COBISS.SI-ID 6523476]
- RESNIK, Drago, VRTAČNIK, Danilo, ALJANČIČ, Uroš, MOŽEK, Matej, **PENIČ, Samo**, AMON, Slavko. Influence of mechanical stress on adhesion properties of DC magnetron sputtered Ti/NiV/Ag layers on n+Si substrate. *Microelectronic engineering*, ISSN 0167-9317. [Print ed.], Jul. 2008, vol. 85, no. 7, str. 1603-1607, ilustr. [COBISS.SI-ID 6523476]
- MESAREC, Luka, GÓŹDŹ, Wojciech, KRALJ, Samo, FOŠNARIČ, Miha, **PENIČ, Samo**, KRALJ-IGLIČ, Veronika, IGLIČ, Aleš. On the role of external force of actin filaments in the formation of tubular protrusions of closed membrane shapes with anisotropic membrane components. *European biophysics journal*, ISSN 0175-7571, 2017, vol. 46, iss. 8, str. 705-718, ilustr. http://link.springer.com/article/10.1007/s00249-017-1212-z, doi: 10.1007/s00249-017-1212-z. [COBISS.SI-ID 11740500]
- **PENIČ, Samo**, FOŠNARIČ, Miha, MESAREC, Luka, IGLIČ, Aleš, KRALJ-IGLIČ, Veronika. Active forces of myosin motors may control endovesiculation of red blood cells. *Acta chimica slovenica*, ISSN 1580-3155. [Spletna izd.], 2020, vol. 67, no. , str. 1-8, ilustr. https://journals.matheo.si/index.php/ACSi/article/view/5863/2503, doi: 10.17344/acsi.2020.5863. [COBISS.SI-ID 12869460]
- MESAREC, Luka, FOŠNARIČ, Miha, **PENIČ, Samo**, KRALJ-IGLIČ, Veronika, KRALJ, Samo, GÓŹDŹ, Wojciech, IGLIČ, Aleš. Numerical study of membrane configurations. *Advances in condensed matter physics*, ISSN 1687-8108, 2014, vol. 2014, art. ID 373674, str. 1-7, ilustr. http://dx.doi.org/10.1155/2014/373674, doi: 10.1155/2014/373674. [COBISS.SI-ID 10880596]

- PEČAR, Borut, MOŽEK, Matej, RESNIK, Drago, VRTAČNIK, Danilo, ALJANČIČ, Uroš, **PENIČ, Samo**, AMON, Slavko. Microflow generator for fuel cell methanol hydrogen microreactor = Dozirni sistem za mikroprocesor goriva. *Informacije MIDEM : časopis za mikroelektroniko, elektronske sestavne dele in materiale*, ISSN 0352-9045. [Tiskana izd.], sep. 2010, letn. 40, št. 3, str. 208-217, ilustr. [COBISS.SI-ID 8169044]
- **PENIČ, Samo**, ALJANČIČ, Uroš, RESNIK, Drago, VRTAČNIK, Danilo, MOŽEK, Matej, AMON, Slavko. Cantilever method for determination of D31 coefficient in thin piezoelectric films = Metoda za določanje koeficienta d31 tankih piezoelektričnih filmov. *Informacije MIDEM : časopis za mikroelektroniko, elektronske sestavne dele in materiale*, ISSN 0352-9045. [Tiskana izd.], mar. 2009, letn. 39, št. 2, str. 85-92, ilustr. [COBISS.SI-ID 7570516]
- MOŽEK, Matej, VRTAČNIK, Danilo, RESNIK, Drago, ALJANČIČ, Uroš, **PENIČ, Samo**, AMON, Slavko. Calibration system for smart pressure sensors = Sistem za umerjanje tlačnih senzorjev. *Informacije MIDEM : časopis za mikroelektroniko, elektronske sestavne dele in materiale*, ISSN 0352-9045. [Tiskana izd.], sep. 2006, letn. 36, št. 3, str. 161-165, ilustr. [COBISS.SI-ID 5672788]
- **PENIČ, Samo**, MESAREC, Luka, FOŠNARIČ, Miha, KRALJ-IGLIČ, Veronika, KRALJ, Samo, GÓŹDŹ, Wojciech, IGLIČ, Aleš. Modeling of closed membrane shapes. V: DIMOVA-MALINOVSKA, Doriana (ur.). *Challenges of nanoscale science : theory, materials, applications*, 18th International School on Condensed Matter Physics (ISCMP), 1-6 September 2014, Varna, Bulgari, (Journal of physics, ISSN 1742-6596, vol. 558). Bristol: IOP. 2014, str. 1-9, ilustr. http://iopscience.iop.org/1742-6596/558/1/012010/pdf/1742-6596_558_1_012010.pdf, doi: 10.1088/1742-6596/558/1/012010. [COBISS.SI-ID 10889300]
- BUDIME SANTHOSH, Poornima, **PENIČ, Samo**, GENOVA, Julia, IGLIČ, Aleš, KRALJ-IGLIČ, Veronika, POKLAR ULRIH, Nataša. A study on the interaction of nanoparticles with lipid membranes and their influence on membrane fluidity. V: DIMOVA-MALINOVSKA, Doriana (ur.). *Open problems in condensed matter physics, biomedical physics and their applications*, 17th International School on Condensed Matter Physics (ISCMP), 2-7 September 2012, Varna, Bulgari, (Journal of physics, ISSN 1742-6596, Vol. 398). Bristol: Institute of Physics Publishing. 2012, vol. 398, str. 012034-1-012034-6. http://iopscience.iop.org/1742-6596/398/1/012034/, doi: 10.1088/1742-6596/398/1/012034. [COBISS.SI-ID 4188536]

MIKROBIOLOGIJA HRANE

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Mikrobiologija hrane
Course title:	Microbiology of food
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (v postopku)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0594918
Koda učne enote na članici/UL Member course code:	0

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
10	20			10	85	5

Nosilec predmeta/Lecturer:	Sonja Smole Možina

Izvajalci predavanj:	Maja Rupnik, Sonja Smole Možina
Izvajalci seminarjev:	
Izvajalci vaj:	
Izvajalci kliničnih vaj:	
Izvajalci drugih oblik:	
Izvajalci praktičnega usposabljanja:	

Vrsta predmeta/Course type:	teoretični/theoretical

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Splošni pogoji za vpis na doktorski študij.	General conditions for enrolment in doctoral studies.

Vsebina:	Content (Syllabus outline):
Glavni vsebinski sklopi predmeta so naslednji: - izbrana poglavja iz mikrobne ekologije hrane in živilskih procesov oz. konzerviranja hrane - aktualni epidemiološki podatki o prenosu mikrobnih povzročiteljev okužb vzdolž proizvodno-oskrbovalne prehranske verige (nacionalni, EU-EFSA/ECDC, Med-Vet-Net, PulseNet, in druge podatkovne baze, specifične za posamezne patogene)	The main points in the contents of the subject are as follows: - selected topics from microbial ecology of foods, food processing and food preservation, - current epidemiological data (national, EU-EFSA/ECDC, Med-Vet-Net, PulseNet and others, specific for some foodborne pathogens),

- novi mikroorganizmi prenosljivi s hrano oz. vzdolž proizvodno-oskrbovalno prehranske verige in njihovo obvladovanje - alimentarne intoksikacije z bakterijskimi in glivnimi (miko)toksini - novejše metode za zagotavljanje sledljivosti mikroorganizmov in/ali njihovih toksinov v hrani. - rezistenca na protimikrobna sredstva pri patogenih mikroorganizmih, povzročiteljih kvarjenja ali indikatorskih mikroorganizmih v primarni in sekundarni proizvodnji hrane.	- emerging microorganisms: viruses, bacteria and eucaryotic causative agents (fungi, protozoa) along food production-food supply chain, - alimentary intoxications with bacterial and fungal (myco)toxins, - new methods for ensuring traceability of microorganisms, - resistance to antimicrobial agents of food-related pathogenic microorganisms, food spoilage or indicator microorganisms.

Temeljna literatura in viri/Readings:

Microorganisms in Foods (izbrana poglavja). International Commission on Microbiological Specifications for Foods (ICMSF) and Springer, New York, 2011 , 400 str.
Food Microbiology: Fundamentals and Frontiers (4. izd.) Doyle M.P. (ur.), Buchanan R.L. (ur). ASM Press, 2013 (izbrana poglavja).
Quantitative Microbiology in Food Processing: Modeling the Microbial Ecology. de Souza Sant'Ana A.(ur). 2017. (izbrana poglavja).
»Aktualni znanstveni in pregledni članki, ki so javno dostopni preko spleta«

Cilji in kompetence:	**Objectives and competences:**
- Poglobitev znanja slušatelja o živilih kot kompleksnih sistemih, ki so lahko vzrok alimentarnim infekcijam in intoksikacijam; - Razumevanje epidemioloških in ekoloških parametrov ter (bio)kemijskih sprememb živil na praktičnih primerih in na poglobljenem raziskovalnem nivoju; - Uporaba pridobljenega znanja za uspešno preprečevanje neželenih okužb in kvarjenja hrane.	The basic aim is deepening the student's knowledge of foods as complex systems which can cause alimentary infections and intoxications; - Understanding epidemiological and ecological parameters and (bio)chemical changes in foods on practical examples and on research level for successful prevention of undesirable infections and food spoilage.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Predviden študijski rezultat je kandidata usposobiti za izvedbo nalog in opravljanje raziskav, katerih rezultati bodo predstavljali pomembne prispevke temeljni ali aplikativni znanosti na področju ekologije in epidemiologije mikroorganizmov hrane.	The intended learning outcome is to qualify the candidate for carrying out the mentioned tasks and performing research, the results of which will make an important contribution to basic and applicative science in the field of ecology and epidemiology of food microorganisms

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, samostojna priprava seminarjev oz. projektov in njihova (javna) predstavitev.	Lectures, seminar and project work of the students in a written form and joined with oral presentation in the group.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Ocena seminarskega dela	50,00 %	Assessment of the seminar work
Ocena izpita	50,00 %	Written examination

Ocenjevalna lestvica:	**Grading system:**
5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

Sonja Smole Možina

1. FRAS ZEMLJIČ, Lidija, KRAŠEVAC GLASER, Tjaša, PLOHL, Olivija, ANŽEL, Ivan, ŠIMAT, Vida, ČAGALJ, Martina, MEŽNAR, Eva, MALIN, Valentina, STERNIŠA, Meta, **SMOLE MOŽINA, Sonja**. Biomass-derived plant extracts in macromolecular chitosan matrices as a green coating for PLA films. *Journal of functional biomaterials*. 2022, vol. 13, iss. 4 (228), str. 1-19, ilustr. ISSN 2079-4983. https://www.mdpi.com/2079-4983/13/4/228, DOI: 10.3390/jfb13040228. [COBISS.SI-ID 128975619],
2. HAO, Ruoyi, SHAH, Bakht Ramin, STERNIŠA, Meta, **SMOLE MOŽINA, Sonja**, MRÁZ, Jan. Development of essential oil-emulsion based coating and its preservative effects on common carp. *Lebensmittel-Wissenschaft + Technologie*. 2022, vol. 154, str. 1-13, art. 112582. ISSN 0023-6438. DOI: 10.1016/j.lwt.2021.112582. [COBISS.SI-ID 81415683],
3. FRAS ZEMLJIČ, Lidija, POKLAR ULRIH, Nataša, STERNIŠA, Meta, **SMOLE MOŽINA, Sonja**, PLOHL, Olivija, KRAŠEVAC GLASER, Tjaša, VOLMAJER VALH, Julija. Pullulan-chitosan coatings onto polyethylene foils for the development of active packaging material. *Cellulose chemistry and technology*, ISSN 0576-9787, 2019, vol. 53, no. 1/2, str. 121-132, ilustr. http://www.cellulosechemtechnol.ro/pdf/CCT1-2(2019)/p.121-132.pdf.
4. SKROZA, Danijela, ŠIMAT, Vida, **SMOLE MOŽINA, Sonja**, KATALINIĆ, Višnja, BOBAN, Nataša, GENERALIĆ MEKINIĆ, Ivana. Interactions of resveratrol with other phenolics and activity against food-borne pathogens. *Food science & nutrition*, ISSN 2048-7177, 2019, vol. 7, str. 2312-2318, ilustr., doi: 10.1002/fsn3.1073 [COBISS.SI-ID 5059704]
5. GENERALIĆ MEKINIĆ, Ivana, LJUBENKOV, Ivica, **SMOLE MOŽINA, Sonja**, ABRAMOVIČ, Helena, ŠIMAT, Vida, KATALINIĆ, Ana, NOVAK, Tina, SKROZA, Danijela. Abiotic factors during a one-year vegetation period affect sage phenolicmetabolites, antioxidants and antimicrobials. *Industrial crops and products*, ISSN 0926-6690, 2019, vol. 141, str. 1-7, [no.] 111741, ilustr., doi: 10.1016/j.indcrop.2019.111741. [COBISS.SI-ID 5094008],
6. KLANČNIK, Anja, ŠIMUNOVIĆ, Katarina, KOVAČ, Jasna, SAHIN, Orhan, WU, Zuowei, VUČKOVIĆ, Darinka, ABRAM, Maja, ZHANG, Qijing, **SMOLE MOŽINA, Sonja**. The anti-Campylobacter activity and mechanisms of pinocembrin action. *Microorganisms*, ISSN 2076-2607, 2019, vol. 7, iss. 12, str. 1-15, ilustr. https://doi.org/10.3390/microorganisms7120675, doi: 10.3390/microorganisms7120675. [COBISS.SI-ID 5133688]

Maja RUPNIK

1. TKALEC, Valerija, VIPREY, Virginie, DAVIS, Georgina L, JANEŽIČ, Sandra, SENTE, Béatrice, DEVOS, Nathalie, WILCOX, Mark, DAVIES, Kerrie, RUPNIK, Maja. Clostridioides difficile positivity rate and PCR ribotype distribution on retail potatoes in 12 European countries, January to June 2018. *Eurosurveillance*. [Online ed.]. 2022, vol. 27, no. 15, str. 1-10. ISSN 1560-7917. https://www.eurosurveillance.org/content/10.2807/1560-7917.ES.2022.27.15.2100417, DOI: 10.2807/1560-7917.ES.2022.27.15.2100417. [COBISS.SI-ID 105165315]
2. TKALEC, Valerija, JAMNIKAR CIGLENEČKI, Urška, RUPNIK, Maja, GREBENC, Stanka, ZELENIK, Katja, BIASIZZO, Majda. Clostridioides difficile in national food surveillance, Slovenia, 2015 to 2017. *Eurosurveillance*. [Online ed.]. 23. Apr. 2020, vol. 25, iss. 16, str. 1-10, ilustr. ISSN 1560-7917. https://www.eurosurveillance.org/content/10.2807/1560-7917.ES.2020.25.16.1900479, DOI: 10.2807/1560-7917.ES.2020.25.16.1900479. [COBISS.SI-ID 15095555]
3. TKALEC, Valerija, JANEŽIČ, Sandra, SKOK, Barbara, SIMONIČ, Tamara, MESARIČ, Simon, VRABIČ, Tanja, RUPNIK, Maja. High Clostridium difficile contamination rates of domestic and imported potatoes compared to some other vegetables in Slovenia. *Food microbiology*. apr. 2019, vol. 78, str. 194-200. ISSN 1095-9998. https://www.sciencedirect.com/science/article/pii/S0740002018306105, DOI: 10.1016/j.fm.2018.10.017. [COBISS.SI-ID 512843320]
4. TREVEN, Primož, MAHNIČ, Aleksander, RUPNIK, Maja, GOLOB, Majda, PIRŠ, Tina, BOGOVIČ MATIJAŠIĆ, Bojana, MOHAR LORBEG, Petra. Evaluation of human milk microbiota by 16S rRNA gene next-generation sequencing (NGS) and cultivation/MALDI-TOF mass spectrometry identification. *Frontiers in microbiology*. 2019, vol. 10, art. no. 2612, str. 1-12, ilustr. ISSN 1664-302X. https://www.frontiersin.org/articles/10.3389/fmicb.2019.02612/full, https://repozitorij.uni-lj.si/IzpisGradiva.php?id=113787, DOI: 10.3389/fmicb.2019.02612. [COBISS.SI-ID 4326792]
5. KNETSCH, C. W., KUMAR, N., FORSTER, S. C., CONNOR, T. R., BROWNE, H. P., HARMANUS, Celine, SANDERS, I. M., HARRIS, S. R., TURNER, L., MORRIS, T., RUPNIK, Maja, et al. Zoonotic transfer of Clostridium difficile harboring antimicrobial resistance between farm animals and humans. *Journal of clinical microbiology*. [Online ed.]. march 2018, vol. 56, iss. 3, f. 1-8. ISSN 1098-660X. http://jcm.asm.org/content/56/3/e01384-17.full.pdf+html, DOI: 10.1128/JCM.01384-17. [COBISS.SI-ID 512807992]

6. RODRIGUEZ DIAZ, C., SEYBOLDT, C., RUPNIK, Maja. Non-human C. difficile reservoirs and sources : animals, food, environment. V: MASTRANTONIO, Paola (ur.), RUPNIK, Maja (ur.). *Updates on Clostridium difficile in Europe*. Cham: Springer Nature, cop. 2018. Str. 227-243. Advances in experimental medicine and biology, Vol. 1050. ISBN 978-3-319-72799-8, ISBN 978-3-319-72798-1. ISSN 2214-8019. DOI: 10.1007/978-3-319-72799-8. [COBISS.SI-ID 94935297]

MIKROBIOLOGIJA IN BIOTEHNOLOGIJA KVASOVK

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Mikrobiologija in biotehnologija kvasovk
Course title:	Microbiology and biotechnology of yeasts
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (v postopku)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0566746
Koda učne enote na članici/UL Member course code:	0

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
10	25	0	0	0	90	5

Nosilec predmeta/Lecturer:	Neža Čadež

Izvajalci predavanj:	Neža Čadež
Izvajalci seminarjev:	
Izvajalci vaj:	
Izvajalci kliničnih vaj:	
Izvajalci drugih oblik:	
Izvajalci praktičnega usposabljanja:	

Vrsta predmeta/Course type:	teoretični/theoretical

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Splošni pogoji za vpis na doktorski študij	General prerequisits to enrol in doctoral study

Vsebina:	Content (Syllabus outline):
Zimologija; splošne lastnosti kvasovk; naravni habitati, pregled industrijske uporabe, pomen za bazične raziskave, pomen za zdravje in povzročitelji bolezni; biotska raznovrstnost, klasifikacija, identifikacija, njihova evolucija in adaptacija kvasovk v različnih habitatih z uporabo genomike. Glavne morfološke lastnosti kvasovk in zgradba kvasne celice. Glavne fiziološke lastnosti kvasovk, esencialni elementi za rast, sprejem nutrientov,	Zymology; general characteristics of yeasts, natural habitats, review of industrial applications, importance for basic research, clinical importance; biotic diversity, classification, evolution and adaptation of yeasts on different habitats by using genomics. Yeasts morphological characteristics and structure of yeast cell. Physiological characteristics, essential elements for their growth, nutrient transport and composition of media for their cultivation. Modes of

sestava substratov za kultivacijo kvasov. Načini vegetativne rasti kvasovk, celični cikel kvasovk in molekularni dejavniki celičnega cikla, načini spolne reprodukcije kvasovk. Rast populacije kvasovk, primerjava kolonijske rasti in rasti v tekočem mediju, strategije kultivacije in ohranjanja kvasovk, fizikalno-kemijski pogoji za rast kvasovk, stresi okolja, smrt kvasovk, interakcije z drugimi organizmi. Metabolizem in njegova regulacija, primarni in sekundarni metaboliti, zimocidnost. Tehnološki pomen v sodobni biotehnologiji, rekombinantne tehnologije kvasovk, pregled alternativnih pristopov pridobivanja novih nekonvencionalnih kvasovk za industrijsko uporabo, pomen kvasovk pri proizvodnji hrane in pijače, proizvodnja biomase, proizvodnja bio-etanola, proizvodnja ekstracelularnih polisaharidov, proizvodnja encimov.	vegetative growth, cell cycle and its molecular mechanisms, modes of yeasts sexual reproduction. Yeast population growth, difference between growth on solid and in liquid media, modes of cultivation, preservation, physical-chemical conditions for growth, stress factors, cell death, interactions with other organisms. Metabolism, their regulation, primary and secondary metabolites, killer activity. Technological importance in modern biotechnology, recombinant yeast technology, alternative approaches for industrial use of non-conventional yeasts, yeast importance for food and beverage production, biomass production, bio-ethanol production, extracellular polysaccharides and enzyme production.

Temeljna literatura in viri/Readings:

Feldmann, H. 2012. Yeast: Molecular and Cell Biology, 2nd Edition, Wiley, 464 str.
Walker GM. Yeast physiology and biotechnology. Chichester [etc.]: J. Wiley & Sons; 1998. IX, 350.
Aktualni znanstveni in pregledni članki, ki so javno dostopni preko spleta.

Cilji in kompetence:	**Objectives and competences:**
Temeljni izobraževalni cilj je celovito zanje in razumevanje mikrobiologije in biotehnologije kvasovk, kar je osnova za samostojno raziskovalno delo. Koncept predmeta procesno združuje komplementarna znanja iz področij mikrobiologije in biotehnologije, s čimer zagotavlja povezovanje sodobnih metodoloških pristopov za izrabo industrijskih mikroorganizmov v tradicionalni in sodobni industriji.	Educational goal is a comprehensive knowledge and understanding of yeasts microbiology and biotechnology as a basis for independent research. The concept of the course combines complementary knowledge in the fields of microbiology and biotechnology and ensures integration of contemporary methodological approaches for manipulation with industrial microorganisms in traditional and modern industry.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Predviden študijski rezultat je kandidata usposobiti za izvedbo raziskav, rezultati katerih bodo predstavljali pomembne prispevke temeljni ali aplikativni znanosti na področju mikrobiologije.	Intended learning outcome is to educate a candidate to undertake research, which results will represent important contributions to basics or applied science in the field of microbiology.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja in seminarji.	Lectures and seminars

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Ustni izpit	70,00 %	Oral exam
Seminarska naloga	30,00 %	Seminar work

Ocenjevalna lestvica:	**Grading system:**
5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

Neža Čadež

1. ČADEŽ, Neža, BELLORA, Nicolas, ULLOA, Ricardo, TOME, Miha, PETKOVIĆ, Hrvoje, GROENEWALD, Marizeth, HITTINGER, Chris Todd, LIBKIND, Diego, et al. *Hanseniaspora smithiae* sp. nov., a novel apiculate yeast species from patagonian forests that lacks the typical genomic domestication signatures for fermentative environments. Frontiers in Microbiology. Jul. 2021, vol. 12, str. 1-11
2. ČADEŽ, Neža, DLAUCHY, Dénes, TOME, Miha, PÉTER, Gábor. *Novakomyces olei* sp. nov., the first member of a novel *Taphrinomycotina* lineage. *Microorganisms*. 2021, vol. 9, no. 2, str. 1-20.
3. ČADEŽ, Neža, DRUMONDE-NEVES, João, SIPICZKI, Matthias, DLAUCHY, Dénes, LIMA, Teresa, PAIS, Célia, SCHULLER, Dorit, FRANCO-DUARTE, Ricardo, LACHANCE, Marc-André, PÉTER, Gábor. *Starmerella vitis* f.a., sp. nov., a yeast species isolated from flowers and grapes. Antonie van Leeuwenhoek : International Journal of General and Molecular Microbiology. 2020, vol. 113, iss. 9, str. 1289-1298.
4. KOSEL, Janez, RASPOR, Peter, ČADEŽ, Neža. Maximum residue limit of fungicides inhibits the viability and growth of desirable non-Saccharomyces wine yeasts. Australian Journal of Grape and Wine Research. 2019, vol. 25, iss. 1, str. 43-52.
5. PONTES, Ana, ČADEŽ, Neža, GONÇALVES, Paula, SAMPAIO, José Paulo. A quasi-domesticate relic hybrid population of *Saccharomyces cerevisiae* x *S. paradoxus* adapted to olive brine. Frontiers in Genetics. May 2019, vol. 10, article 449, str. 1-14.
6. SHEN, Xing-Xing, OPULENTE, Dana A., … ČADEŽ, Neža, LIBKIND, Diego, ROSA, Carlos, DEVIRGILIO, Jeremy, HULFACHOR, Amanda Beth, GROENEWALD, Marizeth, KURTZMAN, C. P., HITTINGER, Chris Todd, ROKAS, Antonis. Tempo and mode of genome evolution in the budding yeast subphylum. Cell. 2018, vol. 175, iss. 6, str. 1533-1545.

MIKROBIOLOŠKE METODE

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Mikrobiološke metode
Course title:	Methods in microbiology
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (v postopku)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0566751
Koda učne enote na članici/UL Member course code:	0

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
0	0	10	0	15	100	5

Nosilec predmeta/Lecturer:	Polonca Štefanič
Izvajalci predavanj:	Tjaša Danevčič, Anja Klančnik, Sonja Smole Možina, Polonca Štefanič, Polona Zalar
Izvajalci seminarjev:	
Izvajalci vaj:	
Izvajalci kliničnih vaj:	
Izvajalci drugih oblik:	
Izvajalci praktičnega usposabljanja:	

Vrsta predmeta/Course type:	individualno raziskovalni /individual research

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Splošni pogoji za vpis na doktorski študij	General requirements for the enrolment in PhD program

Vsebina:	Content (Syllabus outline):
Pri predmetu Mikrobiološke metode se bodo študenti in študentke seznanili s tehnikami, ki se uporabljajo za preučevanje morfologije, fiziologije, biokemije, genetike in molekularne biologije mikroorganizmov, tako na ravni posamezne celice, čistih kultur kot tudi mikrobnih združb. V okviru predmeta bodo sodelujoči laboratoriji predstavili izbor metod, ki jih	Course Methods in microbiology is designed to familiarise students with the techniques used for the study of morphology, physiology, biochemistry, genetics, and molecular biology of microorganisms, from the single cell, pure cultures to the microbial communities. Within the framework of the course, the participating microbiology laboratories will

uporabljajo pri svojih raziskavah. Delo bo eksperimentalno in bo potekalo v izbranih laboratorijih. Študentke in študenti se bodo spoznali z: - osamitvijo mikroorganizmov in njihovo kvantifikacijo v kompleksnih vzorcih, kot so hrana in tla, - določanjem mikrobiološke kvalitete (neoporečnosti) in sledljivosti hrane, - taksonomsko karakterizacijo mikroorganizmov z uporabo (a) klasičnih metod (temelječih na biokemijskih, fizioloških in morfoloških lastnostih) in (b) metod molekularne biologije (polimorfizem konformacije enojne verige (SSCP), polimorfizem dolžin pomnoženih fragmentov (AFLP), poliakrilamidna gelska elektroforeza v temperaturnem gradientu (TGGE), polimorfizem dolžin restrikcijskih fragmentov (RFLP), elektroforeza v pulzirajočem polju (PFGE), tipiziranje na osnovi multilokusnih sekvenc (MLST)…); študentke in študenti se bodo tudi naučili, kako izvesti filogenetske analize na teh podatkih, - identifikacijo sestave mikrobne združbe v nekem okolju z visokozmogljivim sekvenciranjem, - določitvijo odpornosti mikroorganizmov na fizikalne in kemijske dejavnike okolja, - določanjem mikrobne aktivnosti čistih kultur in mikrobnih združb v tleh, aktivnem blatu in drugih habitatih z merjenjem emisij CO2, metana, N2O; merjenjem aktivnosti nitrifikacije in denitrifikacije; določevanjem aktivnosti pomembnih encimov, kot so na primer fenol oksidaze, celulaze, hemicelulaze in hitinaze, - uporabo metod molekularne biologije, kot je verižna reakcija s polimerazo (PCR, in RT-PCR) pri ugotavljanju avtentičnosti živil (mleko, meso), - uporabo podatkov s področij genomike, transkriptomike in proteomike, - ugotavljanjem občutljivosti mikroorganizmov proti protimikrobnim sredstvom in odkrivanjem mehanizmov odpornosti proti antibiotikom in drugim protimikrobnim snovem pri ocenjevanju potencialne nevarnosti mikroorganizmov za zdravje ljudi/živali/rastlin, - določevanjem toksičnosti in genotoksičnosti snovi z uporabo mikroorganizmov (kometni test), - uporabo različnih pristopov pri proučevanju nastanka mikrobnih biofilmov, sposobnosti pritrjevanja na površine in odpornosti na parametre okolja.	introduce to students a selection of methods, which are used in their research. Experimental work will be carried out in the selected labs. Students will learn: - to isolate microorganisms and to quantify them in complex samples, such as food or soil, - to asses microbiological quality and the traceability of food products, - to taxonomically characterize microorganisms applying (i) classical (based on biochemical, physiological, and morphological traits) and (ii) molecular biology methods (single strand conformation polymorphism analysis (SSCP), amplified fragment length polymorphism (AFLP), temporal temperature and denaturing gradient electrophoresis (TTGE, DGGE), restriction fragment length polymorphism (RFLP), pulsed field gel electrophoresis (PFGE), multi locus sequence typing (MLST), etc.); students will also learn how to perform phylogenetic analyses on those data, - identification of the microbial community diversity with high-throughput sequencing, - to characterize the resistance of microorganisms to physical and chemical factors of the environment, - to determine the microbial activity of pure cultures and in microbial communities soil, active sludge and other habitats by measuring the emissions of CO2, methane, N2O; measuring the nitrification and denitrification activities; determination of the activities of important enzymes like phenol oxidase, cellullase, hemicellulase, and chitinase, - to use molecular biology methods, such as polymerase chain reactions (classical and real-time PCR) in food authenticity studies (milk, meat), - to use data from genomics, transcriptomics, and proteomics, - to test for antimicrobial susceptibility and discovering mechanisms of resistance to antibiotics and other antimicrobial substances in the evaluation of potential hazard of microorganisms for the human/animal/plant health, - to determine the toxicity and genotoxicity of substances with the use of microorganisms (comet assay), - to use different approaches for the investigation of microbial biofilm formation, their adhesive abilities and resistance in relation to surface characteristics and other environmental parameters.

Temeljna literatura in viri/Readings:

Revijalni in eksperimentalni članki s področja, ki so prosto dostopni na spletu ali dostopni v elektronski obliki preko konzorcijev NUK in CTK. Current review and scientific articles from the field, which are freely available online or accessible in electronic form through the NUK and CTK consortia.

Cilji in kompetence:	Objectives and competences:
• seznaniti študentko ali študenta z naborom metod, ki se uporabljajo v mikrobiologiji in ji/mu omogočiti izvedbo izbrane metode v laboratoriju. Izbrana metoda bo omogočila študentu rešitev specifičnega eksperimentalnega problema, ki se bo pojavil v okviru njenega/njegovega raziskovalnega dela, • posredovanje ključne znanstvene literature iz področja izbrane znanstvene metode , vključno s posredovanjem lastnega raziskovalčevega znanja, • pomoč pri analizi podatkov pridobljenih z izbrano metodo, rešitev ali izboljšava rešitve specifičnega problema s pridobljenimi rezultati.	• to provide the student with the range of methods used in microbiology and enable her/him to perform a selected method in a chosen laboratory. The selected method will enable the student to solve a specific experimental problem that will appear in the context of her/his research work, • to mediate key scientific literature from the field of the chosen method, including mediation of the lecturer's own experience, • to supply help with the analysis of data obtained with the chosen method, to enable or improve the solution of a specific problem with the obtained results.

Predvideni študijski rezultati:	Intended learning outcomes:
Znanje in razumevanje: Poznavanje izbrane mikrobiološke metode, sposobnost razlage principov na katerih izbrana metoda temelji in interpretacija pridobljenih rezultatov.	Knowledge and understanding: Familiarity with the chosen microbiological method, capability to explain the principles or laws on which the method is based and interpretation of the obtained results.

Metode poučevanja in učenja:	Learning and teaching methods:
V okviru eksperimentalnega laboratorijskega dela bodo udeleženi raziskovalci pomagali pri izvedbi izbrane metode kot tudi pri vpogledu v področje lastnih raziskav, pri katerih si pomagajo z izbrano metodo.	Within the framework of experimental lab work the participating researchers will provide help in realization of the chosen method as well as providing specific insight into their field of research in which they use the this method.

Načini ocenjevanja:	Delež/Weight	Assessment:
- ocena kompetenc pri eksperimentalnem delu v laboratoriju	60,00 %	- evaluation of the competences at the experimental work in the lab
priprava pisnega poročila in ustna predstavitev projekta po zaključenem eksperimentalnem delu	40,00 %	- written report and oral presentation of the project after the completion of the experimental work

Ocenjevalna lestvica:	Grading system:
5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

Polonca Štefanič

1. **ŠTEFANIČ, Polonca**, STARE, Eva, FLOCCARI, Valentina Andrea, KOVAČ, Jasna, HERTEL, Robert, DA ROCHA, Ulisses Nunes, KOVACS, Akos, MANDIĆ-MULEC, Ines, STRUBE, Mikael Lenz, DRAGOŠ, Anna. Ecology of prophage-like elements in Bacillus subtilis at global and local geographical scales. Cell reports. Jan. 2025, vol. 44, issue 1, [article no.] 115197, str. 1-16, ilustr. ISSN 2211-1247
2. **ŠTEFANIČ, Polonca,** BELCIJAN PANDUR, Katarina, KRAIGHER, Barbara, KOSTANJŠEK, Rok, NESME, Joseph, MADSEN, Jonas Stenløkke, KOVAČ, Jasna, SØRENSEN, Søren Johannes, VOS, Michiel, MANDIĆ-MULEC, Ines. Kin discrimination promotes horizontal gene transfer between unrelated strains in Bacillus subtilis. Nature communications. 2021, vol. 12, str. 1-11, ilustr. ISSN 2041-1723
3. **ŠTEFANIČ, Polonca**. Environment shapes the intra-species diversity of Bacillus subtilis isolates. Microbial ecology. 2020, vol. 79, str. 853-864, ilustr. ISSN 0095-3628

4. EREGA, Andi, **ŠTEFANIČ, Polonca**, DANEVČIČ, Tjaša, SMOLE MOŽINA, Sonja, MANDIĆ-MULEC, Ines. Impact of Bacillus subtilis antibiotic bacilysin and Campylobacter jejuni efflux pumps on pathogen survival in mixed biofilms. Microbiology spectrum. [Spletna izd.]. Jul./Aug. 2022, vol. 10, iss. 4, str. 1-14, ilustr. ISSN 2165-0497
5. DRAGOŠ, Anna, **ŠTEFANIČ, Polonca**, VATOVEC, Sabina, BEIGOT GLASER, Sara, RUPNIK, Maja, MANDIĆ-MULEC, Ines. Exploring ComQXPA quorum-sensing diversity and biocontrol potential of Bacillus spp. isolates from tomato rhizoplane. Microbial biotechnology. [Online ed.]. 2015, vol. 8, issue 3, str. 527-540. ISSN 1751-791

Anja Klančnik

1. KLANČNIK, Anja, GOBIN, Ivana, VUČKOVIĆ, Darinka, SMOLE MOŽINA, Sonja, ABRAM, Maja, JERŠEK, Barbara. Reduced contamination and infection via inhibition of adhesion of foodborne bacteria to abiotic polystyrene and biotic amoeba surfaces. *International journal of food science & technology*, ISSN 0950-5423. [Print ed.], 2018, vol. 53, str.1013-1020, doi: 10.1111/ijfs.13677. [COBISS.SI-ID 4856184]
2. BELLICH, Barbara, JANEŽ, Nikolaja, STERNIŠA, Meta, **KLANČNIK, Anja,** RAVENSCROF, Neil, RIZZO, Roberto, SABOTIČ, Jerica, CESCUTTI, Paola. Characterisation of a new cell wall teichoic acid produced by Listeria innocua ŽM39 and analysis of its biosynthesis genes. *Carbohydrate research*. Jan. 2022, vol. 511, str. 1-8, art. 108499, doi: 10.1016/j.carres.2021.108499. [COBISS.SI-ID 92040451],
3. EREGA, Andi, ŠTEFANIČ, Polonca, DOGŠA, Iztok, DANEVČIČ, Tjaša, ŠIMUNOVIĆ, Katarina, **KLANČNIK, Anja,** SMOLE MOŽINA, Sonja, MANDIĆ-MULEC, Ines. Bacillaene mediates the inhibitory effect of Bacillus subtilis on Campylobacter jejuni biofilms. *Applied and environmental microbiology*. Jun. 2021, vol. 87, no. 12, str. 1-14, ilustr. doi: 10.1128/AEM.02955-20. [COBISS.SI-ID 58440963],
4. KLANČNIK, Anja, ŠIKIĆ POGAČAR, Maja, TROŠT, Kajetan, TUŠEK-ŽNIDARIČ, Magda, MOZETIČ VODOPIVEC, Branka, SMOLE MOŽINA, Sonja. Anti-Campylobacter activity of resveratrol and an extract from waste Pinot noir grape skins and seeds, and resistance of C. jejuni planktonic and biofilm cells, mediated via the CmeABC efflux pump. *Journal of applied microbiology*, ISSN 1364-5072, Jan. 2017, vol. 122, iss. 1, str. 65-77, ilustr., doi: 10.1111/jam.13315. [COBISS.SI-ID 4699768]
5. KLANČNIK, Anja, MEGUŠAR, Polona, STERNIŠA, Meta, JERŠEK, Barbara, BUCAR, Franz, SMOLE MOŽINA, Sonja, KOS, Janko, SABOTIČ, Jerica. Aqueous extracts of wild mushrooms show antimicrobial and antiadhesion activities against bacteria and fungi. *Phytotherapy research*, ISSN 0951-418X, 2017, vol. 31, str. 1971-1976, doi: 10.1002/ptr.5934. [COBISS.SI-ID 4820856]
6. KLANČNIK, Anja, ŠIKIĆ POGAČAR, Maja, RASPOR, Peter, ABRAM, Maja, SMOLE MOŽINA, Sonja, VUČKOVIĆ, Darinka. Virulence genes and cytokine profile in systemic murine Campylobacter coli infection. *Virulence*, ISSN 2150-5594, 2015, vol. 6, iss. 6, str. 1-10, ilustr., doi: 10.1080/21505594.2015.1042642. [COBISS.SI-ID 4540536]

Sonja Smole Možina

1. KUNČIČ, Ajda, BUCAR, Franz, SMOLE MOŽINA, Sonja. Rhodiola rosea reduces intercellular signaling in Campylobacter jejuni. *Antibiotics*. 2022, vol. 11, iss. 9, str. 1-13, ilustr. ISSN 2079-6382. https://www.mdpi.com/2079-6382/11/9/1220, DOI: 10.3390/antibiotics11091220. [COBISS.SI-ID 121236483],
2. ŠIMAT, Vida, SKROZA, Danijela, TABANELLI, Giulia, ČAGALJ, Martina, PASINI, Federica, GÓMEZ-CARAVACA, Ana María, FERNÁNDEZ-FERNÁNDEZ, Carmen, STERNIŠA, Meta, SMOLE MOŽINA, Sonja, OZOGUL, Yesim, GENERALIĆ MEKINIĆ, Ivana. Antioxidant and antimicrobial activity of hydroethanolic leaf extracts from six Mediterranean olive cultivars. *Antioxidants*. 2022, vol. 11, iss. 9, str. 1-13, art. 1656, ilustr. ISSN 2076-3921. https://www.mdpi.com/2076-3921/11/9/1656, DOI: 10.3390/antiox11091656. [COBISS.SI-ID 120911875]
3. VRCA, Ivana, RAMIĆ, Dina, FREDOTOVIĆ, Željana, SMOLE MOŽINA, Sonja, BLAŽEVIĆ, Ivica, BILUŠIĆ, Tea. Chemical compositon and biological activity of essential oil and extract from the seeds of Tropaeolum majus L. var altum. *Food technology and biotechnology : journal of the Faculty of Food Technology and Biotechnology University of Zagreb*. 2022, vol. 60, no. 4, str. [1-10, sprejeto v objavo]. ISSN 1330-9862. DOI: 10.17113/ftb.60.04.22.7667. [COBISS.SI-ID 123504131]
4. ŠIMUNOVIĆ, Katarina, SAHIN, Orhan, EREGA, Andi, ŠTEFANIČ, Polonca, ZHANG, Qijing, MANDIĆ-MULEC, Ines, SMOLE MOŽINA, Sonja, KLANČNIK, Anja. Bacillus subtilis PS-216 spores supplemented in broiler chicken drinking water reduce Campylobacter jejuni colonization and increases weight gain. *Frontiers in microbiology*. Jul. 2022, vol. 13, str. 1-11, ilustr. ISSN 1664-302X. https://www.frontiersin.org/articles/10.3389/fmicb.2022.910616/full, DOI: 10.3389/fmicb.2022.910616. [COBISS.SI-ID 115015683]
5. TOMIČIĆ, Zorica, TOMIČIĆ, Ružica, SMOLE MOŽINA, Sonja, BUCAR, Franz, TUREK, Ivana, RASPOR, Peter. Antifungal and anti-adhesion activity of plant extracts and essential oils against Candida

spp. and Pichia spp. *Journal of food and nutrition research*. 2022, vol. 61, no. 1, str. 61-68. ISSN 1336-8672. https://www.vup.sk/index.php?mainID=2&navID=36&version=2&volume=61&article=2263. [COBISS.SI-ID 98242307]

6. BULUT, Sandra, DIMIĆ, Gordana, SMOLE MOŽINA, Sonja, ČARGO, Mihael, RAKIĆ, Irena, ŽIVANČEV, Jelena, ANTIĆ, Igor, KOCIĆ-TANACKOV, Sunčica. Occurrence of moulds and ochratoxin A in dried fruits and vegetables from the Serbian market. *Journal of food and nutrition research*. 2022, vol. 61, no. 4, str. 330-338. ISSN 1336-8672. https://www.vup.sk/index.php?mainID=2&navID=36&version=2&volume=61&article=2285. [COBISS.SI-ID 124342019]

Tjaša Danevčič

1. ŠPACAPAN, Mihael, DANEVČIČ, Tjaša, MANDIĆ-MULEC, Ines. ComX-induced exoproteases degrade ComX in Bacillus subtilis PS-216. Frontiers in microbiology, ISSN 1664-302X, Feb. 2018, vol. 9, article 105, str. 1-11, ilustr., doi: 10.3389/fmicb.2018.00105. [COBISS.SI-ID 4876664],
2. CESAR, Tjaša, DANEVČIČ, Tjaša, KAVKLER, Katja, STOPAR, David. Melamine polymerization in organic solutions and waterlogged archaeological wood studied by FTIR spectroscopy. Journal of cultural heritage, ISSN 1296-2074, 2017, vol. 23, str. 106-110, ilustr., doi: 10.1016/j.culher.2016.09.009. [COBISS.SI-ID 4703096].
3. JERMAN, Vesna, DANEVČIČ, Tjaša, MANDIĆ-MULEC, Ines. Methane cycling in a drained wetland soil profile. Journal of soils and sediments : protection, risk assessment and remediation, ISSN 1439-0108, 2017, vol. 17, iss. 7, str. 1874-1882, ilustr., doi: 10.1007/s11368-016-1648-2. [COBISS.SI-ID 4746616].
4. DANEVČIČ, Tjaša, BORIĆ VEZJAK, Maja, TABOR, Maja, ZOREC, Maša, STOPAR, David. Prodigiosin induces autolysins in actively grown Bacillus subtilis cells. Frontiers in microbiology, ISSN 1664-302X, Jan. 2016, vol. 7, article 27, str. 1-10, ilustr., doi: 10.3389/fmicb.2016.00027. [COBISS.SI-ID 4619128].
5. DANEVČIČ, Tjaša, BORIĆ VEZJAK, Maja, ZOREC, Maša, STOPAR, David. Prodigiosin - a multifaceted Escherichia coli antimicrobial agent. PloS one, ISSN 1932-6203, 2016, vol. 11, iss. 9, str. 1-13, e0162412, ilustr., doi: 10.1371/journal.pone.0162412. [COBISS.SI-ID 4693880].
6. DANEVČIČ, Tjaša, BORIĆ VEZJAK, Maja, STOPAR, David. Microbial ecophysiology of Vibrio ruber. Food technology and biotechnology : journal of the Faculty of Food Technology and Biotechnology University of Zagreb, ISSN 1330-9862, 2014, vol. 52, no. 2, str. 198-203. [COBISS.SI-ID 4367736].

Polona Zalar

1. **ZALAR, Polona**, GUBENŠEK, Ana, GOSTINČAR, Cene, KOSTANJŠEK, Rok, BIZJAK-MALI, Lilijana, GUNDE-CIMERMAN, Nina. Cultivable skin mycobiota of healthy and diseased blind cave salamander (Proteus anguinus). Frontiers in microbiology. Jul. 2022, vol. 13, str. 1-14, ilustr. ISSN 1664-302X. https://doi.org/10.3389/fmicb.2022.926558, DOI: 10.3389/fmicb.2022.926558. [COBISS.SI-ID 118663939].
2. KAVKLER, Katja, DEMŠAR, Andrej, TAVZES, Črtomir, GOSTINČAR, Cene, **ZALAR, Polona**. Discolouration of fungal stains on cotton textiles. International biodeterioration & biodegradation. [Print ed.]. 2022, vol. 172, iss. aug, str. 1-7, ilustr. ISSN 0964-8305. https://www.sciencedirect.com/science/article/pii/S0964830522000555?dgcid=author, DOI: doi.org/10.1016/j.ibiod.2022.105427. [COBISS.SI-ID 110792195].
3. KAVKLER, Katja, HUMAR, Miha, KRŽIŠNIK, Davor, TURK, Martina, TAVZES, Črtomir, GOSTINČAR, Cene, DŽEROSKI, Sašo, POPOVIC, Stefan, PENKO, Ana, GUNDE-CIMERMAN, Nina, **ZALAR, Polona**. A multidisciplinary study of biodeteriorated Celje Ceiling, a tempera painting on canvas. International Biodeterioration & Biodegradation. [Online ed.]. 2022, vol. 170, 1 spletni vir (1 datoteka pdf ([14 str.])), ilustr. ISSN 1879-0208. https://www.sciencedirect.com/science/article/pii/S0964830522000178, DOI: 10.1016/j.ibiod.2022.105389. [COBISS.SI-ID 99197187].
4. PERINI, Laura, ANDREJAŠIČ, Kristina, GOSTINČAR, Cene, GUNDE-CIMERMAN, Nina, **ZALAR, Polona**. Greenland and Svalbard glaciers host unknown basidiomycetes: the yeast Camptobasidium arcticum sp. nov. and the dimorphic Psychromyces glacialis gen. and sp. nov. International journal of systematic and evolutionary microbiology. 27 Jan. 2021, vol. 71, iss. 2, str. 1-17, ilustr. ISSN 1466-5034. https://www.microbiologyresearch.org/content/journal/ijsem/10.1099/ijsem.0.004655, DOI: 10.1099/ijsem.0.004655. [COBISS.SI-ID 50481155].
5. GOSTINČAR, Cene, **ZALAR, Polona**, GUNDE-CIMERMAN, Nina. No need for speed : slow development of fungi in extreme environments. Fungal biology reviews. 2022, vol. 39, 1-14. ISSN 1749-4613. https://www.sciencedirect.com/science/article/pii/S1749461321000543?via%3Dihub, DOI: 10.1016/j.fbr.2021.11.002. [COBISS.SI-ID 103798787].
6. EL BAIDOURI, Fouad, **ZALAR, Polona**, JAMES, Timothy Y., GLADFELTER, Amy S., AMEND, Anthony S. Evolution and physiology of amphibious yeasts. Annual review of microbiology. 2021, vol. 75, str.

337-357, ilustr. ISSN 1545-3251. https://www.annualreviews.org/doi/10.1146/annurev-micro-051421-121352, DOI: 10.1146/annurev-micro-051421-121352. [COBISS.SI-ID 81767171].

MIKROBNA BIOTEHNOLOGIJA

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Mikrobna biotehnologija
Course title:	Microbial Biotechnology
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (v postopku)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037287
Koda učne enote na članici/UL Member course code:	3789

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
20	30	0	0	20	180	10

Nosilec predmeta/Lecturer:	Hrvoje Petković

Izvajalci predavanj:	Mojca Benčina, Hrvoje Petković
Izvajalci seminarjev:	
Izvajalci vaj:	
Izvajalci kliničnih vaj:	
Izvajalci drugih oblik:	
Izvajalci praktičnega usposabljanja:	

Vrsta predmeta/Course type:	teoretični/theoretical

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Splošni pogoji za vpis na doktorski študij.	General conditions for enrolment in doctoral studies apply.

Vsebina:	Content (Syllabus outline):
Pregled in osvežitev znanja na področju tradicionalnih metod in pristopov, kar vključuje različne aspekte mikrobne biotehnologije: -klasični pristopi izolacije mikroorganizmov iz okolja, izboljševanja industrijskih sevov in razvoja bioprocesov za industrijsko proizvodnjo različnih bioproizvodov, proizvodnja primarnih in sekundarnih metabolitov, produktov proteinske narave, uporaba	In the scope of the course an overview of traditional methods and various approaches of microbial biotechnology will be presented such as: -classical approaches if isolation of microorganisms from natural environments, industrial strain and process development for industrial production of various bioproducts, production of primary and

mikroorganizmov in encimov v živilski, kemijski in farmacevtski industriji. -uporaba mikroorganizmov in razvoj bioprocesov v živilski industriji, agrikulturi in okljevarstvu. Nadalje se vsebina predmeta navezuje na novejše, v industriji široko uporabljane pristope metabolnega in biosinteznega in proteinskega inženirstva z uporabo rekombinantne DNA, razvoj izpopolnjenih bioprocesov za produkcijo generičnih proizvodov, in uvajanja novih bioproizvodov, npr. majhnih molekul z novim načinom delovanja, protiteles in drugih biofarmacevtskih produktov proteinske narave. Komparativni pregled najbolj pomembnih industrijskih mikroorganizmov in novih konceptov mikrobne biotehnologije, ki se nanašajo na izbor industrijskih gostiteljskih mikroorganizmov (ang. chassis), primernih za proizvodnjo širokega spektra bioproizvodov, tako tradicionalnih (generičnih) kot tudi novih bioproizvodov. Predstavitev novejši gostiteljskuh sevov, kot so npr. miksobakterije, cianobakterije, alge in arheje, ki se danes še ne uporabljajo pogosto v industijskem merilu, vendar so zaradi potencialnih prednosti, npr. vir novih učinkovin in encimov, izboljšane ekonomike bioprocesa in okoljevarstvenih razlogov danes predmet intenzivnih raziskav. Komparativni pregled najnovejših metod in pristopov, ki so še v razvoju, vendar že prihajajo v industrijsko okolje, kot so to npr.: -metagenomika, podatkovno rudarjenje genomov, (ang. genome mining) ob hitrem razvoj in uporabi zmogljivih bioinformatskih orodji -napredne metode sekvenciranja in sinteze DNA in napredne metode manipulacije mikroorganizmov - uporaba »omskih« pristopov v razumevanju in razvoju industrijskih sevov in bioprocesov - razvoj pristopov t.i. sintezne biologije, konstukcija »ne-naravnih« biosinteznih poti in produktov, uporaba obnovljivih virov energije, razvoj novih biomaterialov (biopolimerov), biofarmacevtskih produktov, vključno s tistimi, ki niso mikrobnega izvora. Predmet se bo vsebinsko dotaknil tudi dimenzij regulative, varnosti, etike, intelektuane lastnine in nasplošno družbeno-ekonomskih dimenzij, ki jih prinaša hiter razvoh biotehnologije.	secondary metabolites, proteins and enzymes for food chemical and pharmaceutical industry. -application of microorganisms in the devlopment of bioprocesses in food, agriculture and environmental industry. Further, the content of the subject is inter-connected with new and widely applied approaches of metabolic and biosynthetic engineering, where recombinant DNA methodology is applied, development of the advanced bioprocesses for production of generic products and introduction of novel bio-products, eg. small molecules with novel mode of action, antibodies and biopharmaceuticals. Comparative overview of the most important industrial microorganisms and recent concepts in microbial biotechnology, relating to the most advanced industrial hosts (chassis), suitable for the production of wide spectrum of bio-products, both, traditional (generic) as well as new bio-products. In the scope of the course, a number of novel hosts in current R&D will be presented, such as myxobacteria, cyanobacteria, algae, archaea, not yet used often in industrial environments, but show great potential for production of various bio-products of potentially high economic advantage and environmental value, currently being under intensive R&D development. In the scope of the subject »Microbial biotechnology«, comparative overview of the most recently developed methods and approaches, only recently reaching industrial environment will be discussed such as: -metagenomics and genome mining approaches, further fortified by the development of powerful bioinformatics approaches - new powerful and affordable DNA sequencing, DNA synthesis and advanced gene manipulation methods - application of recently developed »omics« approaches for better understanding and development of industrial microorganisms and bioprocesses. -further, development and application of »synthetic biology« approaches, construction of novel »non-natural« biosynthetic pathways and bio-products, the use of renewable sources of energy, development of advanced biomaterials (biopolymers) and biopharmaceutical products from heterologous sources. Finally, the subject »Microbial biotechnology« will also deal with issues such as regulatory affairs, safety, ethics, intellectual property and other important issues of modern society, due to the rapid development of biotechnology.

Temeljna literatura in viri/Readings:

- Microbial Biotechnology: Principles and aplications, 2013, 3rd ed. (Ed.: Yuan Kun Lee). World Scientiffic Publishing, Co. Pte. Ltd. ISBN13: 978-9814366816 (Hardcover),

- Microbial Biotechnology: Fundamentals of Applied Microbiology (Hardcover),2007, Eds.: Alexander N. Glazer Hiroshi Nikaido, 2nd ed. ISBN 9780-521-84210-5 (Hardcover).
- Kay Yeoman, Beatrix Fahnert, David Lea-Smith, and Tom Clarke. Microbial Biotechnology, 2020, Oxford University Press, ISBN: 9780198822813
- Rolf D. Schmid, Claudia Schmidt-Dannert, Ruth Hammelehle.Biotechnology: An Illustrated 1st Edition, 2016, John Wiley & Sons. *ISBN*-13. 978-352733515Druga učna gradiva:
- Drugi viri obsegajo novejše revialne in originalne znanstvene publikacije in izbrana patentna literatura

Cilji in kompetence:	**Objectives and competences:**
Študenti se bojo srečali in osvojili znanja, ki dajejo široko platformo razumevanja modernih pristopov v mikrobni biotehnologiji, ki slonijo na tradicionalnih pristopih biotehnologije. Koncept predmeta komparativno združuje spekter komplementarni znanja, od področja mikrobiologije pa do biotehnološkega inženirstva, kar omogoča celovito razumevanje delovanja bioprocesov in njihovo obvladovanje v raziskovanem, razvojnem delu in prenosu v industrijsko delu. Študenti se bojo srečali z novimi koncepti v mikrobni biotehnologiji, ki slonijo na modernih metodah, in zato bistveno spreminjajo pogled na razvoj in raziskave in industrijsko proizvodnjo na področju sodobne mikrobne biotehnologije.	Students will receive a new information and understanding related to wider platform of modern approaches in microbial biotechnology, originaly based on the traditional concepts in biotechnology. The course is unifying complementary knowledge, from wider areas of microbiology to biotechnological engineering , thus ensuring comprehensive understanding on how bioprocesses are developed during research and development efforts and transferred to the industrial environment. Students will meet a new concepts in modern microbial biotechnology, based on recently developed methods, which will clearly have great impact in the near future development in the area of microbial biotechnology.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanja in razumevanje novih konceptov mikrobne biotehnologije, ki se naslanjajo predvsem na uporabo večnameskih industrijskih gensko manipuliranih gostiteljskih mikroorganizmov (ang. Chassis), ki slonijo na modernih metodah biosinteznega in metabolnega inženirstva, sintezne biologije, omskih pristopov, od katerih so nekatere še v razvoju, vendar že bistveno spreminjajo pogled na raziskovalno razvojne aktivnosti v mikrobni biotehnologiji. Vsebinsko se bo predmet povezoval med teorijo in prakso metod dela z industrijskimi mikroorganizmi v laboratoriju in prenosu v industrijsko okolje in ima jasne vsebinske povezave do drugih vej biotehnologije, kot so npr. farmacevtska, medicinska, živilska, in okoljevarstvena biotehnologij. Zato bo predmet prinaša uporabna znanja in razumevanje tudi za študente, ki ne delujejo neposredno na področju mikrobne biotehnologije.	Student will gain knowledge and understanding of new concepts in microbial biotechnology, based on the use of multipurpose host organisms (chassis), where modern methods such as biosynthetic and metabolic engineering, synthetic biology and omics approaches are applied, some of which are still being developed, but will clearly have near future impact in R&D activities in strain and industrial process development. Content of the course will interconnect between theoretical knowledge and practical methodologies, applied in the work with industrial microorganisms at the laboratory scale and their transfer to the industrial environment. The course has obvious connections to the other areas of biotechnology such as pharmaceutical, medical food and environmental biotechnology, thus bringing valuable knowledge to students not closely familiar with are of microbial biotechnology.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, osebne konzultacije in individualno delo v sklopu priprave seminarske naloge	Lecture, personal consultations and individual work on seminar-projects.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Seminar	70,00 %	Seminar
Ustni Izpit	30,00 %	Oral exam

Ocenjevalna lestvica:	Grading system:
5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

Prof. dr. Hrvoje Petković:

1. PŠENIČNIK, Alen, REBERŠEK, Roman, SLEMC, Lucija, GODEC, Tim, KRANJC, Luka, PETKOVIĆ, Hrvoje. Simple and reliable in situ CRISPR-Cas9 nuclease visualization tool is ensuring efficient editing in Streptomyces species. *Journal of microbiological methods*. [Print ed.]. Sep. 2022, vol. 200, str. 1-7, ilustr. ISSN 0167-7012. https://www.sciencedirect.com/science/article/pii/S0167701222001403?via%3Dihub, DOI: 10.1016/j.mimet.2022.106545. [COBISS.SI-ID 122035715]

2. SLEMC, Lucija, JAKŠE, Jernej, FILISETTI, Alessandro, BARANASIC, Damir, RODRÍGUEZ GARCÍA, Antonio, DEL CARRATORE, Francesco, MARINO, Stefano Maria, ZUCKO, Jurica, STARCEVIC, Antonio, ŠALA, Martin, PÉREZ-BONILLA, Mercedes, SÁNCHEZ-HIDALGO, Marina, GONZÁLEZ, Ignacio, REYES, Fernando, GENILLOUD, Olga, SPRINGTHORPE, Vicki, GORANOVIČ, Dušan, KOSEC, Gregor, THOMAS, Gavin, DE LUCREZIA, Davide, PETKOVIĆ, Hrvoje, TOME, Miha. Reference-grade genome and large linear plasmid of streptomyces rimosus: pushing the limits of nanopore sequencing. *Microbiology spectrum*. [Spletna izd.]. Mar./Apr. 2022, vol. 10, iss. 2, str. 1-20, ilustr. ISSN 2165-0497. https://journals.asm.org/doi/10.1128/spectrum.02434-21, DOI: 10.1128/spectrum.02434-21. [COBISS.SI-ID 103836931]

3. SENGES, Christoph, STEPANEK, Jennifer J., WENZEL, Michaela, RAATSCHEN, Nadja, AY, Ümran, MÄRTENS, Yvonne, PROCHNOW, Pascal, VÁZQUEZ HERNÁNDEZ, Melissa, YAYCI, Abdulkadir, SCHUBERT, Britta, JANZING, Niklas, WARMUTH, Helen L., KOZIK, Martin, BONGARD, Jens, ALUMASA, John N., ALBADA, Bauke, PENKOVA, Maya, LUKEŽIČ, Tadeja, SORTO, Nohemy A., LORENZ, Nicole, MILLER, Reece, ZHU, Bingyao, BENDA, Martin, STÜLKE, Jörg, SCHÄKERMANN, Sina, LEICHERT, Lars I., SCHEINPFLUG, Kathi, BRÖTZ-OESTERHELT, Heike, HERTWECK, Christian, SHAW, Jared T., PETKOVIĆ, Hrvoje, BRUNEL, Jean M., KEILER, Kenneth C., METZLER-NOLTE, Nils, BANDOW, Julia E., et al. Comparison of proteomic responses as global approach to antibiotic mechanism of action elucidation. *Antimicrobial agents and chemotherapy*. [Online ed.]. 2021, vol. 65, no. 1, str. 1-17, e01373-20, ilustr. ISSN 1098-6596. https://aac.asm.org/content/aac/65/1/e01373-20.full.pdf, DOI: 10.1128/AAC.01373-20. [COBISS.SI-ID 38393859],

4. ZVER, Špela, CARRILLO RINCON, Andres Felipe, SLEMC, Lucija, GORANOVIČ, Dušan, AVBELJ, Martina, GJURAČIĆ, Krešimir, SUCIPTO, Hilda, STARE, Katja, BAEBLER, Špela, ŠALA, Martin, GUO, Meijin, LUZHETSKYY, Andriy, PETKOVIĆ, Hrvoje, MAGDEVSKA, Vasilka. Multiple copies of the oxytetracycline gene cluster in selected Streptomyces rimosus strains can provide significantly increased titers. *Microbial cell factories*. 17 Feb. 2021, vol. 20, str. 47-1-47-19, ilustr. ISSN 1475-2859. https://microbialcellfactories.biomedcentral.com/articles/10.1186/s12934-021-01522-5, DOI: 10.1186/s12934-021-01522-5. [COBISS.SI-ID 47424003]

5. HORVAT, Monika, AVBELJ, Martina, DURAN ALONSO, Maria Beatriz, BANJANAC, Mihailo, PETKOVIĆ, Hrvoje, ISKRA, Jernej. Antiviral activities of halogenated emodin derivatives against human coronavirus NL63. *Molecules*. Nov. 2021, vol. 26, iss. 22, str. 1-16, ilustr. ISSN 1420-3049. https://www.mdpi.com/1420-3049/26/22/6825/htm, DOI: 10.3390/molecules26226825. [COBISS.SI-ID 86120963],

6. HENNESSEN, Fabienne, MIETHKE, Marcus, ZABURANNYI, Nestor, LOOSE, Maria, LUKEŽIČ, Tadeja, BERNECKER, Steffen, HÜTTEL, Stephan, JANSEN, Rolf, SCHMIEDEL, Judith, FRITZENWANKER, Moritz, IMIRZALIOGLU, Can, VOGEL, Jörg, WESTERMANN, Alexander J., HESTERKAMP, Thomas, STADLER, Marc, WAGENLEHNER, Florian, PETKOVIĆ, Hrvoje, HERRMANN, Jennifer, MÜLLER, Rolf. Amidochelocardin overcomes resistance mechanisms exerted on tetracyclines and natural chelocardin. *Antibiotics*. 2020, vol. 9, iss. 9, str. 1-18, ilustr. ISSN 2079-6382. https://www.mdpi.com/2079-6382/9/9/619, DOI: 10.3390/antibiotics9090619. [COBISS.SI-ID 33973251],

7. LUKEŽIČ, Tadeja, ZVER, Špela, ZABURANNYI, Nestor, REMŠKAR, Maja, PETKOVIĆ, Hrvoje, MÜLLER, Rolf. Heterologous expression of the atypical tetracycline chelocardin reveals the full set of genes required for its biosynthesis. *Microbial cell factories*. 2020, vol. 19, št. članka 230, str. 1-13, ilustr. ISSN 1475-2859. DOI: 10.1186/s12934-020-01495-x. [COBISS.SI-ID 44693507]

8. LUKEŽIČ, Tadeja, ABOU FAYAD, Antoine, BADER, Chantal, HARMROLFS, Kirsten, BARTULI, Johannes, GROSS, Sebastian, LEŠNIK, Urška, HENNESSEN, Fabienne, HERRMANN, Jennifer, ZVER,

Špela, PETKOVIĆ, Hrvoje, MÜLLER, Rolf. Engineering atypical tetracycline formation in Amycolatopsis sulphurea for the production of modified chelocardin antibiotics. *ACS chemical biology*. 2019, vol. 14, iss. 3, str. 468-477, ilustr. ISSN 1554-8929. DOI: 10.1021/acschembio.8b01125. [COBISS.SI-ID 5027448]
9. ŠNAJDER, Marko, CARRILLO RINCON, Andres Felipe, MAGDEVSKA, Vasilka, BAHUN, Miha, KRANJC, Luka, PAŠ, Maja, JUNTES, Polona, PETKOVIĆ, Hrvoje, POKLAR ULRIH, Nataša. Extracellular production of the engineered thermostable protease pernisine from Aeropyrum pernix K1 in Streptomyces rimosus. *Microbial cell factories*. 2019, vol. 18, št. članka 196, str. 1-14, ilustr. ISSN 1475-2859. DOI: 10.1186/s12934-019-1245-3. [COBISS.SI-ID 5116792]
10. ISHIKAWA, Masaaki, GARCÍA-MATEO, Nadia, ČUSAK, Alen, LÓPEZ-HERNÁNDEZ, Iris, FERNÁNDEZ-MARTÍNEZ, Marta, MÜLLER, Marcus, RÜTTIGER, Lukas, SINGER, Wibke, LÖWENHEIM, Hubert, KOSEC, Gregor, FUJS, Štefan, MARTÍNEZ-MARTÍNEZ, Luis, SCHIMMANG, Thomas, PETKOVIĆ, Hrvoje, KNIPPER, Marlies, DURAN ALONSO, Maria Beatriz. Lower ototoxicity and absence of hidden hearing loss point to gentamicin C1a and apramycin as promising antibiotics for clinical use. *Scientific reports*. 2019, vol. 9, str. 1-15, [e]2410, ilustr. ISSN 2045-2322. DOI: 10.1038/s41598-019-38634-3. [COBISS.SI-ID 5024376],

Izr. prof. dr. Mojca Benčina

1. JAZBEC, Vid, JERALA, Roman, BENČINA, Mojca. Proteolytically activated CRAC effectors through designed intramolecular inhibition. *ACS synthetic biology*. 8. Jul. 2022, vol. 11, iss. 8, str. 2756–2765, ilustr. ISSN 2161-5063. DOI: 10.1021/acssynbio.2c00151. [COBISS.SI-ID 115643651]
2. LAINŠČEK, Duško, FORSTNERIČ, Vida, MIKOLIČ, Veronika, MALENŠEK, Špela, PEČAN, Peter, BENČINA, Mojca, SEVER, Matjaž, PODGORNIK, Helena, JERALA, Roman. Coiled-coil heterodimer-based recruitment of an exonuclease to CRISPR/Cas for enhanced gene editing. *Nature communications*. 23 Jun. 2022, vol. 13, str. 1-12, ilustr. ISSN 2041-1723, DOI: 10.1038/s41467-022-31386-1. [COBISS.SI-ID 114151683]
3. PRAZNIK, Arne, FINK, Tina, FRANKO, Nik, LONZARIĆ, Jan, BENČINA, Mojca, JERALA, Nina, PLAPER, Tjaša, ROŠKAR, Samo, JERALA, Roman. Regulation of protein secretion through chemical regulation of endoplasmic reticulum retention signal cleavage. *Nature communications*. 14 Mar. 2022, vol. 13, str. 1-14, ilustr. ISSN 2041-1723, DOI: 10.1038/s41467-022-28971-9. [COBISS.SI-ID 101106947]
4. PLAPER, Tjaša, AUPIČ, Jana, DEKLEVA, Petra, LAPENTA, Fabio, MANČEK KEBER, Mateja, JERALA, Roman, BENČINA, Mojca. Coiled-coil heterodimers with increased stability for cellular regulation and sensing SARS-CoV-2 spike protein-mediated cell fusion. *Scientific reports*. 28 Apr. 2021, vol. 11, [article no.] 9136, str. 1-16. ISSN 2045-2322, DOI: 10.1038/s41598-021-88315-3. [COBISS.SI-ID 64544771]
5. MEŠKO, Maja, LEBAR, Tina, DEKLEVA, Petra, JERALA, Roman, BENČINA, Mojca. Engineering and rewiring of a calcium-dependent signaling pathway. *ACS synthetic biology*. 21 Aug. 2020, vol. 9, iss. 8, str. 2055-2065, ilustr. ISSN 2161-5063, DOI: 10.1021/acssynbio.0c00133. [COBISS.SI-ID 23754243]
6. FINK, Tina, LONZARIĆ, Jan, PRAZNIK, Arne, PLAPER, Tjaša, MERLJAK, Estera, LEBEN, Katja, JERALA, Nina, LEBAR, Tina, STRMŠEK, Žiga, LAPENTA, Fabio, BENČINA, Mojca, JERALA, Roman. Design of fast proteolysis-based signaling and logic circuits in mammalian cells. *Nature chemical biology*. Feb. 2019, vol. 15, iss. 2, str. 115-122, ilustr. ISSN 1552-4450, [COBISS.SI-ID 39867909]

MIKROBNA EKOLOGIJA AGROEKOSISTEMOV

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Mikrobna ekologija agroekosistemov
Course title:	Microbial ecology of agroecosystems
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (v postopku)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037250
Koda učne enote na članici/UL Member course code:	3752

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
10	20	0	0	0	95	5

Nosilec predmeta/Lecturer:	David Stopar

Izvajalci predavanj:	Irena Maček, David Stopar
Izvajalci seminarjev:	
Izvajalci vaj:	
Izvajalci kliničnih vaj:	
Izvajalci drugih oblik:	
Izvajalci praktičnega usposabljanja:	

Vrsta predmeta/Course type:	teoretični/theoretical

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Splošni pogoji za vpis na doktorski študij.	General conditions for enrolment in doctoral studies.

Vsebina:	Content (Syllabus outline):
• Vloga mikroorganizmov pri kroženju elementov (C, N, S, P, Fe, Mn, O, H, Si, Ca, Hg, Cr, Pb, Zn, Cu). • Biorazgradnja rastlinskega materiala. • Mikrobna ekologija rizosfere in filosfere • Simbiontske interakcije mikrooroganizmov in rastlin (mikoriza, fiksacija dušika). • Vloga mikrobnih združb v različnih agroekosistemih.	· Microorganisms and nutrient cycling (C, N, S, P, Fe, Mn, O, H, Si, Ca, Hg, Cr, Pb, Zn, Cu). · Biodegradation of plant material. · Microbial ecology of rhyzo and phylosphere. · Symbiotic interactions between microbes and plants (mycorrhize, nitrogen fixation). Microbial communities in different agroecosystems.

Temeljna literatura in viri/Readings:

Znanstveni članki področja / Scientific articles from the field

Priporočena literatura /Suggested reading

Paul, E. (Ured.), 2007. Soil microbiology, ecology, and biochemistry, Academic Press
Atlas, R.. M., Bartha, R. 1998. Microbial Ecology: Fundamentals and applications., 4th ed.
Smith, S. E., Read, D. J. 2008. Mycorrhizal Symbiosis, Academic Press
Wall, D. H. (Ured.) 2012. Soil Ecology and Ecosystem Services (izbrana poglavja), Oxford University Press

Cilji in kompetence:	**Objectives and competences:**
Študent spozna vlogo mikroorganizmov pri delovanju različnih agroekosistemov. Mikroorganizme zna izkoriščati v proizvodne namene.	Student understands the essential role that microorganisms play in functioning of different agroecosystems. Student is able to exploit microorganims in agricultural production.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Študent razume funkcioniranje sistema rastlina-mikrob v rizosferi in filosferi. Razume vlogo mikroorganizmov pri biorazgradnji, kroženju snovi in energije v ekosistemu in pomenu le tega za prehrano rastlin. V podrobnostih razume mikorizo in biološko fiksacijo in ju zna izrabiti v praksi.	Student understands functioning of plant-microbe system in rhizosphere and filosphere. Understands biogeochemical cycling of elements, biodegradation and how this influences plant nutrition. Understands in detail the processs of mycorrhizae and biological nitrogen fixation.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja po posameznih sklopih. Problemsko voden seminar prilagojen potrebam posameznega študenta. Seminar lahko študent v dogovoru z nosilcem opravi teoretično ali praktično v laboratoriju.	Lectures and seminar adjusted to student needs. In agreeament with the lecture student may decide to do practical or theoretical seminar.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Ocenjuje se izvedba problemsko orientiranega seminarja	100,00 %	Seminar is evaluated

Ocenjevalna lestvica:	**Grading system:**
5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

Prof. Dr. David Stopar

1. MEGUŠAR, Polona, STOPAR, David, POKLAR ULRIH, Nataša, DOGŠA, Iztok, PRISLAN, Iztok. Thermal and rheological properties of gluten-free, starch-based model systems modified by hydrocolloids. *Polymers*. 2022, vol. 14, str. 1-15, art. 3242, ilustr. ISSN 2073-4360. https://www.mdpi.com/2073-4360/14/16/3242/htm, DOI: 10.3390/polym14163242. [COBISS.SI-ID 118514691]

2. PANDUR, Žiga, DULAR, Matevž, KOSTANJŠEK, Rok, STOPAR, David. Bacterial cell wall material properties determine E. coli resistance to sonolysis. *Ultrasonics Sonochemistry*. Feb. 2022, vol. 83, str. 1-10, art. 105919, ilustr. ISSN 1350-4177. https://www.sciencedirect.com/science/article/pii/S1350417722000128?via%3Dihub, DOI: 10.1016/j.ultsonch.2022.105919. [COBISS.SI-ID 93971971

3. MOLAN, Katja, RAHMANI, Ramin, KRKLEC, Daniel, BROJAN, Miha, STOPAR, David. Phi 6 bacteriophage inactivation by metal salts, metal powders, and metal surfaces. *Viruses*. 2022, vol. 14, iss. 2, str.

1-12, art. 204. ISSN 1999-4915. https://www.mdpi.com/1999-4915/14/2/204, DOI: 10.3390/v14020204. [COBISS.SI-ID 94779907]

4. SINKOVIČ, Lovro, NEČEMER, Marijan, OGRINC, Nives, ŽNIDARČIČ, Dragan, STOPAR, David, VIDRIH, Rajko, MEGLIČ, Vladimir. Parameters for discrimination between organic and conventional production : a case study for chicory plants (Cichorium intybus L.). *Food and chemical toxicology*. Feb. 2020, vol. 136, article no. 111109, str. 1-7, ilustr. ISSN 0278-6915. DOI: 10.1016/j.fct.2019.111109. [COBISS.SI-ID 5948264]

5. HYMPANOVA, Michaela, TERLEP, Saša, MARKOVA, Aneta, PRCHAL, Lukas, DOGŠA, Iztok, PULKRABKOVA, Lenka, BENKOVA, Marketa, MAREK, Jan, STOPAR, David. The antibacterial effects of new N-Alkylpyridinium salts on planktonic and biofilm bacteria. *Frontiers in microbiology*. Oct. 2020, vol. 11, str. 1-12, article 573951, ilustr. ISSN 1664-302X. DOI: 10.3389/fmicb.2020.573951. [COBISS.SI-ID 33768963]

6. SIMUNIČ, Urh, PIPP, Peter, DULAR, Matevž, STOPAR, David. The limitations of hydrodynamic removal of biofilms from the dead-ends in a model drinking water distribution system. *Water research*. 2020, vol. 178, str. 1-13, ilustr. ISSN 0043-1354. https://www.sciencedirect.com/science/article/pii/S0043135420303754?via%3Dihub, DOI: 10.1016/j.watres.2020.115838. [COBISS.SI-ID 12956163]

Doc. dr. Irena Maček

1. MAČEK, Irena, CLARK, Dave R., ŠIBANC, Nataša, MOSER, Gerald, VODNIK, Dominik, MÜLLER, Christoph, DUMBRELL, Alex J. Impacts of long-term elevated atmospheric CO2 concentrations on communities of arbuscular mycorrhizal fungi. Molecular Ecology. 2019, vol. 28, iss. 14, str. 3445-3458, ilustr. ISSN 0962-1083. [COBISS.SI-ID 9242489]

2. MAČEK, Irena, PINTARIČ, Sara, ŠIBANC, Nataša, RAJNIŠ, Tatjana, KASTELEC, Damjana, LEŠTAN, Domen, SUHADOLC, Marjetka. Plants play a crucial role in the development of soil fungal communities in the remediated substrate after EDTA washing of metal-contaminated soils. Frontiers in Environmental Science. 2022, vol. 10, art. :978850, 11 str. ISSN 2296-665X. [COBISS.SI-ID 121915395]

3. KAURIN, Anela, GLUHAR, Simon, MAČEK, Irena, KASTELEC, Damijana, LEŠTAN, Domen. Demonstrational gardens with EDTA-washed soil. Part II, Soil quality assessment using biological indicators. Science of the Total Environment. 2021, vol. 792, str. 1-9 (148522). ISSN 0048-9697. [COBISS.SI-ID 68311811]

4. VAŠUTOVÁ, Martina, MLECZKO, Piotr, LÓPEZ-GARCÍA, Alvaro, MAČEK, Irena, BOROS, Gergely, ŠEVČÍK, Jan, FUJII, Saori, HACKENBERGER, Davorka, TUF, Ivan H., HORNUNG, Elisabeth, PÁLL-GERGELY, Barna, KJØLLER, Rasmus. Taxi drivers: the role of animals in transporting mycorrhizal fungi. Mycorrhiza. 2019, vol. 29, iss. 5, str. 413-43 ISSN 0940-6360. [COBISS.SI-ID 9262457]

5. ŠIBANC, Nataša, ZALAR, Polona, SCHROERS, Hans-Josef, ZAJC, Janja, PONTES, Ana, SAMPAIO, José Paulo, MAČEK, Irena. *Occultifur mephitis* f.a., sp. nov. and other yeast species from hypoxic and elevated CO2 mofette environments. International Journal of Systematic and Evolutionary Microbiology. 2018, vol. 68, no. 7, str. 2285-2298. ISSN 1466-5026. [COBISS.SI-ID 8981625]]

6. MARJANOVIĆ, Žaklina, NAWAZ, Ali, STEVANOVIĆ, Katarina, SALJNIKOV, Elmira, MAČEK, Irena, OEHL, Fritz, WUBET, Tesfaye. Root-associated mycobiome differentiate between habitats supporting production of different truffle species in Serbian riparian forests. Microorganisms. 2020, vol. 8, iss. 9, 1331, str. 1-24, ilustr. ISSN 2076-2607. [COBISS.SI-ID 27758339

MIKROBNE INTERAKCIJE

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Mikrobne interakcije
Course title:	Microbial interactions
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (v postopku)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0568365
Koda učne enote na članici/UL Member course code:	0

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
0	20	30	0	0	200	10

Nosilec predmeta/Lecturer:	Ines Mandić Mulec

Izvajalci predavanj:	Ines Mandić Mulec
Izvajalci seminarjev:	
Izvajalci vaj:	
Izvajalci kliničnih vaj:	
Izvajalci drugih oblik:	
Izvajalci praktičnega usposabljanja:	

Vrsta predmeta/Course type:	individualno raziskovalni/individual research

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Splošni pogoji za vpis na doktorski študij	General requirements for the enrolment in PhD program.

Vsebina:	**Content (Syllabus outline):**
Mikrobne interkacije in komunikacije so združuje novo, hitro se razvijajoče področje socialne mikrobiologije, ki obravnava mikrobne interakcije na nivoju molekularnih mehanizmov, ekologije in evolucije: V okviru *teoretičnega dela* predmeta študent spozna koncepte kot so • Mikrobno signaliziranje	Social microbiology is a new and rapidly developing field of microbiology which addresses microbial interactions at the level of molecular mechanisms of interactions and their ecology and evolution. Theoretical social microbiology: • Microbial cell- cell signaling • Cooperative /group behaviors

• Kooperativna vedenja mikroorganizmov • Večceličnost (biofilmi, rojenje) • Sorodstvena selekcija • Goljufi in mehanizmi, ki stabilizirajo kooperacijo • Sorodstveno razlikovanje pri mikrobih-mehanizmi • Kompeticija, antagonizem • Intra and interspecies interactions • Horizontalni prenos genov pri bakterijah v večceličnih skupnostih • Ekologija in evolucija zgoraj naštetih socialnih interakcij • Applications of social microbiology in industry, agriculture and medicine *Metodologija v socialni mikrobiologiji* Zasnova eksperimenta v sociomikrobiologiji Priprava rekombinantnih sevov. Zasnova kompeticijskih eksperimentov in kvantifikacija fitnesa mikroorganizmov, ki vstopajo v interakcije Fluoroescenčna mikroskopija Fluorometrija	• Phenotypic heterogeneity in genetically homogenous groups • Cheating and mechanisms that stabilize cooperation • Kin selection • Kin recognition/discrimination • Competition, antagonisms • Intra and interspecies interactions • Bacterial sex and adaptations • Ecology and evolution of social interactions • Applications of social microbiology in agriculture, industry, medicine *Methodology in social microbiology* Experimental design in social microbiology Competition experiments and methods to quantify fitness of interacting strains Preparation of recombinant strains Fluorescent microscopy Fluorometry

Temeljna literatura in viri/Readings:

Predmet je zasnovan na novejših revijalnih (Nature Review Microbiology, Current Biology, ISME journal, Molecular microbiology, Environemntal microbiology, eLide, mBio, Biofilms, etc) in eksperimentalnih člankih s področja in naštetih revij. The theoretical knwoledge is based on corent topics covered in major journals like Nature Review Microbiology, Current Biology, ISME journal, Molecular microbiology, Environemntal microbiology, eLife, mBio, Biofilms, etc)

Cilji in kompetence:	**Objectives and competences:**
Študent se skozi problemsko zasnovan seminar in eksperimentalno delo seznani s koncepti in naborom metod, ki se uporabljajo v sociomikrobiologiji in so predstavljene v okviru vsebine predmeta. Omogoči se mu izvedba in nudi pomoč pri reševanju eskperimentalne problematike vezane na področje sociomikrobiologije in prirejene individualnim potrebam študenta.	Student learns through seminar work fndamental concepts and methods (described above) used in sociomicrobiology. Student also provided an opportunty to work in the lecturer's laboratory and is supervized in solving the experimental problems in sociomicrobiology. These could alsobe part of student's thesis project.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Študent spozna in razume osnovne koncepte in teorijo v sociomikrobiologiji in uporabo teh konceptov v medicini, biotehnologiji in ekologiji. Študent se nauči zasnovati in izvesti eksperiment s področja sociomikrobiologije. Študent ima možnost izvajati del eksperimentov vezanih na doktorsko tezo v laboratoriju nosilke predmeta (v dogovoru z mentorjem).	Student gains an insight and understands the basic consepts in sociomicrobiology and application of this knowladge in medicine, biotechnology and ecology. Student learns how to design and execute an experiment in the field of sociomicrobiology. Student can perform part of the thesis project in the lecturer's laboratory (in agreement with the student's thesis supervisor)

Metode poučevanja in učenja:	**Learning and teaching methods:**
Konzultacije, pomoč pri zasnovi in izvedbi eksperimentalnega projekta. V okviru predmeta je možna uporaba raziskovalnih orodij, ki	Consulations and experimental project in the laboratory of the lecturer. Student may use research tools developed for the study of sociomicrobiology in

smo jih razvili v laboratoriju za proučevanje sociomikrobiologije, za potrebe raziskovalnega dela doktorskega študenta iz področja sociomikrobiologije v dogovoru z mentorjem.	our laboratory for his/her PhD project related to sociomicrobiology and with the thesis advisor agreement.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Seminar	30,00 %	Seminar
poročilo o rezultatih eksperimentalnega dela	60,00 %	written report of experimental work
pogovor/predstavitev	10,00 %	discussion/presentation

Ocenjevalna lestvica:	**Grading system:**
5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

Ines Mandić-Mulec

1. KALAMARA, Margarita, ŠPACAPAN, Mihael, **MANDIĆ-MULEC**, Ines, STANLEY-WALL, Nicola R. Social behaviours by Bacillus subtilis: quorum sensing, kin discrimination and beyond. Molecular microbiology. 2018, vol. 110, iss. 6, str. 863-878
2. Barbara, BUTOLEN, Monika, ŠTEFANIČ, Polonca, **MANDIĆ-MULEC, Ines**. Kin discrimination drives territorial exclusion during Bacillus subtilis swarming and restrains exploitation of surfactin. The ISME journal. 2022, vol. 16, str. 833–84. DOI: 10.1038/s41396-021-01124-4. [COBISS.SI-ID 80968963].
3. ŠTEFANIČ, Polonca, BELCIJAN, Katarina, KRAIGHER, Barbara, KOSTANJŠEK, Rok, NESME, Joseph, MADSEN, Jonas, KOVAČ, Jasna, SØRENSEN, Søren Johannes, VOS, Michiel**, MANDIĆ-MULEC, Ines**. Kin discrimination promotes horizontal gene transfer between unrelated strains in Bacillus subtilis. Nature communications. 2021, vol. 12, str. 1-11, ilustr. ISSN 2041-1723. https://www.nature.com/articles/s41467-021-23685-w, [COBISS.SI-ID 62369539]
4. EREGA, Andi, ŠTEFANIČ, Polonca, DANEVČIČ, Tjaša, SMOLE MOŽINA, Sonja, **MANDIĆ-MULEC, Ines**. Impact of Bacillus subtilis antibiotic bacilysin and Campylobacter jejuni efflux pumps on pathogen survival in mixed biofilms. Microbiology spectrum. [Spletna izd.]. Jul./Aug. 2022, vol. 10, iss. 4, str. 1-14. DOI: 10.1128/spectrum.02156-22. [COBISS.SI-ID 117948419],
5. LIU, Yan, ŠTEFANIČ, Polonca, MIAO, Youzhi, XUE, Yansheng, XUN, Weibing, ZHANG, Nan, SHEN, Qirong, ZHANG, Ruifu, XU, Zhihui, **MANDIĆ-MULEC, Ines**. Housekeeping gene gyrA, a potential molecular marker for Bacillus ecology study. AMB express. 2022, vol. 12, str. 1-12, ilustr. DOI: 10.1186/s13568-022-01477-9. [COBISS.SI-ID 127325187].
6. SHAO, Jiahui, LIU, Yan, XIE, Jiyu, ŠTEFANIČ, Polonca, LV, Yu, FAN, Ben, **MANDIĆ-MULEC**, **Ines**, ZHANG, Ruifu, SHEN, Qirong, XU, Zhihui. Annulment of bacterial antagonism improves plant beneficial activity of a Bacillus velezensis consortium. Applied and environmental microbiology. Apr. 2022, vol. 88, iss. 8, str. 1-14, ilustr. ISSN 1098-5336. https://journals.asm.org/doi/10.1128/aem.00240-22, DOI: 10.1128/aem.00240-22. [COBISS.SI-ID 105110275].
7. ŠPACAPAN, Mihael, DANEVČIČ, Tjaša, **MANDIĆ-MULEC, Ines**. ComX-induced exoproteases degrade ComX in Bacillus subtilis PS-216. Frontiers in microbiology. Feb. 2018, vol. 9, article 105, str. 1-11, ilustr. ISSN 1664-302X. DOI: 10.3389/fmicb.2018.00105. [COBISS.SI-ID 4876664],
8. XU, Zhihui, **MANDIĆ-MULEC, Ines**, ZHANG, Huihui, LIU, Yan, SUN, Xinli, FENG, Haichao, XUN, Weibing, ZHANG, Nan, SHEN, Qirong, ZHANG, Ruifu. Antibiotic bacillomycin D affects iron acquisition and biofilm formation in Bacillus velezensis through a Btr-mediated FeuABC-dependent pathway. Cell reports. 2019, vol. 29, iss. 5, str. 1192-1202,DOI: 10.1016/j.celrep.2019.09.061. [COBISS.SI-ID 511807
9. DOGŠA, Iztok, ŠPACAPAN, Mihael, DRAGOŠ, Anna, DANEVČIČ, Tjaša, PANDUR, Žiga, **MANDIĆ-MULEC, Ines**. Peptide signaling without feedback in signal production operates as a true quorum sensing communication system in Bacillus subtilis. Communications biology. 2021, vol. 4, str. 1-12. DOI: 10.1038/s42003-020-01553-5. [COBISS.SI-ID 47412483).
10. DANEVČIČ, Tjaša, DRAGOŠ, Anna, ŠPACAPAN, Mihael, ŠTEFANIČ, Polonca, DOGŠA, Iztok, **MANDIĆ-MULEC, Ines**. Surfactin facilitates horizontal gene transfer in Bacillus subtilis. Frontiers in microbiology. May 2021, vol. 12, str. 1-8, article 657407, ilustr. ISSN 1664-302X. DOI: 10.3389/fmicb.2021.657407. [COBISS.SI-ID 58756355].

MIKROFLUIDNE NAPRAVE V BIOINŽENIRSTVU

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Mikrofluidne naprave v bioinženirstvu
Course title:	Microfluidic devices in bioengineering
Članica nosilka/UL Member:	UL ZF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (v postopku)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037271
Koda učne enote na članici/UL Member course code:	3773

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
10	15	10	0	0	90	5

Nosilec predmeta/Lecturer:	Polona Žnidaršič Plazl

Izvajalci predavanj:	Polona Žnidaršič Plazl
Izvajalci seminarjev:	
Izvajalci vaj:	
Izvajalci kliničnih vaj:	
Izvajalci drugih oblik:	
Izvajalci praktičnega usposabljanja:	

Vrsta predmeta/Course type:	teoretični/theoretical

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Zaključen drugostopenjski ali star univerzitetni študij biotehnologije, kemijskega inženirstva, biokemije, kemije, farmacije, mikrobiologije, živilske tehnologije, medicine in sorodnih programov.	Completed university or 2nd level Bologna studies of biotechnology, chemical engineering, biochemistry, chemistry, pharmacy, microbiology, food technology, medicine and other related programmes.

Vsebina:	Content (Syllabus outline):
Temeljna vsebinska področja predmeta so: - splošni pojmi in definicije mikroreaktorske tehnologije (MRT) in mikrofluidnih naprav, - sodobne tehnike izdelave mikrostrukturiranih naprav, obdelava in funkcionalizacija površin,	The basic contents of the subject are: - general concepts and definitions of microreactor technology (MRT) and microfluidic devices - contemporary techniques for manufacturing of microstructured devices; surface treatment and functionalization

- dinamika tekočin v mikrofluidnih napravah: paralelni tok mešljivih in nemešljivih tekočin v mikrokanalih, tokovni režimi večfaznih sistemov (tvorba kapljic, segmentiran tok) - prednosti miniaturiziranih naprav - uporaba mikrofluidnih naprav za bioanalizo, μTAS sistemi - uporaba mikrofluidnih naprav za razvoj in proizvodnjo farmacevtskih učinkovin - mikrobioreaktorji, encimski mikroreaktorji, imobilizacija encimov v mikrostrukturirane naprave - lab-on-a-chip-sistemi - uporaba mikrofluidnih naprav v zaključnih procesih in integracija procesov - uporaba mikrofluidnih naprav v biomedicini (diagnostika, dostava zdravil, hemodializa) - izbrani primeri biokatalitskih in separacijskih procesov v mikrofluidnih napravah, integrirani procesi	- fluid dynamics in microfluidic devices: parallel flow of miscible and non-miscible fluids in microchannels (droplet formation, segmented flow) - advantages of miniaturized devices - use of microfluidic devices for bioanalysis, μTAS systems - use of microfluidic devices for drug development and production - microbioreactors, enzymatic microreactors, enzyme immobilization in microstructured devices - lab-on-a-chip systems -use of microfluidic devices in downstream processing and process integration - use of microfluidic devices in biomedicine (diagnostics, drug delivery, hemodialysis) -selected case studies of biocatalytic and downstream processes in microfluidic devices, integrated processes

Temeljna literatura in viri/Readings:

Izbrana poglavja iz: Hessel, V., Renken, A., Schouten, J.C., Yoshida, J.-I., Eds., Micro Process Engineering: A Comprehensive Handbook, Vol. 1-3, Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, Germany, 2009
Izbrana poglavja iz: Dietrich, T.R., Ed., Microchemical engineering in practice, John Wiley & Sons, Hoboken, 2009
Izbrana poglavja iz: Wirth, T., Ed., Microreactors in Organic Chemistry and Catalysis, 2nd Ed., Completely Revised and Enlarged Edition, Wiley-VCH, Weinheim, 2013
Izbrana poglavja iz : Li, X., Zhou, Y., Eds., Microfluidic devices for biomedical applications, Woodhead Publishing, 2013

Tekoča znanstvena periodika./ Papers from current scientific journals.

Cilji in kompetence:	**Objectives and competences:**
Temeljni izobraževalni cilj je pridobitev teoretičnih in praktičnih znanj za samostojno načrtovanje in izvedbo bioanaliz, bioprocesov in/ali bioseparacij v mikrofluidnih napravah ter integriranih lab-on-a-chip sistemih.	The basic educational aim is gaining theoretical and practical knowledge for independent development and execution of bioanalysis, bioprocesses and/or bioseparations in microfluidic devices, as well as in integrated lab-on-a-chip systems.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Poznavanje osnovnih tehnik izdelovanja mikrofluidnih naprav, tokovnih režimov v njih in načinov obdelovanja površin. Poleg tega je predvideno razumevanje prednosti uporabe mikrofluidnih naprav v bioanalitiki, razvoju in proizvodnji farmacevtskih učinkovin ter drugih bioprocesov in v biomedicini. Poznavanje mikrobioreaktorjev, osnov bioseparacijskih procesov v mikrofluidnih napravah in lab-on-a-chip sistemov.	The intended learning outcomes consider knowledge about technologies for fabrication of microfluidic devices, fluid flow within them and surface modifications. Besides, understanding of benefits of using microfludic devices in bioanalysis, drug development and production, in other bioprocesses and in biomedicine is intended. Gaining of expertise in microbioreactors, basics of bioseparations in microfluidic devices and in lab-on-a-chip systems.

Metode poučevanja in učenja:	**Learning and teaching methods:**
• Predavanja • Priprava seminarja in predstavitev ostalim študentom v okviru rednih seminarskih sestankov	• Lectures • Preparation of seminar work and oral presentation within regular journal club meetings

skupine (diskusija in kritično vrednotenje izbrane znanstvene literature). • Laboratorijsko delo z mikrofluidnimi napravami – spoznavanje tokovnih režimov v mikrokanalih, separacijskih procesov in miniaturiziranih integriranih sistemov.	of the research group (discussion and critical evaluation of selected scientific papers). • Laboratory work with microfluidic devices – observation of fluid flow within microchannels, separation processes and miniaturised integrated systems.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
- Seminar (ocena teksta in predstavitve)	50,00 %	- Seminar (text and presentation)
- Ustni izpit	50,00 %	- Oral exam

Ocenjevalna lestvica:	**Grading system:**
5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

1. T. Menegatti, **P. Žnidaršič-Plazl.** Hydrogel-based enzyme and cofactor co-immobilization for efficient continuous transamination in a microbioreactor. Front. Bioeng. Biotechnol., 2021, 9, 752064, doi: 10.3389/fbioe.202752064.
2. **P. Žnidaršič-Plazl**. Let the Biocatalyst Flow. Acta Chim Slov., 2021, 68, 1-16, doi:10.17344/acsi.2020.6488
3. F. Strniša, **P. Žnidaršič-Plazl**, I. Plazl. Lattice Boltzmann modeling-based design of a membrane-free liquid-liquid microseparator. Chem. Biochem. Eng. Q., 2020, 34, 73-78, doi: 10.15255/CABEQ.2020.1781.
4. G. Stojkovič, **P. Žnidaršič-Plazl**. Covalent Immobilization of Microbial Cells on Microchannel Surfaces. In: Guisan J., Bolivar J., López-Gallego F., Rocha-Martín J. (Eds.) Immobilization of Enzymes and Cells. Methods in Molecular Biology, vol 2100. Humana Press, New York, NY, 2020, pp. 417-426, doi: 10.1007/978-1-0716-0215-7_28
5. Menegatti**, P. Žnidaršič-Plazl**. Copolymeric hydrogel-based immobilization of yeast cells for continuous biotransformation of fumaric acid in a microreactor. Micromachines, 2019, 10: 867; doi: 10.3390/mi10120867
6. **P. Žnidaršič-Plazl.** The promises and the challenges of biotransformations in micro-flow. Biotechnol. J., 2019, 14, 1800580, doi: 10.1002/biot.201800580.

MIKROSKOPIJA IN ANALIZA SLIKE BIOLOŠKIH VZORCEV

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Mikroskopija in analiza slike bioloških vzorcev
Course title:	Microscopy and image analysis of biological samples
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (v postopku)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037358
Koda učne enote na članici/UL Member course code:	3861

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
10	20	0	0	15	80	5

Nosilec predmeta/Lecturer:	Rok Kostanjšek

Izvajalci predavanj:	Rok Kostanjšek, Marko Kreft, Nada Žnidaršič
Izvajalci seminarjev:	
Izvajalci vaj:	
Izvajalci kliničnih vaj:	
Izvajalci drugih oblik:	
Izvajalci praktičnega usposabljanja:	

Vrsta predmeta/Course type:	teoretični/theoretical

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Splošni pogoji za vpis na doktorski študij	General conditions for enrolment in doctoral studies

Vsebina:	Content (Syllabus outline):
- nadgradnja osnovnih svetlobno-mikroskopskih tehnik (mikroskopija v temnem polju, fazno-kontrastna mikroskopija, interferenčno kontrastna-DIC mikroskopija in fluorescenčna mikroskopija) s predstavitvijo njihovih prednosti in uporabe pri opazovanju bioloških vzorcev - predstavitev postopkov zajemanja mikroskopske slike, obdelovanja in kvantitativne analize slike bioloških vzorcev	- Upgrading of student's basic knowledge on light microscopy techniques (e.g. microscopy in a dark field, phase-contrast microscopy, interference contrast-DIC microscopy and fluorescent microscopy), their advantages and applications on biological samples - Procedures for image acquisition, processing, and quantitative analysis of micrographs

- predstavitev naprednih svetlobno-mikroskopskih tehnik za izdelavo optičnih rezin ter osnovami 3D-rekonstrukcije slik bioloških vzorcev - predstavitev presevne elektronske mikroskopije (TEM) za strukturno analizo različnih bioloških vzorcev (tkiva in celice, bakterije, virusi, liposomi...) s poudarkom na razumevanju in praktični izvedbi postopkov za pripravo bioloških vzorcev ter interpretaciji mikrografij - spoznavanje tehnik vrstične elektronske mikroskopije (SEM), praktično seznanjanje s postopki priprave bioloških vzorcev in interpretacijo SEM mikrografij - predstavitev naprednih elektronsko-mikroskopskih tehnik (HRTEM, EELS) in spektroskopskih metod (EDXS, EELS) bioloških vzorcev - seznanjanje s sodobnimi tehnikami in pristopi za vizualizacijo bioloških vzorcev	- advanced light microscopic techniques with demonstration of optical sectioning and 3D reconstruction on biological samples - Principles and techniques of transmission electronic microscopy (TEM) for structural analysis of biological samples (tissues, cells, bacterial, viral particles, liposomes...) with special emphasis on understanding of methodology, interpretation of micrographs and practical preparation of biological samples - Principles and demonstration of scanning electron microscopy (SEM), its application on biological samples, interpretation of micrographs and practical approaches in sample preparation. - Principles and examples of high resolution transmission electron microscopy (HRTEM) and spectroscopic methods (EDXS, EELS) of biological samples - Principles of advanced microscopic techniques and approaches for visualization of biological samples

Temeljna literatura in viri/Readings:

- Izbrani članki iz strokovnih revij:
- Microscopy and microanalysis online journal; Wiley and Sons
- Journal of Microscopy, Blackwell publishing - Hayat M. A. (2000) Principles and techniques of electron microscopy – Biological applications. 4th Edition. Cambridge University Press, cambridge, UK, 543 str., ISBN 0-521-63287-0 (izbrana poglavja str. 367-388, 400-436)
- Bozzola J.J., Russell L.D. (1999): Electron microscopy – Principles and Techniques for Biologists. 2nd Edition. Jones and Bartlett Publishers, Subdury, Masachusetts, USA, 670 str., ISBN 0-7637-0192-0 (str. 16-46, 120-146, 148-201, 262-278, 368-394, 442- 475, 480-608).
- Allen T.D. (ur.) (2008) Introduction to Electron Microscopy for Biologists, Methods in Cell Biology 88, izbrana poglavja D.B. Williams, C.B. Carter, Transmission Electron Microscopy, Plenum Press, 1996, izbrana poglavja
- Russ J.C. (2011) The Image Processing Handbook, 6th Edition. CRC Press, USA, 885 str., ISBN 978-1-4398-4045-0, izbrana poglavja

Cilji in kompetence:	**Objectives and competences:**
- nadgradnja znanja o mikroskopskih metodah in analizi slike - poznavanje z lastnostmi (prednostmi in morebitnimi omejitvami) različnih mikroskopskih tehnik - poznavanje postopkov priprave bioloških vzorcev za opazovanje z različnimi mikroskopskimi tehnikami - poznavanje procesov zajema, obdelave, analize in interpretacije mikrografij - razvijanje lastne iniciativnosti pri zasnovi poskusov, ki vključujejo vizualizacijske pristope	- upgrade of basic knowledge on microscopic methods - acquaintance with properties (benefits and potential drawbacks) of various microscopic techniques - acquaintance with preparation procedures of biological samples o with various microscopic techniques - acquiring of basic skills on acquisition, processing, analysis and interpretation of images of biological samples - development of self-initiative approach in designing of experiment, which include visualization approaches

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: - razumevanje fizikalnih osnov mikroskopskih tehnik - sposobnost izbire ustreznih mikroskopskih tehnik pri zasnovi poizkusov	Knowledge and understanding: - understanding of physical background of microscopic techniques

- poznavanje osnovnih postopkov priprave bioloških vzorcev za svetlobno in elektronsko mikroskopijo - pridobitev znanj za zajemanje, obdelavo in analizo slike - sposobnost interpretacije mikrografij bioloških vzorcev pridobljenih z različnimi mikroskopskimi tehnikami in prepoznavanje artefaktov kot posledice priprave vzorcev	- choosing of appropriate microscopic approach in experiment design - knowledge on basic procedures of biological sample preparation for light and electron microscopy - basic knowledge on image acquisition, processing and analysis - ability of interpretation of micrographs depicting biological samples

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, konzultacije in seminarji	Lectures, consultations and seminars

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Pisni izpit iz tem predavanj	50,00 %	Examiation
Seminar	50,00 %	Seminar

Ocenjevalna lestvica:	**Grading system:**
5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

Kostanjšek Rok

BIZJAK-MALI, Lilijana, ZALAR, Polona, TURK, Martina, NOVAK BABIČ, Monika, **KOSTANJŠEK, Rok**, GUNDE-CIMERMAN, Nina. Opportunistic fungal pathogens isolated from a captive individual of the European blind cave salamander Proteus anguinus. *Diseases of aquatic organisms*, ISSN 0177-5103, 2018, vol. 129, str. 15-30.

KOSTANJŠEK, Rok, VITTORI, Miloš, ŠROT, Vesna, AKEN, Peter van, ŠTRUS, Jasna. Polyphosphate-accumulating bacterial community colonizing the calcium bodies of terrestrial isopod crustaceans Titanethes albus and Hyloniscus riparius. *FEMS microbiology, ecology*, ISSN 0168-6496, 2017, vol. 93, iss. 6, str. 1-13

PANDUR, Žiga, DULAR, Matevž, **KOSTANJŠEK, Rok**, STOPAR, David. Bacterial cell wall material properties determine E. coli resistance to sonolysis. *Ultrasonics Sonochemistry*, ISSN 1350-4177, Feb. 2022, vol. 83, str. 1-10

ŠTEFANIČ, Polonca, BELCIJAN, Katarina, KRAIGHER, Barbara, **KOSTANJŠEK, Rok**, NESME, Joseph, MADSEN, Jonas, KOVAČ, Jasna, SØRENSEN, Søren Johannes, VOS, Michiel, MANDIĆ-MULEC, Ines. Kin discrimination promotes horizontal gene transfer between unrelated strains in Bacillus subtilis. *Nature communications*, ISSN 2041-1723, 2021, vol. 12, str. 1-11

KOČAR, Eva, LENARČIČ, Tea, HODNIK, Vesna, PANEVSKA, Anastasija, HUANG, Yunjie, BAJC, Gregor, **KOSTANJŠEK, Rok**, NAREN, Anjaparavanda P., MAČEK, Peter, ANDERLUH, Gregor, SEPČIĆ, Kristina, PODOBNIK, Marjetka, BUTALA, Matej. Crystal structure of RahU, an aegerolysin protein from the human pathogen Pseudomonas aeruginosa, and its interaction with membrane ceramide phosphorylethanolamine. *Scientific reports*, ISSN 2045-2322, 2021, vol. 11, article no. 6572, str. 1-12

MILIJAŠ JOTIĆ, Matej, PANEVSKA, Anastasija, IACOVACHE, Ioan, **KOSTANJŠEK, Rok**, MRAVINEC, Martina, SKOČAJ, Matej, ZUBER, Benoît, PAVŠIČ, Ana, RAZINGER, Jaka, MODIC, Špela, TRENTI, Francesco, GUELLA, Graziano, SEPČIĆ, Kristina. Dissecting out the molecular mechanism of insecticidal activity of ostreolysin A6/pleurotolysin B complexes on western corn rootworm. *Toxins : Elektronski vir*, ISSN 2072-6651, 2021, vol. 13, no. 7, str. 1-16.

Žnidaršič Nada

ŠOLINC, Gašper, ŠVIGELJ, Tomaž, OMERSA, Neža, SNOJ, Tina, PIRC, Katja, ŽNIDARŠIČ, Nada, YAMAJI-HASEGAWA, Akiko, KOBAYASHI, Toshihide, ANDERLUH, Gregor, PODOBNIK, Marjetka. Pore-forming moss protein bryoporin is structurally and mechanistically related to actinoporins from evolutionarily distant cnidarians. *The Journal of biological chemistry*. 2022, vol. 298, iss. 10, str. 1-15,

PIRC, Katja, CLIFTON, Luke A., YILMAZ, Neval, SALTALAMACCHIA, Andrea, MALLY, Mojca, SNOJ, Tina, ŽNIDARŠIČ, Nada, SRNKO, Marija, BORIŠEK, Jure, PODOBNIK, Marjetka, DERGANC, Jure, ANDERLUH, Gregor, et al. An oomycete NLP cytolysin forms transient small pores in lipid membranes. *Science advances*. 11 Mar. 2022, vol. 8, iss. 10, str. 1-12.

KUNČIČ, Katja, MRAK, Polona, ŽNIDARŠIČ, Nada. Formation and remodelling of septate junctions in the epidermis of isopod Porcellio scaber during development. *ZooKeys*. 2022, iss. 1101, str. 159-181,
PRISLAN, Peter, MRAK, Polona, ŽNIDARŠIČ, Nada, ŠTRUS, Jasna, HUMAR, Miha, THALER, Nejc, MRAK, Tanja, GRIČAR, Jožica. Intra-annual dynamics of phloem formation and ultrastructural changes in sieve tubes in Fagus sylvatica. *Tree physiology*. 2019, vol. 39, iss. 2, str. 262-274
ADEN, Saša, KOZOROG, Mirijam, ŠVIGELJ, Tomaž, POKLAR ULRIH, Nataša, ŽNIDARŠIČ, Nada, PODOBNIK, Marjetka, ANDERLUH, Gregor. Cholesterol enriched archaeosomes as a molecular system for studying interactions of cholesterol-dependent cytolysins with membranes. *The journal of membrane biology*. 2018, vol. 251, iss. 3, str. 491-505
BOGATAJ, Urban, PRAZNIK, Monika, MRAK, Polona, ŠTRUS, Jasna, TUŠEK-ŽNIDARIČ, Magda, ŽNIDARŠIČ, Nada. Comparative ultrastructure of cells and cuticle in the anterior chamber and papillate region of Porcellio scaber (Crustacea, Isopoda) hindgut. *ZooKeys*. 2018, vol. 801, str. 427-458.

Marko Kreft

GONÇALVES, Paula P., STENOVEC, Matjaž, GRÁCIO, Luciano, **KREFT, Marko**, ZOREC, Robert (avtor, korespondenčni avtor). Calcium-dependent subquantal peptide release from single docked lawn-resident vesicles of pituitary lactotrophs. *Cell calcium*. Jan. 2023, vol. 109, str. 1-10, ilustr. ISSN 1532-1991.
GRILC, Sonja, **KREFT, Marko**, LUZAR, Boštjan, GABRIJEL, Mateja, BARTENJEV, Mark Sergej, ZOREC, Robert (avtor, korespondenčni avtor), BARTENJEV, Igor (avtor, korespondenčni avtor). Histological skin remodeling following autologous fibroblast application. *Acta dermatovenerologica Croatica*. 2022, vol. 30, no. 1, str. 1-7, ilustr. ISSN 1330-027X.
RITUPER, Boštjan, GUČEK, Alenka, LISJAK, Marjeta, GÓRSKA, Urszula, ŠAKANOVIĆ, Aleksandra, TRKOV, Saša, LASIČ, Eva, BOŽIĆ, Mićo, JORGAČEVSKI, Jernej, **KREFT, Marko**, VERKHRATSKY, Alexei, ANDERLUH, Gregor, STENOVEC, Matjaž, BOŽIČ, Bojan, ZOREC, Robert (avtor, korespondenčni avtor), et al. Vesicle cholesterol controls exocytotic fusion pore. *Cell calcium*. 2022, vol. 101, str. 1-17, ilustr. ISSN 1532-1991.
LIU, Wei, STENOVEC, Matjaž, LEE, William, MONTANA, Vedrana, **KREFT, Marko**, ZOREC, Robert (avtor, korespondenčni avtor), PARPURA, Vladimir (avtor, korespondenčni avtor). Probing single molecule mechanical interactions of syntaxin 1A with native synaptobrevin 2 residing on a secretory vesicle. *Cell calcium*. 2022, vol. 104, str. 1-11, ilustr. ISSN 1532-1991.
DOLANC, Dorian, ZOREC, Tomaž Mark, SMOLE, Zala, MAVER, Anja, HORVAT, Anemari, PILLAIYAR, Thanigaimalai, TRKOV, Saša, VARDJAN, Nina, **KREFT, Marko**, CHOWDHURY HAQUE, Helena, ZOREC, Robert (avtor, korespondenčni avtor). The activation of GPR27 increases cytosolic L-lactate in 3T3 embryonic cells and astrocytes. *Cells*. 2022, vol. 11, iss. 6, str. 1-14, ilustr. ISSN 2073-4409.
HORVAT, Anemari, MUHIČ, Marko, SMOLIČ, Tina, BEGIĆ, Ena, ZOREC, Robert, **KREFT, Marko**, VARDJAN, Nina. Ca[sup]2+ as the prime trigger of aerobic glycolysis in astrocytes. *Cell calcium*. May 2021, vol. 95, str. 1-11, ilustr. ISSN 1532-1991.

MIKROSKOPIJA IN ANALIZA SLIKE BIOLOŠKIH VZORCEV - PROJEKTNO DELO

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Mikroskopija in analiza slike bioloških vzorcev - projektno delo
Course title:	Microscopy and image analysis of biological samples - project work
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (v postopku)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037359
Koda učne enote na članici/UL Member course code:	3862

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
	20	0	0	30	200	10

Nosilec predmeta/Lecturer:	Rok Kostanjšek

Izvajalci predavanj:	
Izvajalci seminarjev:	Rok Kostanjšek, Marko Kreft, Nada Žnidaršič
Izvajalci vaj:	
Izvajalci kliničnih vaj:	
Izvajalci drugih oblik:	
Izvajalci praktičnega usposabljanja:	

Vrsta predmeta/Course type:	individualno raziskovalni/individual research

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Splošni pogoji za vpis na doktorski študij	General conditions for enrolment in doctoral studies

Vsebina:	Content (Syllabus outline):
- nadgradnja osnovnih svetlobno-mikroskopskih tehnik (mikroskopija v temnem polju, fazno-kontrastna mikroskopija, interferenčno kontrastna-DIC mikroskopija in fluorescenčna mikroskopija) s predstavitvijo njihovih prednosti in uporabe pri opazovanju bioloških vzorcev	- Upgrading of student's basic knowledge on light microscopy techniques (e.g. microscopy in a dark field, phase-contrast microscopy, interference contrast-DIC microscopy and fluorescent microscopy), their advantages and applications on biological samples - Procedures for image acquisition, processing, and quantitative analysis of micrographs

- predstavitev postopkov zajemanja mikroskopske slike, obdelovanja in kvantitativne analize slike bioloških vzorcev - predstavitev naprednih svetlobno-mikroskopskih tehnik za izdelavo optičnih rezin ter osnovami 3D-rekonstrukcije slik bioloških vzorcev - predstavitev presevne elektronske mikroskopije (TEM) za strukturno analizo različnih bioloških vzorcev (tkiva in celice, bakterije, virusi, liposomi...) s poudarkom na razumevanju in praktični izvedbi postopkov za pripravo bioloških vzorcev ter interpretaciji mikrografij - spoznavanje tehnik vrstične elektronske mikroskopije (SEM), praktično seznanjanje s postopki priprave bioloških vzorcev in interpretacijo SEM mikrografij - predstavitev naprednih elektronsko-mikroskopskih tehnik (HRTEM, EELS) in spektroskopskih metod (EDXS, EELS) bioloških vzorcev - seznanjanje s sodobnimi tehnikami in pristopi za vizualizacijo bioloških vzorcev	- advanced light microscopic techniques with demonstration of optical sectioning and 3D reconstruction on biological samples - Principles and techniques of transmission electronic microscopy (TEM) for structural analysis of biological samples (tissues, cells, bacterial, viral particles, liposomes...) with special emphasis on understanding of methodology, interpretation of micrographs and practical preparation of biological samples - Principles and demonstration of scanning electron microscopy (SEM), its application on biological samples, interpretation of micrographs and practical approaches in sample preparation. - Principles and examples of high resolution transmission electron microscopy (HRTEM) and spectroscopic methods (EDXS, EELS) of biological samples - Principles of advanced microscopic techniques and approaches for visualization of biological samples

Temeljna literatura in viri/Readings:

- Izbrani članki iz strokovnih revij:
- Microscopy and microanalysis online journal; Wiley and Sons
- Journal of Microscopy, Blackwell publishing
- Hayat M. A. (2000) Principles and techniques of electron microscopy – Biological applications. 4th Edition. Cambridge University Press, cambridge, UK, 543 str., ISBN 0-521-63287-0 (izbrana poglavja str. 367-388, 400-436)
- Bozzola J.J., Russell L.D. (1999): Electron microscopy – Principles and Techniques for Biologists. 2nd Edition. Jones and Bartlett Publishers, Subdury, Masachusetts, USA, 670 str., ISBN 0-7637-0192-0 (str. 16-46, 120-146, 148-201, 262-278, 368-394, 442- 475, 480-608).
- Allen T.D. (ur.) (2008) Introduction to Electron Microscopy for Biologists, Methods in Cell Biology 88, izbrana poglavja D.B. Williams, C.B. Carter, Transmission Electron Microscopy, Plenum Press, 1996, izbrana poglavja
- Russ J.C. (2011) The Image Processing Handbook, 6th Edition. CRC Press, USA, 885 str., ISBN 978-1-4398-4045-0, izbrana poglavja

Cilji in kompetence:	**Objectives and competences:**
- nadgradnja znanja o mikroskopskih metodah in analizi slike - poznavanje z lastnostmi (prednostmi in morebitnimi omejitvami) različnih mikroskopskih tehnik - poznavanje postopkov priprave bioloških vzorcev za opazovanje z različnimi mikroskopskimi tehnikami - poznavanje procesov zajema, obdelave, analize in interpretacije mikrografij - razvijanje lastne iniciativnosti pri zasnovi poskusov, ki vključujejo vizualizacijske pristope	- upgrade of basic knowledge on microscopic methods - acquaintance with properties (benefits and potential drawbacks) of various microscopic techniques - acquaintance with preparation procedures of biological samples o with various microscopic techniques - acquiring of basic skills on acquisition, processing, analysis and interpretation of images of biological samples - development of self-initiative approach in designing of experiment, which include visualization approaches

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: - razumevanje fizikalnih osnov mikroskopskih tehnik	Knowledge and understanding:

- sposobnost izbire ustreznih mikroskopskih tehnik pri zasnovi poizkusov - poznavanje osnovnih postopkov priprave bioloških vzorcev za svetlobno in elektronsko mikroskopijo - pridobitev znanj za zajemanje, obdelavo in analizo slike - sposobnost interpretacije mikrografij bioloških vzorcev pridobljenih z različnimi mikroskopskimi tehnikami in prepoznavanje artefaktov kot posledice priprave vzorcev	- understanding of physical background of microscopic techniques - choosing of appropriate microscopic approach in experiment design - knowledge on basic procedures of biological sample preparation for light and electron microscopy - basic knowledge on image acquisition, processing and analysis - ability of interpretation of micrographs depicting biological samples

Metode poučevanja in učenja:	**Learning and teaching methods:**
Konzultacije, seminarji (kot osnova projektnega dela) in individualno projektno delo, ki bo izvedeno v laboratorijih za svetlobno in elektronsko mikroskopijo na Oddelku za biologijo Biotehniške fakultete	Consultations, seminars (as background of individual project) and individual project

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Pisni izpit iz tem predavanj	50,00 %	Examiation
Predstavitev individualnega projekta	50,00 %	Project presentation

Ocenjevalna lestvica:	**Grading system:**
5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

KOSTANJŠEK Rok

MALEK-HOSSEINI, Mohammad Javad, JUGOVIC, Jure, FATEMI, Yaser, KUNTNER, Matjaž, **KOSTANJŠEK, Rok**, DOUADY, Christophe J., MALARD, Florian. A new obligate groundwater species of *Asellus* (Isopoda, Asellidae) from Iran. *Subterranean biology*, ISSN 1768-1448, 2022, vol. 42, str. 97-124

KRAJNC, Mojca, ŠTEFANIČ, Polonca, **KOSTANJŠEK, Rok**, MANDIĆ-MULEC, Ines, DOGŠA, Iztok, STOPAR, David. Systems view of *Bacillus subtilis* pellicle development. *npj biofilms and microbiomes*, ISSN 2055-5008, 2022, vol. 8, str. 1-11.

OTONIČAR, Jan, HOSTNIK, Maja, GRUNDNER, Maja, **KOSTANJŠEK, Rok**, GREDAR, Tajda, GARVAS, Maja, ARSOV, Zoran, PODLESEK, Zdravko, GOSTINČAR, Cene, JAKŠE, Jernej, BUSBY, Steve J. W., BUTALA, Matej. A method for targeting a specified segment of DNA to a bacterial microorganelle. *Nucleic acids research*, ISSN 0305-1048, 2022, vol. 50, no. 19, 12 str., e113,

ČERNOŠA, Anja, GOSTINČAR, Cene, LAVRIN, Teja, **KOSTANJŠEK, Rok**, LENASSI, Metka, GUNDE-CIMERMAN, Nina. Isolation and characterization of extracellular vesicles from biotechnologically important fungus *Aureobasidium pullulans*. *Fungal biology and biotechnology*, ISSN 2054-3085, 2022, vol. 9, str. 1-17

TESAŘOVÁ, Markéta, MANCINI, Lucia, MAURI, Edgardo, ALJANČIČ, Gregor, ALJANČIČ, Magdalena, **KOSTANJŠEK, Rok**, BIZJAK-MALI, Lilijana, ZIKMUND, Tomáš, KAUCKÁ, Markéta, PAPI, Federica, GOYENS, Jana, BOUCHNITA, Annas, HELLANDER, Andreas, ADAMEYKO, Igor, KAISER, Jozef. Living in darkness : exploring adaptation of *Proteus anguinus* in 3 dimensions by X-ray imaging. *GigaScience*, ISSN 2047-217X, 5. apr. 2022, vol. 11, art. 30, str. 1-8,

GRUNTAR, Igor, **KOSTANJŠEK, Rok**, PIRŠ, Tina, PAPIĆ, Bojan. *Helicobacter colisuis* sp. nov., isolated from caecal contents of domestic pigs (Sus scrofa domesticus). *International journal of systematic and evolutionary microbiology*, ISSN 1466-5034, 2022, vol. 72, iss. 11, art. 005600, str. 1-7,

PERINI, Laura, GOSTINČAR, Cene, LIKAR, Matevž, FRISVAD, J. C., **KOSTANJŠEK, Rok**, NICHOLES, M., WILLIAMSON, C., ANESIO, A. M., ZALAR, Polona, GUNDE-CIMERMAN, Nina. Interactions of fungi and algae from the Greenland ice sheet. *Environmental microbiology*, ISSN 1462-2912. [Print ed.], 2022, 15 str., doi: 10.1007/s00248-022-02033-5.

FOKTER, Samo K., KUHTA, Matevž, HOJNIK, Marko, LEDINEK, Živa, **KOSTANJŠEK, Rok**. Tissue integration of calcium phosphate compound after subchondroplasty : 4-year follow-up in a 76-year-old female patient. *Bioengineering*, ISSN 2306-5354, 2023, vol. 10, issue 2, [article no.] 208, str. [1]-12,

DOGŠA, Iztok, **KOSTANJŠEK, Rok**, STOPAR, David. eDNA provides a scaffold for autoaggregation of B. subtilis in bacterioplankton suspension. *Microorganisms*, ISSN 2076-2607, 2023, vol. 11, issue 2, [article no.] 332, str. 1-15.
PAVLIN, Anja, LOVŠE, Anže, BAJC, Gregor, OTONIČAR, Jan, KUJOVIĆ, Amela, LENGAR, Živa, GUTIÉRREZ-AGUIRRE, Ion, **KOSTANJŠEK, Rok**, KONC, Janez, FORNELOS, Nadine, BUTALA, Matej. A small bacteriophage protein determines the hierarchy over co-residential jumbo phage in Bacillus thuringiensis serovar israelensis. *Communications biology*, ISSN 2399-3642, 2022, [Vol.] 5, str. 1-12

Nada Žnidaršič

ŠOLN, Katarina, **ŽNIDARŠIČ, Nada**, DOLENC KOCE, Jasna. Root growth inhibition and ultrastructural changes in radish root tips after treatment with aqueous extracts of Fallopia japonica and F. xbohemica rhizomes. *Protoplasma*. 2022, vol. 259, iss. 2, str. 343-355
VIGLIATURO, Ruggero, JAMNIK, Maja, DRAŽIĆ, Goran, PODOBNIK, Marjetka, TUŠEK-ŽNIDARIČ, Magda, DELLA VENTURA, Giancarlo, REDHAMMER, Günther, **ŽNIDARŠIČ, Nada**, CASERMAN, Simon, GIERÉ, Reto. Nanoscale transformations of amphiboles within human alveolar epithelial cells. *Scientific reports*. 2022, vol. 12, str. 1-14
BOGATAJ, Urban, MRAK, Polona, ŠTRUS, Jasna, **ŽNIDARŠIČ, Nada**. Ultrastructural differentiation of plasma membrane and cell junctions in the hindgut cells is synchronized with key developmental transitions in Porcellio scaber. *Arthropod structure & development*. 2019, vol. 50, str. 78-93
OTA, Ajda, ISTENIČ, Katja, SKRT, Mihaela, ŠEGATIN, Nataša, **ŽNIDARŠIČ, Nada**, KOGEJ, Ksenija, POKLAR ULRIH, Nataša. Encapsulation of pantothenic acid into liposomes and into alginate or alginate-pectin microparticles loaded with liposomes. *Journal of food engineering*. [Print ed.]. 2018, vol. 229, str. 21-31,
ŽNIDARŠIČ, Nada, MRAK, Polona, RAJH, Eva, ŽAGAR, Kristina, ČEH, Miran, ŠTRUS, Jasna. Cuticle matrix imaging by histochemistry, fluorescence, and electron microscopy. *Resolution & discovery : new beacon for the microscopy community*. 2018, vol. 3, iss. 1, str. 5-12.
ŠTRUS, Jasna, ŽNIDARŠIČ, Nada, MRAK, Polona, BOGATAJ, Urban, VOGT, Günter. Structure, function and development of the digestive system in malacostracan crustaceans and adaptation to different lifestyles. *Cell and tissue research*. 2019, vol. 377, no. 3, str. 415-443.

Marko Kreft

ŠKORJANC, Aleš, **KREFT, Marko**, BENDA, Jan. Stimulator compensation and generation of Gaussian noise stimuli with defined amplitude spectra for studying input–output relations of sensory systems. *Journal of comparative physiology. A, Sensory, neural, and behavioral physiology*. 2022, 12 str., [in press]. ISSN 0340-7594.
TRATNJEK, Larisa, **KREFT, Marko**, KRISTAN, Katja, ERDANI-KREFT, Mateja. Ciliary beat frequency of in vitro human nasal epithelium measured with the simple high-speed microscopy is applicable for safety studies of nasal drug formulations. *Toxicology in Vitro*. [Online ed.]. Aug. 2020, vol. 66, str. 1-9, ilustr. ISSN 1879-3177.
UMEK, Nejc, HORVAT, Simon, CVETKO, Erika, **KREFT, Marko**, JANÁČEK, Jiří, KUBÍNOVÁ, Lucie, STOPAR PINTARIČ, Tatjana, ERŽEN, Ida. 3D analysis of capillary network in skeletal muscle of obese insulin-resistant mice. *Histochemistry and cell biology*. 2019, vol. 152, iss. 5, str. 323-331, ilustr. ISSN 0948-6143.
MEGLIČ, Andrej, ILIĆ, Marko, PIRIH, Primož, ŠKORJANC, Aleš, WEHLING, Martin F., **KREFT, Marko**, BELUŠIČ, Gregor. Horsefly object-directed polarotaxis is mediated by a stochastically distributed ommatidial subtype in the ventral retina. *Proceedings of the National Academy of Sciences of the United States of America*. 2019, vol. 116, no. 43, str. 21843-21853, ilustr. ISSN 0027-8424.
ILIĆ, Marko, MEGLIČ, Andrej, **KREFT, Marko**, BELUŠIČ, Gregor. The fly sensitizing pigment enhances UV spectral sensitivity while preventing polarization-induced artifacts. *Frontiers in cellular neuroscience*. 2018, vol. 12, str. 1-7. ISSN 1662-5102.
ERŽEN, Ida, JANÁČEK, Jiří, **KREFT, Marko**, KUBÍNOVÁ, Lucie, CVETKO, Erika. Capillary network morphometry of pig soleus muscle significantly changes in 24 hours after death. *The Journal of histochemistry and cytochemistry*. Jan. 2018, vol. 66, no. 1, str. 23-31, ilustr. ISSN 0022-1554.