SODOBNA BIOLOŠKA ZDRAVILA

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Sodobna biološka zdravila
Course title:	Modern biological medicines
Članica nosilka/UL Member:	

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (od študijskega leta 2023/2024 dalje)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037294
Koda učne enote na članici/UL Member course code:	3796

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	5	0	5	85	5

Nosilec predmeta/Lecturer:	Borut Štrukelj

Izvajalci predavanj:	Borut Štrukelj
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 for application on doctoral study

Vsebina:	Content (Syllabus outline):
Predmet »Sodobna biološka zdravila« je razdeljen na dva sklopa: splošni del in specialni del. V okviru splošnega dela bo slušatelj spoznal razdelitev in regulativo sodobnih bioloških in genskih zdravil ter njihovo identifikacijo in karakterizacijo. V specialnem delu pa bo poudarek na sledeče skupine bioloških zdravil: 1. Monoklonska protitelesa in fuzijski proteini 2. Inzulini in osali hormoni	Content of the subject: Modern biological medicines« is composed of two parts: general one and special one. Within the general part, student is going to get information about the division and regulatory aspects of modern biologicals. The second (special)part deals with the following subgroups of biologicals: 1. Monoclonal antibodies and fusion proteins 2. Insulins and other hormones

3. Eritropoetini 4. Rekombinantna in genska cepiva 5. Citokini 6. Podobna biološka zdravila	3. Erhytropoietins 4. Recombinant and gene vacines 5. Citokines 6. Biosimilars

Temeljna literatura in viri/Readings:

1. Biološka zdravila : od gena do učinkovine. 1. izd. Ljubljana: Slovensko farmacevtsko društvo, 2007, Urednika: Borut Štrukelj, Janko Kos; ISBN 978-961-90099-8-7.
2. Oosting RS, Crommelin DJA, Sindelar RD. Pharmaceutical Biotechnoloy: Fundamentals and Apllications, Fifth Edition, 2019, ISBN 978-3-030-00709-6

Cilji in kompetence:	**Objectives and competences:**
Cilj predmeta je razjasniti in poglobiti znanja na področju sodobne farmacevtske biotehnologije. Poleg teoretskih znanj bo študent pridobil kompetenco priprave, izvedbe in reševanja težjih biotehnoloških nalog in problemov, ki jih bo s pridom implementiral v času doktorskega dela in kasneje v praksi.	The main goal of the subject is to clarify and upgrade broad theoretical and practical knowledge and competencies in the field of pharmaceutical biotechnology. Student will be qualified to plan, perform and solve complex biotechnological problems and will achieve competences for their implementation during doctoral work and later in real professional environment.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Z osvojitvijo in razumevanjem tematik programa ter z uspešno izdelavo in rešitvijo farmacevtsko-biotehnološkega problema bo študent pridobil sposobnost hitrejšega, boljšega in popolnejšega načrtovanja in izvajanja doktroskega dela kot tudi zmožnost širitve znanja na sodelavce v nadaljnjem profesionalnem okolju.	Knowledge and understanding: By absolving the content of the sylabus with the outcome of biotech problem learning students will be able to achieve the knowledge that lead to individual, fully-responsible planning of research experiments as well as to transfer the topics to other co-workers in real conditions.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Neposredna predavanja z aktivno udeležbo slušateljev;e-študij preko telekonference; pomoč in nadzor pri projektnem delu, pomoč in diskusija pri pripravi preglednega ali poljudno-strokovnega članka	Frontal ex-cathedra teaching with active discussion; e-leranking by means of teleconferences; supervision of project-based learning; monitoring and supervising in the manuscript preparation, discussion and consultation.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Priprava in oddaja farmacevtsko-biotehnološkega projekta;	70,00 %	Elaboration of pharma-biotech project,
Sodelovanje v pripravi preglednega strokovnega ali poljudno-strokovnega članka	30,00 %	Colaboration in the preparation of review or popular-scientific article

Reference nosilca/Lecturer's references:

Borut Štrukelj:
IGNJATOVIC, Janko, ŠVAJGER, Urban, RAVNIKAR, Matjaž, MOLEK, Peter, ZADRAVEC, Darko, PARIŠ, Alenka, **ŠTRUKELJ, Borut**. Aggregation of recombinant monoclonal antibodies and its role in potential immunogenicity. *Current pharmaceutical biotechnology*. 2018, iss. 4, vol. 19, str. 343-356. ISSN 1389-2010. http://www.eurekaselect.com/162830/article, DOI: 10.2174/1389201019666180605130252. [COBISS.SI-ID 33809625]
ŠKRLEC, Katja, RUČMAN, Rudolf, JARC JOVIČIĆ, Eva, SIKIRIĆ, Predrag, ŠVAJGER, Urban, PETAN, Toni, PERIŠIĆ, Milica, **ŠTRUKELJ, Borut**, BERLEC, Aleš. Engineering recombinant Lactococcus lactis as

a delivery vehicle for BPC-157 peptide with antioxidant activities. *Applied microbiology and biotechnology*. 2018, vol. 102, no. 23, str. 10103-10117. ISSN 0175-7598. DOI: 10.1007/s00253-018-9333-6. [COBISS.SI-ID 31660583

ZAHIROVIĆ, Abida, KOREN, Ana, KOPAČ, Peter, **ŠTRUKELJ, Borut**, KOROŠEC, Peter, LUNDER, Mojca. Identification of bee venom Api m 1 IgE epitopes and characterization of corresponding mimotopes. *The journal of allergy and clinical immunology*. [Online ed.]. Feb. 2019, vol. 143, iss. 2, str. 791-794.e5, ilustr. ISSN 1097-6825. https://www.sciencedirect.com/science/article/pii/S0091674918314337?dgcid=raven_sd_aip_email, DOI: 10.1016/j.jaci.2018.10.003. [COBISS.SI-ID 2048372849]

LUNDER, Mojca, VODNIK, Miha, KUBALE, Valentina, GRGUREVIČ, Neža, MAJDIČ, Gregor, **ŠTRUKELJ, Borut.** Peptide mimetic of N-terminal ghrelin enhances ghrelin induced growth hormone secretion and c-Fos expression in mice. *Journal of neuroendocrinology*. 2018, vol. 30, no. 12, e12656. ISSN 1365-2826. https://onlinelibrary.wiley.com/doi/pdf/10.1111/jne.12656, DOI: 10.1111/jne.12656. [COBISS.SI-ID 4721018]

PLAVEC, Tina Vida, **ŠTRUKELJ, Borut,** BERLEC, Aleš. Screening for new surface anchoring domains for Lactococcus lactis. *Frontiers in microbiology*. 2019, vol. 10, str. 1879-1-1879-13. ISSN 1664-302X. DOI: 10.3389/fmicb.2019.01879. [COBISS.SI-ID 32563239]

SODOBNE BIOTEHNOLOŠKE METODE

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Sodobne biotehnološke metode
Course title:	Modern biotechnological methods
Članica nosilka/UL Member:	

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (od študijskega leta 2023/2024 dalje)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037295
Koda učne enote na članici/UL Member course code:	3797

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	5	0	25	85	5

Nosilec predmeta/Lecturer:	Igor Križaj

Izvajalci predavanj:	Radovan Komel, Igor Križaj
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 prerequisites to enter doctoral study.

Vsebina:	Content (Syllabus outline):
Proteini: Čiščenje: viri proteinov; homogenizacija; centrifugiranje; ultrafiltracija; dializa; principi različnih vrst tekočinske kromatografije (gelska, hidrofobna, ionska, afinitetna …) in načini njihove izvedbe (klasična, FPLC, HPLC …); elektroforetske metode (nativna in NaDS PAGE, izoelektrično fokusiranje, prenos Western); izolacija membranskih proteinov (detergenti …). Metode za detekcijo, kvantifikacijo in karakterizacijo proteinov: v raztopinah, gelih,	**Proteins:** Purification: protein sources; homogenization; centrifugation; ultrafiltration; dialysis; principles of liquid chromatography (gel filtration, hydrophobic, ion-exchange, affinity …) and modes of their implementation (classical, FPLC, HPLC …); electrophoretic methods (native and SDS PAGE, isoelectric focussing, Western blotting …); isolation of membrane proteins (detergents). Methods for detection, quantification and characterization of

bioloških membranah in na sintetičnih membranah (imunološke, radioizotopske in spektroskopske metode, barvila). Strukturna karakterizacija proteinov: določanje aminokislinske sestave in zaporedja, post-translacijskih modifikacij. Proteomika: 2D PAGE; masna spektrometrija, tehnologija MudPIT. **Nukleinske kisline (NK):** *Izolacija in čiščenje* (biološki viri/tkiva – shranjevanje in homogeniziranje; varnostni ukrepi; obarjanje in centrifugiranje NK; elektroforezne metode in izolacija NK; kromatografske metode; subtrakcija). *Izdelava genske knjižnice/banke* (restrikcijski encimi, fragmentiranje DNA, delna restrikcija, metoda PCR in njene izvedenke; vektorji za prenos DNA, vnos in kloniranje DNA v različnih gostiteljskih celicah, selekcija rekombinantnih klonov; genomske in cDNA knjižnice). *Preiskava genskih knjižnic* (gensko-specifične sonde, hibridizacija kolonij/plakov, ekspresijske knjižnice; RFLP, pozicijsko kloniranje, sprehod/skok po kromosomu). *Določanje nukleotidnega zaporedja* (metoda po Sangerju, po-genomski pristopi – avtomatizacija). *Karakterizacija NK* (restrikcijska analiza, prenosa Southern in Northern; iskanje podobnosti nukleotidnih zaporedij; analiza genskih mutacij in polimorfizmov). *Mutageneza* (naključna in usmerjena/mestno-specifična mutageneza; proteinsko inženirstvo). *Izražanje tujih genov* (fuzijski proteini, sekrecija; analiza mRNA, RT-PCR; hibridizacija *in situ*, FISH; »DNA-prstni odtis«; kvasni dvohibridni sistem; diferenčne metode, fagni prikaz, qPCR, DNA mikromreže (bio-čipi)). *Transgeneza pri evkariontih* (opis metod; utišanje genov). Preurejanje genomov (CRISPR/Cas, gensko zdravljenje, imunonoterapija/CAP-T). *Analiza genomov* (kartiranje, določanje nukleotidnih zaporedij, primerjalna genomika; transkriptomika). *Bioinformatika, podatkovne baze in Internet.*	proteins: in solution, gels, biological membranes and on synthetic membranes (immunological, radioisotopic and spectroscopic methods, dyes). Structural characterization of proteins: determination of amino acid composition and sequence, post-translational modifications. Proteomics: 2D PAGE; mass spectrometry, MudPIT technology. **Nucleic acids (NA):** *Isolation and purification* (biological sources/tissues – storage and homogenization; protection provisions; NA precipitation and centrifugation; electrophoresis and isolation of NA; chromatography; subtraction). *Construction of gene library/bank* (restriction enzymes, cutting and joining DNA molecules, partial digestion, PCR methods; vectors and DNA transfer, DNA cloning in various host cells, selection of recombinant clones; genomic and cDNA libraries). *Gene library screening* (gene specific probes, colony hybridization, expression libraries; RFLP, positional cloning, chromosome walking/jumping). *DNA sequencing* (Sanger method, post-genomic approaches – automatization). *Characterization of NA* (restriction analysis, Southern and Northern blotting; comparative sequence analysis; genetic polymorphisms and mutation analysis). *Mutagenesis* (random and site-specific mutagenesis; protein engineering). *Heterologous gene expression* (fusion proteins, secretion; mRNA analysis, RT-PCR, *in situ* hybridization, FISH; DNA fingerprinting; yeast two-hybrid system; differential screening, phage display, qPCR, DNA microarrays (biochips)). *Transgenesis* (methods; gene silencing). *Genome editing* (CRISPR/Cas, gene therapy, immunotherapy/CAR-T). *Genome analysis* (genome maping and sequencing, comparative genomics; transcriptomics). *Bioinformatics, databases and Internet.*

Temeljna literatura in viri/Readings:

WILLSON, K., WALKER, J. (Eds.), 2005. Principles and Techniques of Biochemistry and Molecular Biology; 6th Edition. Cambridge University Press, Cambridge (U.K.), 783 str., ISBN 0-521-82889-9.

S. B. Primrose and R. M. Twyman (2006): Principles of Gene Manipulation and Genomics; 7th Edition. Blackwell Publishing, Malden (U.S.A.), Oxford (U.K.), Carlton (Austr.), 390 str., ISBN: 1-4051-3544-1.

Zapiski predavanj, revijalni članki s področja, tekoča periodika, druga učna gradiva.

Cilji in kompetence:	**Objectives and competences:**
Temeljni izobraževalni cilj je seznanitev študentov z metodami in tehnikami sodobne biokemije in molekularne biologije s posebnim poudarkom na tistih, ki se uporabljajo v tako imenovani 'sodobni biotehnologiji'. Predmet usmerja študenta k samostojnemu teoretičnemu (analiza literature, reševanje problemo, sinteza zaključkov, sposobnost reševanja problemov) in eksperimentalnemu delu (organiziranje in načrtovanje dela).	The main educational goal is to familiarize students with the contemporary methods and techniques of biochemistry and molecular biology especially emphasising those used in the so-called "modern biotechnology". The course directs students to autonomous theoretical (analysis of literature, problem solving, formulation of conclusions) and experimental work (organization and planning of the work).

Predvideni študijski rezultati:	Intended learning outcomes:
Študent spozna ali poglobi znanje o metodah in tehnikah analize proteinov in nukleinskih kislin. Predmet usmerja študenta k uporabi pridobljenega znanja v temeljnih ali aplikativnih raziskavah na področju njegovega raziskovalnega ali razvojnega dela. Usmerja ga k samostojnemu načrtovanju analitskih postopkov, reševanju problemov z organiziranjem in načrtovanjem eksperimentalnega dela.	Student learns or deepens the knowledge about methods and techniques for analysis of proteins and nucleic acids. The course leads student towards application of the acquired knowledge in his research or developmental work. It teaches students to devise their analytical procedures and to resolve their research problems by organizing and designing their experimental work autonomously.

Metode poučevanja in učenja:	Learning and teaching methods:
Predavanja, vodene diskusija, problemsko-zasnovano učenje, demonstracije v laboratoriju, konzultacije.	Lectures, moderated discussions, problem-based learning, laboratory demonstrations, consultations.

Načini ocenjevanja:	Delež/Weight	Assessment:
Ustni izpit.	100,00 %	Oral examination.

Reference nosilca/Lecturer's references:

Ivanušec, A., Šribar, J., Leonardi, A., Zorović, M., Živin, M. and **Križaj, I.** (2022): Rat Group IIA Secreted Phospholipase A2 Binds to Cytochrome c Oxidase and Inhibits its Activity: A Possible Episode in the Development of Alzheimer's Disease. *International Journal of Molecular Sciences* 23, 12368.

Požek, K., Leonardi, A., Pungerčar, J., Rao, W., Gao, Z., Liu, S., Laustsen, A.H., Trampuš Bakija, A., Reberšek, K., Podgornik, H. and **Križaj**, **I.** (2022): Genomic confirmation of the P-IIIe subclass of snake venom metalloproteinases and characterization of its first member, a disintegrin-like/cysteine-rich protein. *Toxins* 14(4), 232.

Latinović, Z., Leonardi, A., Koh, C.Y., Kini, R.M., Trampuš Bakija, A., Pungerčar, J. and **Križaj, I.** (2020): The procoagulant snake venom serine protease potentially having a dual, blood coagulation factor V and X-activating activity. *Toxins* 12(6), 358.

Lang Balija M., Leonardi, A., Brgles, M., Sviben, D., Kurtović, T., Halassy, B. and **Križaj, I.** (2020): Biological activities and proteomic profile of the venom of *Vipera ursinii* ssp., a very rare karst viper from Croatia. *Toxins* 12(3), 187.

Leonardi, A., Sajevic, T., Pungerčar, J. and **Križaj, I.** (2019): A comprehensive study of the proteome and transcriptome of the venom of the most venomous European viper: Discovery of a new subclass of ancestral snake venom metalloproteinase precursor-derived proteins. *J. Proteome Res.* 18, 2287–2309.

Latinović, Z., Leonardi, A., Kovačič, L., Koh, C.Y., Šribar, J., Trampuš Bakija, A., Venkateswarlu D., Kini, R.M. and **Križaj, I.** (2018): The first intrinsic tenase complex inhibitor with serine protease structure offers a new perspective in anticoagulant therapy. *Thromb. Haemost.* 118(10), 1713–1728.

SODOBNE TEHNOLOGIJE ANIMALNIH ŽIVIL

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Sodobne tehnologije animalnih živil
Course title:	New technologies in food of animal origin
Članica nosilka/UL Member:	

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (od študijskega leta 2023/2024 dalje)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037368
Koda učne enote na članici/UL Member course code:	3871

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:	Lea Demšar

Izvajalci predavanj:	Andreja Čanžek Majhenič, Lea Demšar, Tomaž Polak
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):**
Meso: • sodobni procesi konzerviranja in kakovost mesa in mesnih izdelkov (aseptično procesiranje, mikrovalovno segrevanje, nove tehnologije, sous vide tehnologija, aktivno pakiranje, …) • problematika heterocikličnih aminov v toplotno obdelanih živilih živalskega izvora (poznavanje biosinteznih poti, njihova identifikacija, delovanje *in vitro*, fiziološko-zdravstveni učinki nekaterih	**Meat:** • contemporary processes of preservation and quality of meat and meat products (aseptic processing, microwave heating, new technologies, *sous vide* technology, active packaging, ...) • issue of heterocyclic amines in heat-treated foods of animal origin (knowledge of the biosynthetic pathway, their identification, activity *in vitro*, physiologically-health effects of some

heterocikličnih aminov in produkti Maillardove reakcije; načini zmanjševanja tvorbe) • problematika maščobnokislinskega profila mesa in mesnih izdelkov (vpliv prehrane živali, analitika, možnost razvoja funkcionalnega živila z optimalnim maščobnokislinskim profilom) **Mleko:** • kot izvor funkcionalnih sestavin: *bioaktivni peptidi* – pregled, primer ACE-inhibitornih peptidov, protimikrobnih peptidov, kazeinopeptidov (definicija, struktura, proizvodnja, varnost, aplikacija), *bakteriocini* mlečnokislinskih bakterij ter možnost njihove uporabe kot naravnih biokonzervansov – primer nizin, gassericini (definicija, sinteza, razvrstitev, lastnosti, delovanje, aplikacija, regulative), *oligosaharidi* (fiziološki učinki, sodobne analitske metode karakterizacije), *konjugirana linolna kislina* (naravni izvor, komercialno pridobivanje, analitske metode določanja, zdravju pozitivni učinki) • razvoj in oblikovanje funkcionalnih mlečnih izdelkov za posamezne kategorije potrošnikov (izdelki s prilagojeno sestavo - brezlaktozni mlečni izdelki ali z znižano vsebnostjo laktoze; izdelki obogateni s konjugirano linolno kislino, bioaktivnimi peptidi, antioksidanti, simbiotiki; zaščitne starterske kulture, pripravki na bazi serumskih beljakovin)	heterocyclic amines and Maillard reaction products; methods of reducing formation) • problems bound on fatty acid profile of meat and meat products (impact of animal nutrition, analitics, possibility of developing functional foods with optimal fatty acid profile) **Milk:** • as a source of functional components: *bioactive peptides* – overview, case study of ACE-inhibitory peptides, antimicrobial peptides, caseinopeptides (definition, structure, production, safety assessment, application); bacteriocins of lactic acid bacteria and their possible use as natural biopreservatives, case study of nisin, gassericins (definition, synthesis, classification, characteristics, mode of action, application, regulative); *oligosaccharides* (physiological functions, modern analytical methods for their characterization); *conjugated linoleic acid* (natural sources and commercial production of CLA, analytical methods, health benefits of CLA) • development and designing of functional products for particular category of consumers (products with adapted composition: reduced lactose or lactose-free dairy products; products enriched with conjugated linoleic acid, bioactive peptides, antioxidants and/or symbiotics; protective starter cultures; whey proteins based products)

Temeljna literatura in viri/Readings:

Izbrana poglavja iz monografij:
Sun D.W. 2012. Thermal food processing: new technologies and quality issues. New York, CRC Press: 666 str.
Hui Y. H. 2012. Handbook of Meat and Meat Processing, Second Edition. New York, CRC Press: 1000 str.
Research and applications in bacteriocins. 2007. Riley M.A., Gillor O. (eds.). Wymondham, UK: Horizon Bioscience: 218 str.
Functional dairy products. 2003. Mattila-Sandholm T., Saarela M. (eds.). CRC Woodhead publishing Ltd., 1-312.
Introduction to Functional Food Science. 2013. Martirosyan, DM (ed.). Food Science Publisher, 6-58.
Revijalni članki s področja, tekoča periodika, druga učna gradiva...

Cilji in kompetence:	**Objectives and competences:**
Temeljni izobraževalni cilj je poglobitev znanja za samostojno delo na področju raziskav predelave mesa in mleka, s poudarkom na seznanjanju s principi in tehnologijami predelave, tako tradicionalnih kot sodobnih, ter kakovostjo in zagotavljanjem varnosti živil živalskega izvora.	The goals of the course are deepening and extending knowledge and skills for self-dependent work on the meat and milk technology area, with a focus on communicating the principles and techniques of processing, traditional and modern, as well as ensuring quality and safety of foods of animal origin.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Predviden študijski rezultat je kandidata usposobiti za izvedbo raziskav na področju raziskav predelave mesa in mleka, rezultati katerih bodo predstavljali pomembne prispevke temeljni ali aplikativni znanosti	Knowledge and understanding: Students acquire capacity to implement the in the field of meat and milk processing; the results of these studies will constitute an important contribution to basic or applied science in the field of food science.

na področju živilskih znanosti. Študent v okviru predmeta pridobi sposobnost identifikacije, kritične presoje in reševanja tehnoloških problemov, razvoja novih živil, zbiranja podatkov analiz in njihove interpretacije, uporabe domače in tuje strokovne literature preko knjižnice BF in IKT, timskega dela.	Students receive direction and indicate the possibility of potential research, critical thinking and solving technological problems, novel foods, use of data collection analysis in this area, as well as use of domestic and foreign literature through BF and IKT libraries, and get ready to write articles and work in a professional team.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, samostojna priprava seminarjev in predstavitev.	Lectures, seminar, independent preparation and presentation.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
a) oddana, pregledana in zagovarjana seminarska naloga	50,00 %	a) seminar
b) izpit (pisni ali ustni)	50,00 %	b) exam (oral or written)

Reference nosilca/Lecturer's references:

Lea Demšar

1. TRBOVIĆ, Dejana, POLAK, Tomaž, **DEMŠAR, Lea, P**ARUNOVIĆ, Nenad, DIMITRIJEVIĆ, Mirjana, NIKOLIĆ, Dragica, ĐORĐEVIĆ, Vesna. Determination of the fatty acids in fish tissue and feed - comparison of different methods and statistical evaluation. Acta Chromatographica. 2018, vol. 30, no. 3, str. 175-179. ISSN 2083-5736. DOI: 10.1556/1326.2017.00165. [COBISS.SI-ID 4913272]
2. POLAK, Tomaž, LUŠNIC POLAK, Mateja, LOJEVEC, Igor, **DEMŠAR, Lea**. Effects of different hydrocolloids on the texture profile of chicken meat emulsions. Meat technology. 2018, vol. 59, no. 2, str. 91-101. ISSN 2466-4812.
3. POLAK, Tomaž, LUŠNIC POLAK, Mateja, SOK, Gregor, **DEMŠAR, Lea**. The effect of technological procedure of making burgers on their physico-chemical parameters and sensory properties. Meso. 2018, vol. 20, no. 2, str. 122-130, ilustr. ISSN 1332-0025. https://hrcak.srce.hr/196114. [COBISS.SI-ID 4891512]
4. LUŠNIC POLAK, Mateja, POLAK, Tomaž, DOLHAR, Urška, **DEMŠAR, Lea**. Effect of iodized salt on the physico-chemical parameters and the sensory properties of dry-cured pork loin. Meso. 2018, vol. 20, no. 4, str. 300-307, ilustr. ISSN 1332-0025.
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6. POLAK, Tomaž, LUŠNIC POLAK, Mateja, TOMOVIĆ, Vladimir, ŽLENDER, Božidar, **DEMŠAR, Lea**. Characterization of the Kranjska klobasa, a traditional Slovenian cooked, cured, and smoked sausage from coarse ground pork. Journal of food processing and preservation. Dec. 2017, vol. 41, iss. 6, str. 1-9, e13269, ilustr. ISSN 1745-4549. http://onlinelibrary.wiley.com/doi/10.1111/jfpp.13269/abstract;jsessionid=C2600A2BED081364D51B95DED7552023.f03t02, DOI: 10.1111/jfpp.13269. [COBISS.SI-ID 4798072]

Tomaž Polak

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2. ZAHIJA, Iva, JERŠEK, Barbara, DEMŠAR, Lea, LUŠNIC POLAK, Mateja, POLAK, Tomaž. Production of aflatoxin B1 by Aspergillus parasiticus grown on a novel meat-based media. Toxins : Elektronski vir. 2023, vol. 15, iss. 1, str. 1-17, ilustr. ISSN 2072-6651. https://www.mdpi.com/2072-6651/15/1/25, DOI: 10.3390/toxins15010025. [COBISS.SI-ID 135836163]
3. RISTIĆ MEDIĆ, Danijela, PETROVIĆ, Snježana, POLAK, Tomaž, BERTONCELJ, Jasna, ARSIĆ, Aleksandra, TAKIĆ, Marija, VUČIĆ, Vesna, GURINOVIĆ, Mirjana, KOROŠEC, Mojca. Trans fatty acids in frequently consumed products from Serbian and Slovenian market. Central European journal of public health. 2022, vol. 30, iss. 1, str. 51-57. ISSN 1210-7778. https://cejph.szu.cz/artkey/cjp-202201-

0009_trans-fatty-acids-in-frequently-consumed-products-from-serbian-and-slovenian-market.php, DOI: 10.21101/cejph.a5928. [COBISS.SI-ID 105262339]

4. KOS, Ivica, PLEADIN, Jelka, LEŠIĆ, Tina, DERGESTIN BAČUN, Lidija, POLAK, Tomaž, VNUČEC, Ivan, BENDELJA LJOLJIĆ, Darija, VAHČIĆ, Nada. Sensory profile and likeability of Croatian traditional dry meat products from different regions. Meso : prvi hrvatski časopis o mesu. May/Jun. 2022, vol. 24, no. 3, str. 238-248, ilustr. ISSN 1332-0025. https://hrcak.srce.hr/279248. [COBISS.SI-ID 111755523]
5. LEŠIĆ, Tina, VULIĆ, Ana, VAHČIĆ, Nada, ŠARKANJ, Bojan, HENGL, Brigita, KOS, Ivica, POLAK, Tomaž, KUDUMIJA, Nina, PLEADIN, Jelka. The occurrence of five unregulated mycotoxins most important for traditional dry-cured meat products. Toxins : Elektronski vir. 2022, vol. 14, iss. 7, str. 1-16, ilustr. ISSN 2072-6651. https://www.mdpi.com/2072-6651/14/7/476/htm, DOI: 10.3390/toxins14070476. [COBISS.SI-ID 115110659],
6. POLAK, Tomaž, MEJAŠ, Rok, JAMNIK, Polona, KRALJ CIGIĆ, Irena, POKLAR ULRIH, Nataša, CIGIĆ, Blaž. Accumulation and transformation of biogenic amines and gamma-aminobutyric acid (GABA) in chickpea sourdough. Foods. 2021, vol. 10, iss. 11, str. 1-18, ilustr. ISSN 2304-8158. https://www.mdpi.com/2304-8158/10/11/2840, DOI: 10.3390/foods10112840. [COBISS.SI-ID 85596675]

Andreja Čanžek Majhenič

1. ĐORĐEVIĆ, Jasna, LEDINA, Tijana, GOLOB, Majda, MOHAR LORBEG, Petra**, ČANŽEK MAJHENIČ, Andreja,** BOGOVIČ MATIJAŠIĆ, Bojana, BULAJIĆ, Snežana. Safety evaluation of enterococci isolated from raw milk and artisanal cheeses made in Slovenia and Serbia. *Food science and technology international*. 2022, vol. , iss. , str. 1-11, ilustr. ISSN 1532-1738. https://journals.sagepub.com/doi/10.1177/10820132221117870, DOI: 10.1177/10820132221117870. [COBISS.SI-ID 117510403], [JCR, SNIP, WoS]
2. KOLENC, Borut, MOHAR LORBEG, Petra, **ČANŽEK MAJHENIČ, Andreja**, CIVIDINI, Angela, SIMČIČ, Mojca, TREVEN, Primož. Influence of two feed supplements on technological properties of goat's milk. *Mljekarstvo : proizvodnja proučavanje i tehnologija mlijeka i mliječnih proizvoda*. 2020, vol. 70, no. 3, str. 162-170, ilustr. ISSN 0026-704X. https://doi.org/10.15567/mljekarstvo.2020.0303, DOI: 10.15567/mljekarstvo.2020.0303.
3. VARDJAN, Tinkara, MOHAR LORBEG, Petra, **ČANŽEK MAJHENIČ, Andreja**. Stability of prevailing lactobacilli and yeasts in kefir grains and kefir beverages during ten weeks of propagation. *International journal of dairy technology*. 2018, vol. 71, no. s1, str. 51-60, ilustr. ISSN 1364-727X. http://onlinelibrary.wiley.com/doi/10.1111/1471-0307.12463/full, DOI: 10.111/1471-0307.12463.
4. **ČANŽEK MAJHENIČ, Andreja.** "Pregreta smetana" (overheated cream) : a revived Slovenian traditional dairy product. *Acta agriculturae Slovenica*. [Tiskana izd.]. 2017, letn. 110, št. 1, str. 29-35. ISSN 1581-9175. http://ojs.aas.bf.uni-lj.si/index.php/AAS/article/view/471/238, DOI: 10.14720/aas.2017.110.1.4.
5. **ČANŽEK MAJHENIČ, Andreja**, MOHAR LORBEG, Petra. Antistaphylococcal potential and application of autochthonous enterococci and lactobacilli in pilot cheese production. *Acta alimentaria : an International journal of food science*. 2018, vol. 47, no. 3, str. 359-369. ISSN 1588-2535. https://akademiai.com/doi/pdf/10.1556/066.2018.47.3.12, DOI: 10.1556/066.2018.47.3.12.
6. BOLTAR, Iva, **ČANŽEK MAJHENIČ, Andreja**, JARNI, Kristjan, JUG, Tjaša, BAVCON KRALJ, Mojca. Research of volatile compounds in cheese affected by different technological parameters. *Journal of food and nutrition research*. 2019, vol. 58, no. 1, str. 75-84. ISSN 1336-8672. http://www.vup.sk/en/index.php?mainID=2&navID=34&version=2&volume=58&article=2131

SODOBNE TEHNOLOGIJE RASTLINSKIH ŽIVIL

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Sodobne tehnologije rastlinskih živil
Course title:	Contemporary technologies of plant food
Članica nosilka/UL Member:	

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (od študijskega leta 2023/2024 dalje)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037369
Koda učne enote na članici/UL Member course code:	3872

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	0	85	5

Nosilec predmeta/Lecturer:	Rajko Vidrih

Izvajalci predavanj:	Tatjana Košmerl, Rajko Vidrih
Izvajalci seminarjev:	
Izvajalci vaj:	
Izvajalci kliničnih vaj:	
Izvajalci drugih oblik:	
Izvajalci praktičnega usposabljanja:	

Vrsta predmeta/Course type:	izbirni/elective

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 study

Vsebina:	Content (Syllabus outline):
Usmerjati poobiralno fiziologijo sadja v skladišču (mejne vrednosti O2 in temperature) v izboljšanje parametrov kakovosti, ki jih določajo potrošniki. Pilotna aplikacija dinamične atmosfere za skladiščenje sadja ter vpliv dinamične atmosfere na pojav fizioloških bolezni. Študij sinteze aromatskih spojin med zorenjem sadja ter pomembnost arome sadja s stališča potrošnika. Študij uporabe mejnih temperatur (0,2 °C nad zmrziščem sadja) kot alternativa uporabe	Steer poobiralno physiology of fruit in storage (limiting O2 and temperature) to improve the quality parameters as perceived by consumers. The application of pilot dynamic atmosphere storage of fruits and the impact of dynamic atmosphere on the occurrence of physiological diseases. Study of the synthesis of aroma compounds during ripening of fruit and the importance of fruit flavors from the perspective of the consumer. Study of the application

1-MCP. Študij fiziologije rastlinskih tkiv pri pakiranju v modificirano atmosfero in uporaba drugih modernih tehnologij pakiranja (aktivno pakiranje, uporaba nanokompozitov). Uporaba naravnih dodatkov za izboljšanje funkcionalnih lastnosti moke in povečanje prehranske vrednosti kruha. Uporaba modernih tehnologije predelave grozdja (flotacija, makrooksigencacija, stabulacija grozdnega soka) in pridelave vina (mikrooksigenacija, reduktivna tehnologija ob uporabi različnih inertnih plinov). Študij ohranjanja aromatičnih spojin vina (sortnih, fermentacijskih in zorilnih arom). Proučevanje dejavnikov, ki vplivajo na alkoholno in jabolčno-mlečnokislinsko fermentacijo. Študij optimalnega zorenja vina in drugih proizvodov iz grozdja in vina. Zmanjšanje uporabe enoloških sredstev ob zagotavljanju prehranske vrednosti vina kot varnega živila. Študij fizikalno-kemijske in mikrobiološke stabilnosti vina.	of minimum temperature (0.2 °C above the freezing point of fruit) as an alternative to the use of 1-MCP. Study of the physiology of plant tissues packed in a modified atmosphere and use of other modern packaging technologies (active packaging, use of nanocomposites). The use of natural additives for improving the functional properties of flour and increasing the nutritional value of bread. The use of modern technologies for grape processing (flotation , macrooxygenation, grape juice stabulation) and wine production (microoxygenation, reductive technology using various inert gases). Studies of preserving the aroma compounds of wine (varietal , fermentation and aging aromas). The study of factors affecting the alcoholic and malolactic fermentation. Study of optimal maturation of wine and other grape and wine products. Reduce the use of oenological agents while ensuring the nutritional value of wine as a safe food . Study of physico-chemical and microbiological stabilization of wine.

Temeljna literatura in viri/Readings:

Izbrana poglavja iz naslednjih publikacij:

- Bekatorou, A., 2019. Advances in vinegar production. CRC Press.
- Jaiswal, A.K., 2020. Nutritional composition and antioxidant properties of fruits and vegetables. Academic Press.
- Pareek, Sergio Tonetto de Freitas Sunil, 2019. Postharvest Physiological Disorders in Fruit and Vegetables, in Postharvest Physiological Disorders in Fruits and Vegetables. CRC Press.
- Skinner, M.; Hunter, D., 2015. Bioactives in fruit. Wiley Online Library.
- Wills, R.B.; Golding, J., 2016. Advances in postharvest fruit and vegetable technology. CRC press.
- Butzke C.E. 2010. Winemaking problems solved. Cambridge, Woodhead Publishing Limited: 432 s.
- Jackson R.S. 2020. Wine science. Principles and applications. 5rd edition. Oxford, Elsevier Inc.: 573-724; 725-812.
- Jackson, R.S. 2009. Wine tasting: A professional handbook. 2nd edition. Elsevier Inc., Oxford.
- Kilcast, D. 2010. Sensory analysis for food and beverage quality control: A practical guide. Woodhead Publishing Limited, Cambridge.
- OIV. 2022. Compendium of International Methods of Analysis of Wines and Musts (2 volumes). O.I.V., Paris; https://www.oiv.int/en/technical-standards-and-documents/methods-of-analysis/compendium-of-international-methods-of-analysis-of-wines-and-musts
- Reynolds A.G. 2022. Managing wine quality. Volume 2: Oenology and wine quality. 2nd edition. Cambridge, Woodhead Publishing Limited: 2-368.
- Ribéreau-Gayon, P., Glories, Y., Maujean, A., Dubourdieu, D. 2006. Handbook of enology, Volume 1: Microbiology of wine and vinifications, 2nd edition. John Wiley & Sons, Ltd., Chichester.
- Ribéreau-Gayon, P., Glories, Y., Maujean, A., Dubourdieu, D. 2006. Handbook of enology, Volume 2: Chemistry of wine stabilization and treatments, 2nd edition. John Wiley & Sons, Ltd., Chichester.
- Robertson G.L. 2013. Food packaging: principles and practice. CRC Press, Taylor Francis group
- Brody A. L., Zhuang H., Han H. H. 2011. Modified atmosphere packaging for fresh-cut fruits and vegetables.Wiley-Blackwell
- Galanakis C. M. 2021. Trends in wheat and bread making. Elsevier Academic Press
- Goyal M., Kaur K., Kaur J. 2022. Cereal and cereal based foods – Functional benefits and technological advances for nutrition and healthcare. CRC Press
- Beta T., Camire M. E. 2019. Cereal grain-based functional foods – Carbohydrate and phytochemical components. Royal society of chemistry
- »revijalni članki s področja, tekoča periodika, druga učna gradiva…«

Cilji in kompetence: **Objectives and competences:**

Znanje in razumevanje: Študentje se seznanijo s sodobnimi tehnološkimi postopki predelave rastlinskih živil, ki vključuje sadje, zelenjavo, poljščine in vino. Spoznajo tehnologijo, ki omogoča pridobitev kakovosti in stabilnosti pridelkov, ki jo vedno bolj zahtevajo potrošniki. Študentje se bodo v laboratoriju srečali s praktično uporabo nekaterih od naštetih tehnologij.	Knowledge and Understanding: Students get acquainted with modern technological processes of plant foods, which include fruits, vegetables, cereals and wine. Learn about the technology, which will allow obtaining the quality and stability of products that consumers increasingly demand. Students will meet in the laboratory to practical application of some of these technologies.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Predmet daje znanje, potrebno pri razvoju sodobnih tehnologij v živilski tehnologiji. Seznani se s kritičnim ovrednotenjem prednosti in pomanjkljivosti novih tehnologij s stališča končnega proizvoda.	Knowledge and Understanding: The subject gives the knowledge needed in the development of modern technologies in food technology. Pair it with a critical evaluation of the advantages and disadvantages of new technologies from the perspective of the end product.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, laboratorijsko delo, samostojna priprava seminarjev in predstavitev. Pisno preverjanje znanja.	Lectures, laboratory work, independent preparation of seminars and presentations. Written examination.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
seminar	50,00 %	seminar
pisni izpit	50,00 %	written exam

Reference nosilca/Lecturer's references:

Rajko Vidrih

1. KOKALJ, Doris, ZLATIĆ, Emil, CIGIĆ, Blaž, VIDRIH, Rajko. Postharvest light-emitting diode irradiation of sweet cherries (Prunus avium L.) promotes accumulation of anthocyanins. Postharvest biology and technology. [Print ed.]. Feb. 2019, vol. 148, str. 192-199, ilustr. ISSN 0925-5214. DOI: 10.1016/j.postharvbio.2018.1011. [COBISS.SI-ID 4995192]
2. WANG, Xuepei, LI, Xinwu, FU, Daqi, VIDRIH, Rajko, ZHANG, Xiaoshuan. Ethylene sensor-enabled dynamic monitoring and multi-strategies control for quality management of fruit cold chain logistics. Sensors. 2020, vol. 20, iss. 20, str. 1-21. ISSN 1424-8220. https://www.mdpi.com/1424-8220/20/20/5830, DOI: 10.3390/s20205830. [COBISS.SI-ID 34884099]
3. ŠIŠKOVIČ, Nina, STROJNIK, Lidija, GREBENC, Tine, VIDRIH, Rajko, OGRINC, Nives. Differentiation between species and regional origin of fresh and freeze-dried truffles according to their volatile profiles. Food control. [Print ed.]. 2021, vol. 123, str. 1-10. ISSN 0956-7135. DOI: 10.1016/j.foodcont.2020.107698. [COBISS.SI-ID 35713027]
4. BOHINC, Klemen (avtor, korespondenčni avtor), ŠTUKELJ, Roman, ABRAM, Anže, JERMAN, Ivan, VAN DE VELDE, Nigel Willy, VIDRIH, Rajko. Biophysical characterization of autochthonous and new apple cultivar surfaces. Agronomy. 2022, iss. 9, art. 2051, str. 1-11, ilustr. ISSN 2073-4395. https://www.mdpi.com/2073-4395/12/9/2051, DOI: 10.3390/agronomy12092051. [COBISS.SI-ID 119426051]
5. 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 0278-691 DOI: 10.1016/j.fct.2019.111109. [COBISS.SI-ID 5948264]
6. HUČ, Aleks, VIDRIH, Rajko, TREBAR, Mira. Determination of pears ripening stages based on electrochemical ethylene sensor. IEEE sensors journal. [Print ed.]. 2020, vol. 20, no. 23, str. 13976-13983, ilustr. ISSN 1530-437X. DOI: 10.1109/JSEN.2020.2975940. [COBISS.SI-ID 5172600]

Tatjana Košmerl

1. PESTAR BIZJAK, Sandra, HRISTOV, Hristo, KOŠMERL, Tatjana, KUHAR, Aleš. Influence of consumer regiocentrism on perceived value of wine. *British food journal*. 2018, vol. 120, no. 1, str. 33-43.

ISSN 0007-070X. http://www.emeraldinsight.com/doi/full/10.1108/BFJ-03-2017-0181, DOI: 10.1108/BFJ-03-2017-018 [COBISS.SI-ID 4050824]
2. ŠUĆUR RADONJIĆ, Sanja, KOŠMERL, Tatjana, OTA, Ajda, PROSEN, Helena, MARAŠ, Vesna, DEMŠAR, Lea, POLAK, Tomaž. Technological and microbiological factors affecting polyphenolic profile of Montenegrin red wines. *Chemical industry & chemical engineering quarterly*. 2019, vol. 25, iss. 4, str. 309-319, ilustr. ISSN 1451-937 DOI: 10.2298/CICEQ180814009R. [COBISS.SI-ID 5034360]
3. ŠUĆUR RADONJIĆ, Sanja, PROSEN, Helena, MARAŠ, Vesna, DEMŠAR, Lea, KOŠMERL, Tatjana. Incidence of volatile phenols in Montenegrin red wines : Vranac, Kratošija and Cabernet Sauvignon. *Chemical industry & chemical engineering quarterly*. 2020, vol. 26, iss. 4, str. 337-347, ilustr. ISSN 1451-9372. DOI: 10.2298/CICEQ190813010R. [COBISS.SI-ID 5174392]
4. POKLAR ULRIH, Nataša, OPARA, Rok, SKRT, Mihaela, KOŠMERL, Tatjana, WONDRA, Mojmir, ABRAM, Veronika. Polyphenols composition and antioxidant potential during 'Blaufränkisch' grape maceration and red wine maturation, and the effects of trans-resveratrol addition : part I. *Food and chemical toxicology*. Mar. 2020, vol. 137, 8 str., ilustr. ISSN 0278-6915. DOI: 10.1016/j.fct.2020.111122. [COBISS.SI-ID 5148792]
5. VELIĆ, Darko, VELIĆ, Natalija, AMIDŽIĆ KLARIĆ, Daniela, KLARIĆ, Ilija, PETRAVIĆ-TOMINAC, Vlatka, KOŠMERL, Tatjana, VIDRIH, Rajko. The production of fruit wines - a review. *Croatian journal of food science and technology : scientific-professional journal*. 2018, vol. 10, no. 2, str. 279-290. ISSN 1847-3466. DOI: 10.17508/CJFST.2018.10.2.19. [COBISS.SI-ID 4936824]
6. ŠUĆUR RADONJIĆ, Sanja, MARAŠ, Vesna, RAIČEVIĆ, Jovana, KOŠMERL, Tatjana. Wine or beer? : comparison, changes and improvement of polyphenolic compounds during technological phases. *Molecules*. 2020, vol. 25, no. 21, str. 1-35, ilustr. ISSN 1420-3049. https://www.mdpi.com/1420-3049/25/21/4960, DOI: 10.3390/molecules25214960. [COBISS.SI-ID 34581507]

SONARAVNA PRIDELAVA SADJA

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Sonaravna pridelava sadja
Course title:	Sustainable technological measures in fruit production
Članica nosilka/UL Member:	

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (od študijskega leta 2023/2024 dalje)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037309
Koda učne enote na članici/UL Member course code:	3811

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:	Franc Štampar

Izvajalci predavanj:	Jerneja Jakopič, Franc Štampar, 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):**
Spreminjajoče se okolje zahteva novo določitev optimalnih okoljskih parametrov (izbira lege, tal,..), določitev novih sadnih vrst, sort, podlag ter posledično najoptimalnejših tehnologij pridelave s katero bomo dosegali visoke, trajne in kakovostne pridelke. Predstavljena bo analiza klimatskih in talnih dejavnikov, metodika odbire podlag, sort, klonov ter različni vidiki najsodobnejših tehnoloških ukrepov (naprava nasada, vzdrževanje do rodnosti, oskrba v	The changing climate requires determination of optimal environmental parameters (ideal location, soil), appropriate fruit species/cultivars/rootstocks and consequently improve production technologies to achieve high, sustainable and best-quality products. Student will be equipped with advanced knowledge on climatic and soil analysis, methods of cultivar/clone/rootstock selection and various aspects of modern technological measures (orchard

rodnosti) pri integrirani in sonaravni pridelavi jablan, hrušk, breskev, češenj, jagod, orehov, oljke, slive in ostalih sadnih vrst. Poseben poudarek bo na proučitvi različnih kombinacij podlaga-sorta-tehnologija glede na predvidene stresne dejavnike, ki se vedno pogosteje pojavljajo v našem klimatu in ki naj bi krojili pridelavo sadja v naslednjih letih. Poseben poudarek bo na sonaravnem gnojenju, varstvu sadnih rastlin, gojitvenih oblikah ter obvladovanju stresnih dejavnikov (suša – namakanje, toča, povečano UV sevanje – mreža proti toči) ter sortah, ki so tolerantne oziroma odporne na različne bolezni in škodljivce.	planning, maintenance of young and full-cropping orchards). Integrated and sustainable production of apples, pears, peaches, cherries, strawberries, nuts, olives, plums and other fruit species will be discussed. Particular emphasis will be given on different combinations of rootstock-cultivar-technology and their response to various stress factors, increasingly occurring in our climate which will potentially represent the limiting factors of fruit production in the coming years. Sustainable fertilization, protection of fruit plants, appropriate training systems and controlling of stress factors (drought - irrigation, hail, increased UV radiation - hail nets) will be emphasized along with information on pest and disease tolerant/resistant cultivars.

Temeljna literatura in viri/Readings:

Winter F. 2002 Lucas' Anleitung zum Obstbau. Stuttgart, Eugen Ulmer GmbH & Co.: 448 str. ISBN 3-8001-5545-1

revijalni članki s področja, tekoča periodika, druga učna gradiva…

Cilji in kompetence:	**Objectives and competences:**
Cilj je suvereno poznavanje interakcij med okoljem, tlemi, sadnimi vrstami, sortami, podlagami in tehnološkimi postopki z vidika sonaravne pridelave sadja.	The aim is to successfully implement the knowledge of the interactions between the environment, soil, fruit species, cultivars, rootstocks and technological processes into sustainable fruit production.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Študent razume vse prej omenjene interakcije in je sposoben ustvarjati nove tehnološke postopke, optimalne v novo nastajajočih razmerah.	Knowledge and understanding: The student understands all of the aforementioned interactions and is able to create new technological processes and optimize them for specific situations.

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.

Reference nosilca/Lecturer's references:

Franci ŠTAMPAR

1. TOMIĆ, Jelena, ŠTAMPAR, Franci, GLIŠIĆ, Ivana, JAKOPIČ, Jerneja. Phytochemical assessment of plum (Prunus domestica L.) cultivars selected in Serbia. Food chemistry. [Print ed.]. 2019, art. no. 125113, vol. 299, str. 1-9. ISSN 0308-8146. DOI: 10.1016/j.foodchem.2019.125113. [COBISS.SI-ID 9290617],

2. ŠENICA, Mateja, ŠTAMPAR, Franci, MIKULIČ PETKOVŠEK, Maja. Harmful (cyanogenic glycoside) and beneficial (phenolic) compounds in different Sambucus species. Journal of berry research. 2019, no. 3, vol. 9, str. 395-409, ilustr. ISSN 1878-5093. DOI: 10.3233/JBR-180369. [COBISS.SI-ID 9214329],

3. SOLAR, Anita, JAKOPIČ, Jerneja, MIKLAVC, Jože, ŠTAMPAR, Franci, VEBERIČ, Robert, TRDAN, Stanislav. Walnut husk fly substantially affects sensory attributes and phenolic contents of the kernels in common walnut. Scientia horticulturae. [Print ed.]. 2019, vol. 247, str. 17-26. ISSN 0304-4238. DOI: 10.1016/j.scienta.2018.11.078. [COBISS.SI-ID 9114489],

4. ŠENICA, Mateja, ŠTAMPAR, Franci, VEBERIČ, Robert, MIKULIČ PETKOVŠEK, Maja. Cyanogenic glycosides and phenolics in apple seeds and their changes during long term storage. Scientia horticulturae. [Print ed.]. 2019, vol. 255, str. 30-36. ISSN 0304-4238. [COBISS.SI-ID 9287033],
5. ŠENICA, Mateja, ŠTAMPAR, Franci, MIKULIČ PETKOVŠEK, Maja. Different extraction processes affect the metabolites in blue honeysuckle (Lonicera caerulea L. subsp. edulis) food products. Turkish journal of agriculture and forestry. [Tiskana izdaja]. 2019, vol. 43, iss. 6, str. 576-585. ISSN 1300-011X. DOI: 10.3906/tar-1907-48. [COBISS.SI-ID 9358201],
6. ŠENICA, Mateja, BAVEC, Martina, ŠTAMPAR, Franci, MIKULIČ PETKOVŠEK, Maja. Blue honeysuckle (Lonicera caerulea subsp. edulis (Turcz. Ex Herder) Hultén.) berries and changes in their ingredients across different locations. Journal of the science of food and agriculture. [Print ed.]. 2018, vol. 98, iss. 9, str. 3333-3342. ISSN 0022-5142. DOI: 10.1002/jsfa.8837. [COBISS.SI-ID 8898425],

Robert VEBERIČ
1. MEDIČ, Aljaž, ZAMLJEN, Tilen, HUDINA, Metka, VEBERIČ, Robert. Time-dependent degradation of naphthoquinones and phenolic compounds in walnut husks. Biology. 2022, vol. 11, iss. 2 (342), 12 str., ilustr. ISSN 2079-7737. https://www.mdpi.com/2079-7737/11/2/342, DOI: 10.3390/biology11020342. [COBISS.SI-ID 99036419],
2. SMRKE, Tina, VEBERIČ, Robert, HUDINA, Metka, ŠTAMIC, Domen, JAKOPIČ, Jerneja. Comparison of highbush blueberry (Vaccinium corymbosum L.) under ridge and pot production. Agriculture. 2021, vol. 11, no. 10 (929), str. 1-11. ISSN 2077-0472. https://www.mdpi.com/2077-0472/11/10/929, DOI: 10.3390/agriculture11100929. [COBISS.SI-ID 82591235],
3. MEDIČ, Aljaž, HUDINA, Metka, VEBERIČ, Robert. The effect of cane vigour on the kiwifruit (Actinidia chinensis) and kiwiberry (Actinidia arguta) quality. Scientific reports. 2021, vol. 11 (12749), str. 1-8, ilustr. ISSN 2045-2322. https://www.nature.com/articles/s41598-021-92161-8.pdf, DOI: 10.21203/rs.3.rs-149988/v1. [COBISS.SI-ID 67713027],
4. ČEBULJ, Anka, HALBWIRTH, Heidi, MIKULIČ PETKOVŠEK, Maja, VEBERIČ, Robert, SLATNAR, Ana. The impact of scald development on phenylpropanoid metabolism based on phenol content, enzyme activity, and gene expression analysis. Horticulture, environment and biotechnology. 2020, vol. 61, iss. 5, str. 849-858, ilustr. ISSN 2211-3452. DOI: 10.1007/s13580-020-00268-0. [COBISS.SI-ID 26859523],
5. SLATNAR, Ana, KWIECINSKA, Iwona, LICZNAR-MALANCZUK, Maria, VEBERIČ, Robert. The effect of green cover within rows on the qualitative and quantitative fruit parameters of full-cropping apple trees. Horticulture, environment and biotechnology. 2020, vol. 61, str. 41-49, ilustr. ISSN 2211-3452. DOI: 10.1007/s13580-019-00195-9. [COBISS.SI-ID 9371001],
6. ČEBULJ, Anka, MIKULIČ PETKOVŠEK, Maja, SLATNAR, Ana, ELER, Klemen, VEBERIČ, Robert. Typical and extremely hot summer conditions trigger a diverse response of phenolic metabolism in apple peel. European journal of horticultural science. 2019, vol. 84, no. 5, str. 257-262. ISSN 1611-4426. DOI: 10.17660/eJHS.2019/84.5.1. [COBISS.SI-ID 9357945],

Jerneja JAKOPIČ
1. SMRKE, Tina, VEBERIČ, Robert, HUDINA, Metka, JAKOPIČ, Jerneja. Pot and ridge production of three highbush blueberry (Vaccinium corymbosum L.) cultivars under high tunnels. Agriculture. 2022, vol. 12, iss. 4, art. 438, 14 str. ISSN 2077-0472. https://www.mdpi.com/2077-0472/12/4/438, DOI: 10.3390/agriculture12040438. [COBISS.SI-ID 113557251],
2. CVELBAR WEBER, Nika, KORON, Darinka, JAKOPIČ, Jerneja, VEBERIČ, Robert, HUDINA, Metka, BAŠA ČESNIK, Helena. Influence of nitrogen, calcium and nano-fertilizer on strawberry (Fragaria x ananassa Duch.) fruit inner and outer quality. Agronomy. 18 May 2021, vol. 11, iss. 5, str. 1-18, ilustr. ISSN 2073-4395. https://www.mdpi.com/2073-4395/11/5/997, DOI: 10.3390/agronomy11050997. [COBISS.SI-ID 63686147],
3. JAKOPIČ, Jerneja, SCHMITZER, Valentina, VEBERIČ, Robert, SMRKE, Tina, ŠTAMPAR, Franci. Metabolic response of 'Topaz' apple fruit to minimal application of nitrogen during cell enlargement stage. Horticulturae. 2021, vol. 7, no. 9 (266), str. 1-10. ISSN 2311-7524. https://www.mdpi.com/2311-7524/7/9/266, DOI: 10.3390/horticulturae7090266. [COBISS.SI-ID 77559811],
4. JAKOPIČ, Jerneja, VEBERIČ, Robert. Influence of partial spur leaves removal on fruitlet shedding, fruit quality and shoot growth in apple trees as a basis for mechanical thinning. Acta Scientiarum Polonorum. Hortorum Cultus= Horticulture= Ogrodnictwo. 2020, vol. 19, no. 1, str. 53-59, ilustr. ISSN 1644-0692. DOI: 10.24326/asphc.2020.1.5. [COBISS.SI-ID 9447801],
5. SMRKE, Tina, PERŠIĆ, Martina, VEBERIČ, Robert, ŠIRCELJ, Helena, JAKOPIČ, Jerneja. Influence of reflective foil on persimmon (Diospyros kaki Thunb.) fruit peel colour and selected bioactive compounds.

Scientific reports. 2019, vol. 9, str. 1-8 (19069), ilustr. ISSN 2045-2322. DOI: 10.1038/s41598-019-55735-1. [COBISS.SI-ID 9376889],

6. JAKOPIČ, Jerneja, ŠTAMPAR, Franci, VEBERIČ, Robert. Daily dynamics of sugar and phenol contents in apple fruitlets during june drop. Notulae botanicae Horti agrobotanici Cluj-Napoca. Tiskana izd. 2018, vol. 46, no. 1, str. 75-81. ISSN 0255-965X. DOI: 10.15835/nbha46110870. [COBISS.SI-ID 8823673]

SPECIALNE TEHNIKE V ELEKTRONSKI MIKROSKOPIJI

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Specialne tehnike v elektronski mikroskopiji
Course title:	Special techniques of electron microscopy
Članica nosilka/UL Member:	

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (od študijskega leta 2023/2024 dalje)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037361
Koda učne enote na članici/UL Member course code:	3864

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

Nosilec predmeta/Lecturer:	Rok Romih

Izvajalci predavanj:	
Izvajalci seminarjev:	Rok Romih
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 terms for doctor study.

Vsebina:	Content (Syllabus outline):
Predstavitev novosti v presevni in vrstični elektronski mikroskopiji in možnosti uporabe novejših metod v bioznanostih. Pregled krio-metod s poudarkom na teoretskih osnovah zamrzovanja kot načina fiksacije bioloških vzorcev, uporabi zmrzovalnega lomljenja in jedkanja za študij strukture membran, študiju celične ultrastrukture s tehniko zmrzovanja pri visokem pritisku tlaku in hladne izmenjave ter pripravi krioultratankih rezin. Predstavitev metod za	Introduction to recent advances in transmission and scanning electron microscopy and their application in life sciences. Overview of cryo methods with emphasis on theory of freezing and its comparison with chemical fixation, on the use of freeze-fracturing and freeze-etching for studying cell membranes, on the studies of ultrastructure by high pressure freezing and freeze-substitution methods and on preparation of cryo-ultrathin sections. Introduction to methods

lokalizacijo celičnih sestavin na ultrastrukturnem nivoju: spoznavanje principov imunohistocitokemije in posebnosti v elektronski mikroskopiji, primerjava metod označevanja antigenov pred vklaplanjem vzorcev in po vklapljanju. Uporaba elektronsko gostih označevalcev za sledenje membranskih transportov. Princip elektronske tomografije: izdelava tridimenzionalnih rekonstrukcij in modelov celičnih struktur. Praktični primeri kombinacij navednih metod pri študiju celične organizacije in funkcije.	for ultrastructural localization of molecules: the basic principles of immunohistocytochemistry and considerations in the field of electron microscopy, comparison of pre-embedding and post-embedding labelling. Markers of intracellular membrane traffic. Principles of electron tomography: production of three dimensional reconstructions and models of cellular structures. Examples of application of various methods to study cell organisation and function.

Temeljna literatura in viri/Readings:

- Electron Microscopy: Methods and Protocols (Methods in Molecular Biology, 1117) 3rd ed. 2014 Edition by John Kuo (Editor)
- Revijalni članki s področja in tekoča periodika. / Review articles from selected journals.

Cilji in kompetence:	**Objectives and competences:**
- pridobivanje znanj s področja elektronske mikroskopije; - seznanitev z najsodobnejšimi metodami elektronske mikroskopije v bioznanostih; - spoznati možnosti izbire ustrezne metodike za reševanje znanstvenih vprašanj; - zmožnost interpretacije rezultatov.	- learning in the field of electron microscopy; - to get an overview of recent advances in electron microscopy for life sciences; - to know possibilities of choosing appropriate method for answering scientific questions; - to develop the ability to interpret results.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Študenti spoznajo najnovejše metode elektronske mikroskopije in dobijo vpogled v razvoj področja. Študenti znajo izbrati ustrezne metode, ki omogočajo študij določenih problemov v bioznanostih. Študenti znajo interpretirati rezultate, pridobljene z različnimi metodami. Študenti samostojno prepoznajo napake (artefakte), ki so posledica metodoloških omejitev metod v elektronski mikroskopiji	Knowledge and understanding: - of the state-of-the-art electron microscopy and its perspectives; - students are abel to differentiate and select suitable methods for their research in life sciences; - students can interpret results of different methods; - students recognise artefacts of specimen preparations in electron microscopy.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, demonstracije, praktično delo v laboratoriju, predstavitev seminarjev in konzultacije.	Lectures, demonstrations, practical work, seminars and consultations.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Izpit in izdelava seminarja.	100,00 %	Exam and seminar preparation.

Reference nosilca/Lecturer's references:

Rok Romih

1. ŽEROVNIK MEKUČ, Manca, BOHAK, Ciril, BONEŠ, Eva, HUDOKLIN, Samo, **ROMIH, Rok**, MAROLT, Matija. Automatic segmentation and reconstruction of intracellular compartments in volumetric electron microscopy data. Computer methods and programs in biomedicine. 2022, vol. 223, str. 1-14. ISSN 0169-2607.
2. RESNIK, Nataša, **ROMIH, Rok**, ERDANI-KREFT, Mateja, HUDOKLIN, Samo (avtor, korespondenčni avtor). Freeze-fracture electron microscopy for extracellular vesicle analysis. Journal of visualized experiments. 2022, vol. 187, str. 1-13, ilustr. ISSN 1940-087X.

3. LIAO, Yi, THAM, Daniel K. L., LIANG, Feng-Xia, CHANG, Jennifer, WEI, Yuan, SUDHIR, Putty-Reddy, SALL, Joseph, REN, Sarah J., CHICOTE, Javier U., **ROMIH, Rok**, et al. Mitochondrial lipid droplet formation as a detoxification mechanism to sequester and degrade excessive urothelial membranes. Molecular biology of the cell. Nov. 2019, vol. 30, iss. 24, str. 2969-2984, ilustr. ISSN 1059-1524.
4. MANČEK KEBER, Mateja, LAINŠČEK, Duško, BENČINA, Mojca, CHEN, Jiaji G., ROMIH, Rok, HUNTER, Zachary R., TREON, Steven P., JERALA, Roman. Extracellular vesicle-mediated transfer of constitutively active MyD88L265P engages MyD88wt and activates signaling. Blood. 12. Apr. 2018, vol. 131, iss. 15, str. 1720-1729. ISSN 0006-4971.
5. HUDOKLIN, Samo, JEZERNIK, Kristijan, NEUMÜLLER, Josef, PAVELKA, Margit, ROMIH, Rok. Electron tomography of fusiform vesicles and their organization in urothelial cells. PloS one, ISSN 1932-6203, 2012, vol. 7, iss. 3, str. [1-8], e3293

STATISTIČNA ANALIZA BIOLOŠKIH PODATKOV

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Statistična analiza bioloških podatkov
Course title:	Statistical analysis of biological data
Članica nosilka/UL Member:	

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (od študijskega leta 2023/2024 dalje)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037279
Koda učne enote na članici/UL Member course code:	3781

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	20	0	5	80	5

Nosilec predmeta/Lecturer:	Maja Kajin

Izvajalci predavanj:	Maja Kajin
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 in pridobljenih vsaj 3 do 5 KT iz osnov statistike na predhodno končanih študijih.	General requirements. In addition, At least 3 to 5 ECTS gained in basic statistics in previously completed studies.

Vsebina:	Content (Syllabus outline):
1. Pregled osnovnih statističnih metod in njihova uporaba za analizo podatkov. Statistično preskušanje domnev. Metode proučevanja odvisnosti pojavov. 2. Osnove uporabe okolja za analizo podatkov »R«. Vrste podatkov, priprava in urejanje podatkov. Vnos	1. Review of basic statistical methods and their use for the analysis of data. Statistical testing of assumptions. Methods of studying the dependence of phenomena. 2. Basis of use of the environment for analysis of data »R«. Types of data, preparation and arrangement of

in izpis podatkov, izmenjava podatkov z drugimi programskimi okolji. Grafično prikazovanje podatkov. Priprava lastnih funkcij. Statistične porazdelitve in simulacija podatkov. Analiza podatkov z R. 3. Pregled metod multivariatne analize. Osnovni pojmi linearne algebre za uporabo v statistiki večdimenzionalnih podatkov. Vektorska algebra, matrike in matrični račun, pojem lastnih vrednosti in lastnih vektorjev. Statistična in geometrijska interpretacija pojmov linearne algebre. Metoda glavnih komponent, diskriminacijska analiza, faktorska analiza, razvrščanje v skupine, vizualizacija podatkov. 4. Statistično ozadje analize mikromrež. Načrt poskusa, priprava podatkov, metode za odstranjevanje šuma ozadja, normalizacija podatkov, analiza diferencialne izraženosti, grafične predstavitve in vizualizacija rezultatov, analiza omrežij, povezovanje z bazami podatkov in ontologij na svetovnem spletu. 5. Izbrane metode za analizo podatkov. Izbor posebnih metod bomo prilagajali glede na usmeritev in področje dela prijavljenih študentov.	data. Entry and extraction of data, exchange of data with other programme environments. Graphic presentation of data. Preparation of own functions. Statistical distribution and simulation of data. Analysis of data with R. 3. Review of methods of multivariate analysis. Basic concepts of linear algebra for use in statistics of multidimensional data. Vector algebra, matrices and matrix calculation, concept of own values and own vectors. Statistical and geometric interpretation of concepts of linear algebra. Method of main components, discrimination analysis, factorial analysis, classifying in groups, visualisation of data. 4. Statistical background to analysis of micronets. Plan of experiment, preparation of data, methods for removing background noise, normalisation of data, analysis of differential expression, graphic presentation and visualisation of results, analysis of networks, linkage with databases amd ontologies on the internet. 5. Selected methods for data analysis. The selection of special methods will be adapted to the orientation and field of work of students.

Temeljna literatura in viri/Readings:

1. Weinberg, Harel & Abramovitz. **Statistics using R: An integrative approach.** Cambridge University Press, 2021. ISBN: 978-1-108-71914-8
2. Whitlock & Schluter. **The analysis of biological data.** Greenwood Village, Colo., Roberts and Co. Publishers, 2009. ISBN: 978-1-319156-71-8
3. Dytham. **Choosing and using statistics: A biologist's guide.** Tretja izdaja. Wiley-Blackwell, 2011. ISBN 978-1-4051-9838-7
4. Gotelli & Ellison. **A primer of ecological statistics.** Druga izdaja. Sinauer Associates Inc., 2013. ISBN 978-1-60535-064-6
5. Fowler J, Cohen L, Jarvis P.. **Practical statistics for field Biology**, 272 pages, John Wiley & Sons; 2 edition (1998), ISBN: 0471982962.

- Krzanowski WJ, Principles of Multivariate Analysis, Oxford Science Publications, 1988.
- Blejec, A: Introduction to R
http://ablejec.nib.si/R/I2R/DOC/I2R.pdf
- različni viri na svetovnem spletu.

Cilji in kompetence:	**Objectives and competences:**
Študent nadgradi poznavanje statističnih metod z zahtevnejšimi metodami, ki jih bo potreboval pri raziskovalnem delu. Poudarek je na konceptualnem razumevanju metod, primernosti metod za različne probleme in samostojni analizi podatkov s pomočjo sodobne programske opreme (R). .	The student builds on understanding of statistical methods with more demanding methods required in research work. The stress is on conceptual understanding of methods, comparability of methods for various problems and independent analysis of data with the aid of up-to-date software (R).

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

Študent se usposobi za čim bolj samostojno izbiro ustrezne metode in analize problema, s katerim se vsebinsko ukvarja. Dosežena znanja mu pomagajo pri komunikaciji s strokovnjaki statističnih strok ter pri primerni vključitvi statističnih rezultatov v poročila in znanstvene članke	The student is trained for as independent as possible selection of suitable methods and analysis of problems with which he or she is dealing. The achieved knowledge will help him or her in communication with statistical experts and with suitable inclusion of statistical results in reports and scientific articles.

Metode poučevanja in učenja:	**Learning and teaching methods:**
- predavanja, - laboratorijske vaje, - konzultacije, - seminarske naloge	- lectures - work in computer lab - consultations - seminar

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
- ustni/pisni izpit/seminar	90,00 %	- oral/written exam/seminar
- praktično delo v računalnici	10,00 %	- Practical work in the lab

Reference nosilca/Lecturer's references:

Zandonà, E.*; **Kajin, M.***; Buckup, P. A.; Amaral, J. R.; Souto-Santos, I. C. & Reznick, D. N. Mode of maternal provisioning in the fish genus *Phalloceros*: a variation on the theme of matrotrophy. *Biological Journal of the Linnean Society* 2021; 134(4), 867-878. * Shared first authorship

Ribeiro, S. E.; de Almeida-Rocha, J. M.; Weber, M. M.; **Kajin, M.**; Lorini, M. L. & Cerqueira, R. Do anthropogenic matrix and life-history traits structure small mammal populations? A meta-analytical approach. *Conservation Genetics* 2021; 22(5), 703-716

Mello, A. B. D., Molina, J. M. B., **Kajin, M.,** & Santos, M. C. D. O. (2019). Abundance estimates of Guiana dolphins (*Sotalia guianensis*; Van Bénéden, 1864) inhabiting an estuarine system in southeastern Brazil. *Aquatic mammals*, 45(1), 56-65.

Santos, G. S.; Salguero-Gómez, R.; Dias, A. T. C. & **Kajin, M.** To buffer or to be labile? A framework to disentangle demographic patterns and evolutionary processes. bioRxiv 2021; DOI: https://doi.org/10.1101/2021.04.12.439165

Kajin, M.; Penz, C.; DeVries, P. J. 2017. Large-scale climate effects meet an Amazonian butterfly: which population parameters respond to El Niño? *Environmental Entomology*, 46, 1-10.

Santos, G. S., & **Kajin, M.** (2022). Matrix population models (MPMs) applied to ecology: a gentle guide from theory to practice. SciELO Preprints (https://preprints.scielo.org/index.php/scielo/preprint/view/3989)

STATISTIČNE METODE ZA ANALIZO PODATKOV

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Statistične metode za analizo podatkov
Course title:	Statistical methods for data analysis
Članica nosilka/UL Member:	

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (od študijskega leta 2023/2024 dalje)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037254
Koda učne enote na članici/UL Member course code:	3756

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	35	0	0	80	5

Nosilec predmeta/Lecturer:	Katarina Košmelj

Izvajalci predavanj:	Katarina Košmelj
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:
Potrebno je znanje osnovne statistike.	Knowledge of basic statistics is required.

Vsebina:	Content (Syllabus outline):
Moderni grafični prikazi. Analiza kontingenčnih tabel. Analiza enega vzorca za povprečje in za delež; parametrični in neparametrični pristop. Analiza dveh vzorcev za povprečji in za deleža: parametrični in neparametrični pristop. Analiza variance: slučajne skupine, slučajni bloki, večfaktorske zasnove; parametrične in neparametrične alternative.	Modern graphics for data presentation. Analysis of contingency tables. One sample mean and proportion analysis with parametric and nonparametric tests. Two sample means and proportions analysis with parametric and nonparametric tests. Analysis of variance; complete random one-way design, randomized complete block design, multi-

	factor experiment with parametric and nonparametric tests.

Temeljna literatura in viri/Readings:

KOŠMELJ, Katarina. *Uporabna statistika*. 2. dopolnjena izd. Ljubljana: Biotehniška fakulteta, 2007. ISBN 978-961-6275-26-2. http://www.bf.uni-lj.si/fileadmin/groups/2721/Uporabna_statistika_01.pdf. [COBISS.SI-ID 235777024]

Košmelj K.: Interna gradiva.(pdf datoteke)

Mead R, Curnow R & Hasted A. (2002). Statistical Methods in Agriculture and Experimental Biology, Third Edition. Chapman & Hall/CRC Press.

R Core Team (2013). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL http://www.R-project.org/.

Cilji in kompetence:	**Objectives and competences:**
Cilj predmeta je seznaniti študenta s koncepti, postopki in statističnimi metodami za načrtovanje poskusov in analizo podatkov v bioloških in biotehniških vedah.	Main objective is to give students an overview of concepts and statistical methods for design and analysis of experiments in biological and biotechnical sciences.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: študent nadgradi znanje osnovne statistike z znanjem zahtevnejših statističnih metod in pristopov. Poudarek je na uporabi ustrezne metode, na interpretaciji rezultatov ter na uporabi modernih programskih orodij.	Knowledge and understanding: students upgrade basic knowledge of statistics with modern statistical and computing approaches. The focus is on the choice of appropriate methods, on the interpretation of the results and of the use of modern tools for statistical computing.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Pouk je v računalniški učilnici, pri pouku se uporablja moderna programska oprema. Domače delo.	Lectures in computer room; modern software is used. Home work.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Izpit v računalniški učilnici.	100,00 %	Exam in computer laboratory.

Reference nosilca/Lecturer's references:

Katarina Košmelj

1. JESENIČNIK, Taja, ŠTAJNER, Nataša, RADIŠEK, Sebastjan, KUMAR MISHRA, Ajay, **KOŠMELJ, Katarina**, KUNEJ, Urban, JAKŠE, Jernej. Discovery of microRNA-like small rnas in pathogenic plant fungus Verticillium nonalfalfae using high-throughput sequencing and qPCR and RLM-RACE validation. *International journal of molecular sciences*. 2022, vol. 23, no. 2, str. 1-17 (900), ilustr. ISSN 1422-0067. https://www.mdpi.com/1422-0067/23/2/900, DOI: 10.3390/ijms23020900. [COBISS.SI-ID 94636035],

2. 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. https://www.mdpi.com/2223-7747/10/2/314/htm, DOI: 10.3390/plants10020314. [COBISS.SI-ID 50629891],

3. ŠINIGOJ, Petra, VENE, Nina, **KOŠMELJ, Katarina**, MAVRI, Alenka. Risk of major bleeding in elderly patients with atrial fibrillation on direct oral anticoagulants : real world experience. *International journal of clinical pharmacy*. [Print ed.]. Apr. 2020, vol. 42, iss. 2, str. 445-452, ilustr. ISSN 2210-7703.

https://link.springer.com/content/pdf/10.1007/s11096-020-01008-1.pdf, DOI: 10.1007/s11096-020-01008-1. [COBISS.SI-ID 34777561],

4. LAZNIK, Žiga, KOŠIR, Iztok Jože, **KOŠMELJ, Katarina**, MUROVEC, Jana, JAGODIČ, Anamarija, TRDAN, Stanislav, KOCJAN AČKO, Darja, FLAJŠMAN, Marko. Effect of Cannabis sativa L. root, leaf and inflorescence ethanol extracts on the chemotrophic response of entomopathogenic nematodes. *Plant and soil*. [Print ed.]. 2020, vol. 455, iss. 1, str. 367-379. ISSN 0032-079X. DOI: 10.1007/s11104-020-04693-z. [COBISS.SI-ID 27604995]

5. FLAJŠMAN, Marko, ŠANTAVEC, Igor, KOLMANIČ, Aleš, **KOŠMELJ, Katarina**, KOCJAN AČKO, Darja. Agronomic performance and stability of seed, protein and oil yields of seven soybean cultivars determined in field experiments in Slovenia. *Genetika : časopis Saveza društava genetičara Jugoslavije*. 2019, vol. 51, no. 1, str. 31-46. Acta biologica Iugoslavica. ISSN 0534-0012. DOI: 10.2298/GENSR1901031F. [COBISS.SI-ID 9216121]

6. VOLK, Helena, MARTON, Kristina, FLAJŠMAN, Marko, RADIŠEK, Sebastjan, TIAN, Hui, HEIN, Ingo, PODLIPNIK, Črtomir, THOMMA, Bart P. H. J., **KOŠMELJ, Katarina**, JAVORNIK, Branka, BERNE, Sabina. Chitin binding protein of Verticillium nonalfalfae disguises fungus from plant chitinases and supresses chitin-triggered host immunity. *Molecular plant-microbe interactions*. 2019, vol. 32, no. 10, str. 1378-1390. ISSN 0894-0282. DOI: 10.1094/MPMI-03-19-0079-R. [COBISS.SI-ID 9214841],

7. ČOP, Jure, **KOŠMELJ, Katarina**, ŽNIDARŠIČ, Tomaž, VERBIČ, Jože. Pridelek, morfološki razvoj in hranilna vrednost zelinja lucerne med rastno sezono v osrednji Sloveniji : analiza časovnih potekov. *Acta agriculturae Slovenica*. [Tiskana izd.]. 2018, letn. 111, št. 1, str. 177-187, ilustr. ISSN 1581-9175. DOI: 10.14720/aas.2018.111.1.17. [COBISS.SI-ID 8967545], [SNIP, Scopus]

8. MARTON, Kristina, FLAJŠMAN, Marko, RADIŠEK, Sebastjan, **KOŠMELJ, Katarina**, JAKŠE, Jernej, JAVORNIK, Branka, BERNE, Sabina. Comprehensive analysis of Verticillium nonalfalfae in silico secretome uncovers putative effector proteins expressed during hop invasion. *PloS one*. 2018, vol. 13, iss. 6, str. 1-28, ilustr. ISSN 1932-6203. http://journals.plos.org/plosone/article/file?id=10.1371/journal.pone.0198971&type=printable, DOI: 10.1371/journal.pone.0198971. [COBISS.SI-ID 8940665]

STRATEŠKO PLANIRANJE IN ANALIZA POLITIK

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Strateško planiranje in analiza politik
Course title:	Strategic planning and policy analysis
Članica nosilka/UL Member:	

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (od študijskega leta 2023/2024 dalje)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037311
Koda učne enote na članici/UL Member course code:	3813

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:	Mojca Golobič

Izvajalci predavanj:	Mojca Golobič
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):
Pomen in implikacije strateškega merila obravnave. Makrotrendi in gonilne sile. Strateško načrtovanje: ekonomski, okoljski in družbeni vidiki. Osnove socio-ekonomskih analiz. Metode in pristopi v strateškem planiranju: (1) metode za konceptualizacijo in oblikovanje alternativ: modeliranje, napovedovanje, oblikovanje scenarijev (deskriptivni in normativni). (2) Metode za vrednotenje alternativ: SWOT analiza,	The meaning and implication of planning on strategic level. Macro-trends and driving forces. Strategic planning: economic, social and environmental aspects. Basic principles of socio- economic analysis. Methods and approaches in strategic planning: (1) Methods of developing and conceptualising alternatives: forecasting, visioning scenario modelling (prospective and proactive scenarios).

cost-benefit analiza, Delphi, večkriterijsko vrednotenje (glede na merila in cilje) (3) Metode za posvetovanje, participacijo in azreševanje konfliktov na strateški ravni: interesne skupine, pogajanja, argumentacija, soodločanje. Institucionalni in politični okvir strateškega planiranja. Instrumenti strateškega upravljanja: politike, plani in programi, ukrepi. Osnove analize politik (namen, orodja, dileme). Presoja vplivov politik na okolje/prostor/trajnostni razvoj. Seminarska naloga: Obdelava izbranega strateškega problema	(2) Methods of evaluating alternatives: SWOT analysis, cost-benefit analysis, Delphi, multicriteria evaluation against a range of criteria and against the objectives. (3) Methods of undertaking consultation, participation and conflicts resolutions on strategic level: interest groups, negotiations, Institutional and political framework of strategic planning. Instruments of strategic management: policies, plans and programmes, measures. The basis of policy analysis. Policy impact assessment on environment/space/sustainable development. The theoretical knowledge is applied on a practical case in the seminar.

Temeljna literatura in viri/Readings:

J. Friedman: Planning in the public domain: From Knowledge to action, Princeton University Press, Princeton, 1987
Kontič B., Marega M. (ur.), 2000, Trajnostno regionalno razvojno načrtovanje, Regionalni center za okolje za srednjo in vzhodno Evropo, Ljubljana, 104 str.
RADEJ, Bojan, GOLOBIČ, Mojca, MACUR, Mirna, DRAGOŠ, Srečo. Vrednotenje politik : obzorja nove miselnosti. Ljubljana: Vega, 2011. 247 str., ilustr. ISBN 978-961-93138-0-0. [COBISS.SI-ID 257309696]
Seznam izbranih člankov in drugih materialov bo pripravljen vsako leto sproti

Cilji in kompetence:	**Objectives and competences:**
Cilj je usposabljanje študentov za razumevanje in obvladovanje prostorskih problemov na strateški ravni, na osnovi pridobljenih znanj in obvladovanja metod in pristopov strateškega planiranja, napovedovanja in modeliranja, analize in oblikovanja politik ter razreševanja konfliktov. Razumevanje vloge deležnikov v procesu oblikovanja politik/planiranja ter poznavanje metod za konzultacijo/participacijo na strateški ravni Sposobnost hierarhiziranja (problemov, meril, ciljev, ponujenih rešitev). sposobnost določanja vizij in ciljev ter oblikovanje ukrepov za njihovo doseganje.	to make students comprehend the strategic dimensions of spatial problems -to obtain knowledge about concepts and theories of strategic planning and decision making -to get to know and to learn how to use methods and tools for strategic planning, forecasting, scenario development and policy analysis -to understand the role of stakeholders in the planning process and to learn how to use methods and tools for participation and consultation. To be able to determine the hierarchy (of problems, criteria, objesctives, solutions) To be able to develop visons, objectives and measures for implementation

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Razumevanje procesov in trendov na strateški ravni, poznavanje glavnih pristopov in metod strateškega planiranja, poznavanje metod napovedovanja in oblikovanja scenarijev, poznavanje izhodišč ter osnovnih pristopov analize politik in presoje vplivov politik na prostor, poznavanje osnovnih metod argumentacije, pogajanja in soodločanja. *Uporaba:* Izdelava SWOT in cost-benefit analiz, oblikovanje vizij in konceptov prostorskega razvoja na regionalni in nacionalni ravni, obvladovanje večkriterijskih odločitvenih postopkov, uporaba nekaterih metod (scenariji, analiza deležnikov	*Knowledge and understanding*: Of processes and trends on strategic levels. Of Methods and approaches to strategic planning, policy analysis and policy impact assessment Of methods ofargumentation, negotiation and decision-making *Application*: Of SWOT analysis and scenario approach, visions and concepts of (spatial) development, multicriteria evaluation, use of selected methods How to develop and use scenario models How to carry out stakeholder analysis

v strateških načrtih, presojah vplivov na okolje / prostor, presojah izvajanja politik (ukrepov, programov, planov) *Refleksija:* veljavnosti strokovnih znanj in vrednostnih sistemov v strateškem kontekstu, prevladujočih konceptov na področju trajnostnega razvoja in upravljanja z naravnimi viri, izhodišč in strategij obstoječih (in bodočih) varstvenih in razvojnih politik, prevladujočih etičnih, kulturnih in geopolitičnih izhodišč planiranja ter odločevalskih form *Prenosljive spretnosti*: Strateško razmišljanje in analiza kompleksnih problemov, delovanje v večdisciplinarnih skupinah in kompleksnih institucionalnih okoljih, določanje ciljev in prioritet, argumentacija, razmišljanje o alternativah, uspešno delovanje v posvetovalnih procesih	in strategic planning (developing policies, plans and programs on national and regional level and strategic impact assessments) How to evaluate options How to develop a monitoring and evaluation programme resources, strategies of existing policies, prevailing ethical cultural and geopolitical basics for planning and related decision making forms. *Transferable skills*: Strategic thinking and analysis of complex problems, functioning in interdisciplinary groups and complex institutional environments, identification *Reflection:* of validity of existing knowledge and value systems in a strategic context, prevailing concepts of sustainable development and management of natural and formulation of problems, prioritization, argumentation, conceptualising alternatives, participation in a consultation process

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, delo v skupini, analiza primerov, razprave, individualne seminarske naloge s konzultacijami, Predstavitev z zagovorom	Lectures, discussion in groups, case studies, individual seminar work with consultation Presentation of seminar task with discussion

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Seminarska naloga	60,00 %	Final written report
predstavitev in zagovor seminarske naloge	40,00 %	Presentation and discussion on the report

Reference nosilca/Lecturer's references:

1. MAROT, Naja, FISCHER, Thomas Bernard, SYKES, Oliver, GOLOBIČ, Mojca, MUTHOORA, Tara, GONZÁLEZ, Ainhoa. Territorial impact assessment : a policy assessment-like strategic environmental assessment in action. V: FISCHER, Thomas Bernard (ur.), GONZÁLEZ, Ainhoa (ur.). *Handbook of strategic environmental assessment*. Cheltenham: Edward Elgar Publishing, 2021. Str. 58-79, ilustr. Research handbooks on impact assessment. ISBN 978-1-78990-992-0, ISBN 978-1-78990-993-7. [COBISS.SI-ID 61640451]
2. RADEJ, Bojan, GOLOBIČ, Mojca. *Complex society : In the middle of a Middle World*. Wilmington, Delaware: Vernon Press, cop. 2021. XII, 228 str. Series in sociology. ISBN 978-1-64889-019-2. https://vernonpress.com/book/1083. [COBISS.SI-ID 45924099]
3. MAROT, Naja, GOLOBIČ, Mojca, FISCHER, Thomas Bernard. The ESPON EATIA : A qualitative approach to territorial impact assessment. V: MEDEIROS, Eduardo (ur.). *Territorial impact assessment*. Cham: Springer, 2020. Str. 77-99, ilustr. Advances in Spatial Science. ISBN 978-3-030-54501-7, ISBN 978-3-030-54502-4. ISSN 1430-9602. https://link.springer.com/chapter/10.1007/978-3-030-54502-4_5. [COBISS.SI-ID 39012099]
4. MAROT, Naja, GOLOBIČ, Mojca. Delivering a national spatial development strategy: a success story?. *European planning studies*. 2018, vol. 26, no. 6, str. 1202-1221. ISSN 0965-4313. DOI: 10.1080/09654313.2018.1459502. [COBISS.SI-ID 8974201]
5. PENKO SEIDL, Nadja, GOLOBIČ, Mojca. The effects of EU policies on preserving cultural landscape in the Alps. *Landscape research*. 2018, vol. 43, no. 8, str. 1085-1096, ilustr. ISSN 0142-6397. DOI: 10.1080/01426397.2018.1503237. [COBISS.SI-ID 9021049]
6. RADEJ, Bojan, GOLOBIČ, Mojca, MACUR, Mirna, DRAGOŠ, Srečo. *Vrednotenje politik : obzorja nove miselnosti*. Ljubljana: Vega, 2011. 247 str., ilustr. ISBN 978-961-93138-0-0. [COBISS.SI-ID 257309696]

STRUKTURNE ANALIZE LESA NA PODROČJU KULTURNE DEDIŠČINE

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Strukturne analize lesa na področju kulturne dediščine
Course title:	Structural analysis of wood in the field of cultural heritage
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (od študijskega leta 2023/2024 dalje)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code: 0643142

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:	Maks Merela

Izvajalci predavanj:	Angela Balzano, Maks Merela
Izvajalci seminarjev:	Angela Balzano
Izvajalci vaj:	
Izvajalci kliničnih vaj:	
Izvajalci drugih oblik:	Angela Balzano
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):**
Les je material, ki ga je človek med dolgoročno zgodovino najbolj uporabljal. Kljub temu, da je njegova trajnost omejena, obstajajo številne lesene ostaline, leseni predmeti in artefakti, ki pričajo o	Wood is the material that man has used the most during his long history. Despite its limited durability, there are many wooden remains, wooden objects and artifacts that testify to the

pomenu tega materiala za človeštvo in ga danes obravnavamo kot del kulturne dediščine. Preiskava lesa omogoča pridobivanje številnih informacij, ki so pomembne za razumevanje pretekle zgodovine, pojava novih drevesnih vrst, preseljevanja, razvoja obdelovalnih tehnik in gradbenih aktivnosti, kulturnega razvoja, ugotavljanje starosti in istovetnosti objektov ter s tem preverjanje zgodovinskih dejstev. Izziv je ohraniti predmete kulturne dediščine z ohranjanjem materiala, iz katerega so izdelani. Preiskovanje zgradbe lesa omogoča identifikacijo vrst in oceno degradacije, ki je osnova pri pravilni izbiri postopkov konserviranja lesa. Analiza prirastnih plasti omogoča dendrokronološke analize za določanje starosti in istovetnosti lesenih predmetov. Teme ki jih zajema predmet: ravnanje z mokrim arheološkim lesom (na poti od najdbe, izkopavanja do hrambe). Obdelava mokrega arheološkega lesa – priprava vzorcev za preiskave zgradbe lesa ter dendrokronološke meritve. Metode vzorčenja suhega lesa iz objektov kulturne dediščine. Dendrokronološke meritve in analize ter kombinacija z radio-karbonskim datiranjem. Mikroskopske tehnike (svetlobna mikroskopija, elektronske mikroskopija, EDS, UV-mikrospektrofotometrija) za identifikacijo lesnih vrst in analizo degradacije/ohranjenosti lesa. Pregled postopkov in izbira postopkov za konserviranje lesa.	importance of this material for humanity and today we consider it as part of the cultural heritage. Investigation of wood enables to obtain a lot of important information to understand the past history, the emergence of new tree species, migration, the development of cultivation techniques and construction activities, cultural development, age and identity of the buildings and therefore the verification of historical facts. The challenge is to preserve cultural heritage objects by preserving the material from which they are made. Investigation of wood structure enables the identification of species and the assessment of degradation, which is the basis for the correct choice of wood conservation procedures. Growth ring analysis allows dendrochronological analyzes to determine the age and identity of wooden objects. Topics covered by the subject: handling of waterlogged wood (all the way from finding, excavation to storage). Treatment of waterlogged archaeological wood - preparation of samples for investigations of wood structure and dendrochronological measurements. Methods of sampling dry wood from cultural heritage buildings. Dendrochronological measurements and analyses in combination with radio-carbon dating. Microscopic techniques (light microscopy, electron microscopy, EDS, UV microspectrometry) for the identification of wood species and analysis of wood degradation/conservation. Review of methods and selection of procedures for wood conservation.

Temeljna literatura in viri/Readings:

Florian Mary-Lou, E. (1990), Scope and History of Archaeological Wood (1990). In: Archaeological wood Properties, Chemistry, and Preservation. Eds.: Roger M. Rowell in R. James Barbour. American Chemical Society, Washington.

Čufar, Katarina. (2009). Dendrochronology and Past Human Activity—A Review of Advances Since 2000. Tree-Ring Research. 63. 47-60. 10.3959/1536-1098-63.1.47

Kristof Haneca, Katarina Čufar, Hans Beeckman (2009). Oaks, Tree-rings and Wooden Cultural Heritage: a review of the main characteristics and applications of oak dendrochronology in Europe,

Journal of Archaeological Science, Volume 36, 1,P 1-11. https://doi.org/10.1016/j.jas.2008.07.005.

T. Nilsson, R. Rowell (2012). Historical wood–structure and properties. J. Cult. Herit., 13,3, S5-S9. Special issue on Wood science and conservation.

Gril, Joseph (2012). Wood Science for Conservation. J. Cult. Herit. Special Issue, V. 13, 3. S1-S216

https://www.sciencedirect.com/journal/journal-of-cultural-heritage/vol/13/issue/3/suppl/S

Macchioni N. (2014) Wood: Conservation and Preservation. In: Smith C. (eds) Encyclopedia of Global Archaeology. Springer, New York, NY. https://doi.org/10.1007/978-1-4419-0465-2_480

Nash, Stephen. (2002). Archaeological Tree-Ring Dating at the Millennium. Journal of Archaeological Research. 10. 243-275. 10.1023/A:1016024027669.

M. Jones, R. Eaton (2006). Conservation of ancient timbers from the sea. E. May, M. Jones (Eds.), Conservation science heritage materials, RSC, Publishing, Cambridge, UK. https://doi.org/10.1039/9781847557629-00266

Bontadi, J., & Bernabei, M. (2016). Inside the Dogon Masks: The Selection of Woods for Ritual Objects, IAWA Journal, 37(1), 84-97. doi: https://doi.org/10.1163/22941932-20160122

Kim, Yoon & Singh, Adya. (2016). Wood as Cultural Heritage Material and its Deterioration by Biotic and Abiotic Agents. 10.1016/B978-0-12-802185-9.00012-7.

Mauro Bernabei, Nicoletta Martinelli, Paolo Cherubini (2019). Tree-Ring Analysis on Wooden Artifacts: What Can It Tell Us? In Advanced Nanomaterials, Nanotechnologies and Nanomaterials for Diagnostic, Conservation and Restoration of Cultural Heritage. Eds. Giuseppe Lazzara, Rawil Fakhrullin. Elsevier,P: 111-125. https://doi.org/10.1016/B978-0-12-813910-3.00006-9.

Broda, M.; Hill, C.A.S. (2021). Conservation of Waterlogged Wood—Past, Present and Future Perspectives. Forests , 12, 1193. https://doi.org/10.3390/f12091193

Zisi, A. (2021). Forest Wood through the Eyes of a Cultural Conservator. Forests, 12, 1001. https://doi.org/10.3390/f12081001

Walsh-Korb, Zarah. 2022. "Sustainability in Heritage Wood Conservation: Challenges and Directions for Future Research" Forests 13, no. 1: 18. https://doi.org/10.3390/f13010018

Sodobna literatura s področja znanosti o lesu na področju kulturne dediščine

Cilji in kompetence:	**Objectives and competences:**
Cilji: Pridobiti poglobljeno znanje o pomenu lesa v kulturni dediščini in uporabe lesa v določenem (zgodovinskem) času in prostoru. Pridobiti znanja s področja vzorčenja lesa v vseh pojavnih oblikah ter obvladovanje metod, ki omogočajo natančno preiskavo zgradbe lesa, identifikacije lesnih vrst, oceno ohranjenosti ter preiskavo prirastnih značilnosti. Cilj je tudi izvajanje dendrokronoloških analiz za potrebe datiranja lesenih objektov. Kompetence: Študent bo kompetenten za presojo o pravilni izbiri načina vzorčenja in hrambe vzorcev lesa. Študent bo sposoben samostojno pripravljati vzorcev in preiskovati zgradbo lesa ter identificirati lesne vrste. Na osnovi predstavljenih vsebin bo usposobljen za izbiro optimalnega postopka konserviranja lesenih predmetov. Pridobljeno znanje bo omogočilo analizo starosti lesenih objektov.	Objectives: Gain knowledge of the importance of wood in the cultural heritage and use of wood in a particular (historical) time and space. Acquire knowledge in the field of wood sampling in all pop-up forms and master the methods that enable the precise investigation of the structure of wood, identification of wood species, assessment of conservation and examination of growth ring characteristics. The aim is also to carry out dendrochronological analyses for the purposes of dating wooden objects. Competences: The student will be competent to judge the correct choice of method of sampling and storage of wood samples. She/he will be able to independently prepare samples and investigate the structure of the wood and identify the wood species. On the basis of the content presented, she/he will be qualified to choose the optimal process of conserving

	wooden objects. The knowledge gained will allow analysis of the age of wooden objects.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Študent ima pregled in pozna različne kategorije lesa z vidika ohranjenosti. Razume, pomen okoljskih dejavnikov na ohranjenost lesa. Zna presoditi načine in metode vzorčenja lesa za različne potrebe preiskovanja. Seznanjen je z različnimi raziskovalnimi metodami za preiskave zgradbe in ohranjenosti lesa ter preiskavo prirastnih značilnosti. Razume pomen ohranjenosti za ustrezno izbiro postopkov za ohranjanje lesa skladno s sodobnimi smernicami, ki veljajo v konservatorstvu. Pozna metode določanja starosti lesa z dendrokronologijo ter radiokarbonsko datacijo po metodi wiggle matching. Uporaba: Pridobljeno znanje omogoči uporabo naprednih mikroskopskih tehnik za oceno ohranjenosti lesa, za identifikacijo lesnih vrst, za ustrezno izbiro postopkov za ohranjanje lesa. Znanje omogoča ustrezno ravnanje z lesom v različnih stopnjah ohranjenosti kot tudi preiskavo starosti lesenih objektov. Refleksije: Poznavanje zgradbe lesa in stopenj degradacije, obvladovanje in izvajanje raziskovalnih metod, na področju preiskav lastnosti lesa. Prenosljive spretnosti: Študent pridobi spretnosti uporabe znanstvene literature. Znanje študent uporablja in nadgrajuje pri ostalih predmetih in strukturiranju doktorske disertacije.	**Knowledge and understanding:** The student has an overview and knows the different categories of wood in terms of preservation. She/he understands the importance of environmental factors on the preservation of wood. She/he can assess wood sampling methods for different investigation needs. She/he is familiar with various research methods for investigating the anatomy and preservation of wood and investigating growth ring characteristics. She/he understands the importance of conservation for the proper selection of wood conservation procedures in accordance with the modern guidelines in force in the conservatory. She/he knows methods of determining the age of wood with dendrochronology and radiocarbon data by wiggle matching method. Use: The knowledge gained enables the use of advanced microscopic techniques to assess the conservation of wood, to identify wood species and to select the wood conservation procedures appropriately. Knowledge enables proper management of wood at different stages of conservation as well as an investigation of the age of wooden objects. Reflection: Knowledge of wood structure and degradation rates, management and implementation of research methods, in the field of investigations of the properties of wood. Transferable skills: The student acquires the skills of using scientific literature. Knowledge is used and upgraded by the student in other subjects and in structuring the doctoral thesis.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Interaktivna predavanja in razlage, konzultacije, vaje, vzorčenje na terenu, delo v laboratoriju, seminar.	Interactive lectures and explanations, consultations, exercises, field sampling, laboratory work, seminar.

Načini ocenjevanja:	Delež/Weight	Assessment:
Izdelava seminarja	50,00 %	Seminar
Ustni zagovor	50,00 %	Oral exam

Reference nosilca/Lecturer's references:

Maks Merela

1. OUT, Welmoed A., HÄNNINEN, Kirsti, MERELA, Maks, VELUŠČEK, Anton, VERMEEREN, Caroline, ČUFAR, Katarina. Evidence of woodland management at the Eneolithic pile dwellings (3700–2400 BCE) in the Ljubljansko barje, Slovenia?. Plants. 2023, vol. 12, iss. 2, str. 1-19 (291), ilustr. ISSN 2223-7747. https://www.mdpi.com/2223-7747/12/2/291, DOI: 10.3390/plants1202029 [COBISS.SI-ID 136903171], [JCR, SNIP]
2. BALZANO, Angela, MERELA, Maks, ČUFAR, Katarina. Scanning electron microscopy protocol for studying anatomy of highly degraded waterlogged archaeological wood. Forests. [Online ed.]. 2022, vol. 13, iss. 2, 1-17 str., ilustr. ISSN 1999-4907. https://www.mdpi.com/1999-4907/13/2/161, DOI: 10.3390/f13020161. [COBISS.SI-ID 94546947], [JCR, SNIP, WoS do 26. 10. 2022: št. citatov (TC): 1, čistih citatov (CI): 1, čistih citatov na avtorja (CIAu): 0,33, Scopus do 1. 1 2022: št. citatov (TC): 2, čistih citatov (CI): 2, čistih citatov na avtorja (CIAu): 0,67]
3. GANGULY, Sauradipta, BALZANO, Angela, PETRIČ, Marko, KRŽIŠNIK, Davor, TRIPATHI, Sadhna, ŽIGON, Jure, MERELA, Maks. Effects of different energy intensities of microwave treatment on heartwood and sapwood microstructures in Norway spruce. Forests. [Online ed.]. 2021, 12, iss. 5, [17] str. ISSN 1999-4907. https://www.mdpi.com/1999-4907/12/5/598, DOI: 10.3390/f12050598. [COBISS.SI-ID 62577411], [JCR, SNIP, WoS do 19. 12. 2022: št. citatov (TC): 5, čistih citatov (CI): 4, čistih citatov na avtorja (CIAu): 0,57, Scopus do 7. 8. 2022: št. citatov (TC): 5, čistih citatov (CI): 4, čistih citatov na avtorja (CIAu): 0,57]
4. ČUFAR, Katarina, DEMŠAR, Blaž, BEUTING, Micha, BALZANO, Angela, ŠKRK, Nina, KRŽE, Luka, MERELA, Maks. Dendrochronological dating and provenancing of string instruments. Journal of visualized experiments. Okt. 2022, art. 64591, str. 1-13, ilustr. ISSN 1940-087X. https://review.jove.com/t/64591/dendrochronological-dating-and-provenancing-of-string-instruments, DOI: 10.3791/64591. [COBISS.SI-ID 125117187], [JCR, SNIP]
5. MERELA, Maks, THALER, Nejc, BALZANO, Angela, PLAVČAK, Denis. Optimal surface preparation for wood anatomy research of invasive species by scanning electron microscopy = Optimalna priprema površine drva za istraživanje anatomije invazivnih vrsta drva pretražnim elektronskim mikroskopom. Drvna industrija : Znanstveno stručni časopis za pitanja drvne tehnologije. 2020, vol. 71, iss. 2, str. 117-127, ilustr. ISSN 0012-6772. https://hrcak.srce.hr/index.php?show=clanak&id_clanak_jezik=346865, DOI: 10.5552/drvind.2020.1958. [COBISS.SI-ID 19766787], [JCR, SNIP, WoS do 26. 10. 2022: št. citatov (TC): 10, čistih citatov (CI): 4, čistih citatov na avtorja (CIAu): 1,00, Scopus do 31. 3. 2022: št. citatov (TC): 9, čistih citatov (CI): 4, čistih citatov na avtorja (CIAu): 1,00]
6. ŽLAHTIČ ZUPANC, Mojca, MIKAC, Urška, SERŠA, Igor, MERELA, Maks, HUMAR, Miha. Water distribution in wood after short term wetting. Cellulose. Jan. 2019, vol. 26, iss. 2, str. 703-721. ISSN 0969-0239. DOI: 10.1007/s10570-018-2102-y. [COBISS.SI-ID 2966665], [JCR, SNIP, WoS do 2 10. 2022: št. citatov (TC): 9, čistih citatov (CI): 7, čistih citatov na avtorja (CIAu): 1,40, Scopus do 16. 9. 2022: št. citatov (TC): 8, čistih citatov (CI): 6, čistih citatov na avtorja (CIAu): 1,20]

Angela Balzano

1. KRAPEŽ TOMEC, Daša, BALZANO, Angela, ŽIGON, Jure, ŠERNEK, Milan, KARIŽ, Mirko. The effect of printing parameters and wood surface preparation on the adhesion of directly 3d-printed PLA on wood. Journal of renewable materials. 2022, vol. 10, no. 7, str. 1787-1796. ISSN 2164-634 https://www.techscience.com/jrm/online/detail/18383, DOI: 10.32604/jrm.2022.019760. [COBISS.SI-ID 93164291], [JCR, SNIP, WoS]
2. 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. [COBISS.SI-ID 48762115], [JCR, SNIP, WoS do 26. 10. 2022: št. citatov (TC): 1, čistih citatov (CI): 1, čistih citatov na avtorja (CIAu): 0,25, Scopus do 25. 9. 2021: št. citatov (TC): 1, čistih citatov (CI): 1, čistih citatov na avtorja (CIAu): 0,25]
3. HUMAR, Miha, BALZANO, Angela, GRBEC, Samo, GRIČAR, Jožica, KRŽIŠNIK, Davor, LESAR, Boštjan, VEK, Viljem. Investigation of the material resistance and moisture performance of pubescent oak (Quercus pubescens). Holzforschung. [Online ed.]. 2021, vol. 75, iss. 1, str. 22-36, ilustr. ISSN 1437-434X. https://www.degruyter.com/document/doi/10.1515/hf-2020-0045/html, DOI: 10.1515/hf-2020-

0045. [COBISS.SI-ID 24103683], [JCR, SNIP, WoS do 26. 10. 2022: št. citatov (TC): 3, čistih citatov (CI): 0, čistih citatov na avtorja (CIAu): 0,00, Scopus do 26. 2. 2022: št. citatov (TC): 2, čistih citatov na avtorja (CIAu): 0,00]

4. VEK, Viljem, BALZANO, Angela, POLJANŠEK, Ida, HUMAR, Miha, OVEN, Primož. Improving fungal decay resistance of less durable sapwood by impregnation with Scots pine knotwood and black locust heartwood hydrophilic extractives with antifungal or antioxidant properties. Forests. [Online ed.]. 2020, vol. 11, iss. 9, 23 str., ilustr. ISSN 1999-4907. https://doi.org/10.3390/f11091024, DOI: 10.3390/f1109102 [COBISS.SI-ID 29712643], [JCR, SNIP, WoS do 26. 10. 2022: št. citatov (TC): 12, čistih citatov (CI): 7, čistih citatov na avtorja (CIAu): 1,40, Scopus do 23. 10. 2022: št. citatov (TC): 12, čistih citatov (CI): 7, čistih citatov na avtorja (CIAu): 1,40]
5. DE MICCO, Veronica, AMITRANO, Chiara, STINCA, Adriano, GENNARO IZZO, Luigi, ZALLONI, Enrica, BALZANO, Angela, BARILE, Rossella, CONTI, Paola, ARENA, Carmen. Dust accumulation due to anthropogenic impact induces anatomical and photochemical changes in leaves of Centranthus ruber growing on the slope of the Vesuvius volcano. Plant biology : joint international journal. 2020, vol. 22, iss. s1, str. 93-102, ilustr. ISSN 1435-8603. https://onlinelibrary.wiley.com/doi/abs/10.1111/plb.12966, DOI: 10.1111/plb.12966. [COBISS.SI-ID 2997129], [JCR, SNIP, WoS do 4. 11. 2022: št. citatov (TC): 10, čistih citatov (CI): 10, čistih citatov na avtorja (CIAu): 1,11, Scopus do 23. 3. 2022: št. citatov (TC): 9, čistih citatov (CI): 9, čistih citatov na avtorja (CIAu): 1,00]
6. CIRILLO, Chiara, DE MICCO, Veronica, ROUPHAEL, Youssef, BALZANO, Angela, CAPUTO, Rosanna, DE PASCALE, Stefania. Morpho-anatomical and physiological traits of two Bougainvillea genotypes trained to two shapes under deficit irrigation. Trees. 2017, vol. 31, no. 1, str. 173-187. ISSN 0931-1890. https://link.springer.com/article/10.1007/s00468-016-1466-6, DOI: 10.1007/s00468-016-1466- [COBISS.SI-ID 2829193], [JCR, SNIP, WoS do 26. 10. 2022: št. citatov (TC): 14, čistih citatov (CI): 12, čistih citatov na avtorja (CIAu): 2,00, Scopus do 13. 5. 2022: št. citatov (TC): 18, čistih citatov (CI): 16, čistih citatov na avtorja (CIAu): 2,67]

ŠTUDIJ ŽIVIH CELIC - PRAKTIČNO DELO

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Študij živih celic - praktično delo
Course title:	Live Cell Imaging – practical course
Članica nosilka/UL Member:	

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (od študijskega leta 2023/2024 dalje)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037362
Koda učne enote na članici/UL Member course code:	3865

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
	5	0	0	45	200	10

Nosilec predmeta/Lecturer:	Peter Veranič

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

Vrsta predmeta/Course type:	individualno raziskovalni /individual research

Jeziki/Languages:	Predavanja/Lectures:	
	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 dodiplomskem študiju.	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:**
Razprava o teoretičnih principih in praktičnem delu v laboratoriju, priprava bioloških vzorcev, analiza mikrografij, seminarsko delo, konzultacije	Discussion on theoretical principles, practical work in laboratory, preparation of biological specimens, microscopy, analysis of micrographs, seminar work, consultations

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

predstavitve seminarja,	50,00 %	seminar presentation,
razprava	50,00 %	discussions

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],
7. IVANUŠEC, Adrijan, ŠRIBAR, Jernej, VERANIČ, Peter, KRIŽAJ, Igor. The phospholipase activity of ammodytoxin, a prototype snake venom β-neurotoxin, is not obligatory for cell internalisation and translocation to mitochondria. *Toxins : Elektronski vir*. 2022, vol. 14, no. 6, str. 375-1-375-11. ISSN 2072-6651. DOI: 10.3390/toxins14060375. [COBISS.SI-ID 109967619],
8. RESNIK, Nataša, TRATNJEK, Larisa, ERDANI-KREFT, Mateja, KISOVEC, Matic, ADEN, Saša, BEDINA ZAVEC, Apolonija, ANDERLUH, Gregor, PODOBNIK, Marjetka, VERANIČ, Peter. Cytotoxic activity of LLO Y406A is targeted to the plasma membrane of cancer urothelial cells. *International journal of molecular sciences*. 1 Apr. 2021, vol. 22, iss. 7, str. 3305-1-3305-15. ISSN 1422-0067. https://www.mdpi.com/1422-0067/22/7/3305, DOI: 10.3390/ijms22073305. [COBISS.SI-ID 57572867],
9. DRAGIN JERMAN, Urška, VIŠNJAR, Tanja, HAFNER BRATKOVIČ, Iva, RESNIK, Nataša, PAVLIN, Mojca, VERANIČ, Peter, ERDANI-KREFT, Mateja. Attachment of cancer urothelial cells to the bladder epithelium occurs on uroplakin-negative cells and is mediated by desmosomal and not by classical cadherins. *International journal of molecular sciences*. 2021, vol. 22, iss. 11, str. 1-18, ilustr. ISSN 1422-0067. https://www.mdpi.com/1422-0067/22/11/5565, DOI: 10.3390/ijms22115565. [COBISS.SI-ID 65359619],
10. ERMAN, Andreja, KAMENŠEK, Urška, DRAGIN JERMAN, Urška, PAVLIN, Mojca, ČEMAŽAR, Maja, VERANIČ, Peter, ROMIH, Rok. How cancer cells invade bladder epithelium and form tumors : the mouse bladder tumor model as a model of tumor recurrence in patients. *International journal of molecular sciences*.

2021, vol. 22, iss. 12, str. 1-20, ilustr. ISSN 1422-0067. https://www.mdpi.com/1422-0067/22/12/6328, DOI: 10.3390/ijms22126328. [COBISS.SI-ID 67627523],

TEHNIČNI INFORMACIJSKI SISTEMI

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Tehnični informacijski sistemi
Course title:	Technical information systems
Članica nosilka/UL Member:	

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (od študijskega leta 2023/2024 dalje)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037333
Koda učne enote na članici/UL Member course code:	3836

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	10	0	10	90	5

Nosilec predmeta/Lecturer:	Leon Kos

Izvajalci predavanj:	Leon Kos
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):
Proizvodni sistem. Razvojni, izdelovalni, komercialni, finančni in upravljalski sistemi v proizvodnji. Informacijski sistemi v proizvodnji ERP, PDM in PLM sistemi. Izdelek ali storitev kot nosilec procesa. Popis izdelka ali storitve s podatki, ki so pomembni za celoten življenjski cikel. Življenjski cikel izdelka. Spremljanje izdelka skozi življenjski cikel. Prepoznavanje procesa v proizvodnji in generiranje podatkov o izdelku. Značilnosti PLM sistemov.	Production system. Development, manufacturing, commercial, financial and management systems in production. Information systems in production. ERP, PDM and PLM systems. A product or service as a process holder. Cataloguing a product or service with data that are important for its entire life cycle. A product's life cycle. Monitoring a product throughout its life cycle. Recognizing a process in the production and generation of product data. PDM systems

Struktura PLM sistemov. Uvajanje PLM sistemov v proizvodno okolje. Varovanje informacij. Delo v oblaku in vpliv na poslovni proces. ISO sistem zagotavljanja kakovosti. Logična povezava ISO sistema z uporabo PDM/PLM sistemov. Seminarske naloge: Popis realnega izdelka s podatki. Izdelki v življenjskem ciklu. Spremljanje podatkov izdelka skozi ves čas življenjskega cikla. Opredelitev zaznave pravega podatka v določenem času. Modeliranje procesiranja podatkov v določenem procesu. Identifikacija podatkov za kakovostno upravljanje. Prenos podatkov določen PDM/PLM sistem.	characteristics. PDM systems structure. Introducing PDM/PLM systems into the production environment. Cloud computing. Data security. ISO quality assurance. Logical connection of the ISO system with the use of PDM/PLM systems. Seminar work: Cataloguing a real product with data. Life cycle of products. Monitoring product data throughout its life cycle. Defining the detection of relevant information at a specific time. Modelling of data processing in a specific process. Identification of data for good quality management. Transfer of data to a specific PDM/PLM system.

Temeljna literatura in viri/Readings:

Abramovici M., Aidi Y. (2013) Next Generation Product Lifecycle Management (PLM). In: Fathi M. (eds) Integration of Practice-Oriented Knowledge Technology: Trends and Prospectives. Springer, Berlin, Heidelberg
John Stark, Product Lifecycle Management (Volume 1): 21st Century Paradigm for Product Realisation, Springer, 2019 (4th edition)
John Stark, Product Lifecycle Management (Volume 2): The Devil is in the details, Springer, 2016
John Stark, Product Lifecycle Management (Volume 3): The Executive Summary, Springer, 2018
DUHOVNIK, Jože, TAVČAR, Jože. Elektronsko poslovanje in tehnični informacijski sistemi : PDMS - products data management systems, (Konstruiranje: raziskave, razvoj in uporaba, 2). 1. tisk. Ljubljana: LECAD, Fakulteta za strojništvo, 2000. 243 str. loč. pag., [7] f. zganj. pril., ilustr., tabele. ISBN 961-6238-43-4. [COBISS.SI-ID 108401920]
Eigner, M.; Stelzer, R.: Product Lifecycle Management. Ein Leitfaden für Product Development und Lifecycle Management. 2. Auflage. Springer Verlag : Berlin Heidelberg, 2009.
BELLIVEAU, P. GRIFFIN, A., SOMERMEYER, S. The PDMA toolbook for new product development, Hoboken: Wiley, 2004.

Cilji in kompetence:	**Objectives and competences:**
Izobraževalni cilji: Osnovni namen predmeta je pregledati funkcionalnost PDM/PLM sistemov: inženirski model izdelka, kontrola dostopa, informacijski tok in odobritve, klasifikacijski modeli, strukturna kosovnica, prekrivanje funkcionalnosti z drugimi informacijskimi sistemi. Velika pozornost bo namenjena modeliranju procesov, ker dober model predstavlja izhodišče za optimiranje in obvladovanju podakov o izdelku skozi celoten življenjski cikel; kot izhodišče bo vzet ARIS model.	The main aim of the course is to survey the functionality of PDM/PLM systems: engineering product models, access control, information flow and approvals, classification models, structural and modular parts list, overlapping between functionality and other information systems. Special attention will be paid to the modelling of processes, because a good model is the basis for optimizing and management of product data throughout its life-cycle; the ARIS model will be taken as the reference.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Slušatelj je po zaključku predmeta usposobljen za samostojno in multidisciplinarno timsko delo na področju sledenja podatkov o izdelkih skozi celoten življenjski cikel. Na ugotovljenem informacijskem toku bo sposoben zasnovati model podjetja, ki je izhodišče za prenovo in optimizacijo poslovanja.	After the course, the student is trained for individual and multidisciplinary team work in the area of products data tracing throughout their life cycles. With the established information flow, he or she will be capable of devising a company model that is the basis for the reform and optimization of business activities.

Metode poučevanja in učenja:	**Learning and teaching methods:**
V primeru manjšega števila študentov pod 5 bo študij izveden po predloženi literaturi in s konzultacijami.	In the event of fewer than 5 students, the course will be conducted in the form of consultations and with the use of the provided literature.

Običajno pa s predavanji in vajami za pripravo seminarskih nalog. Pomemben delež zajema samostojno delo z uporabo pridobljenih znanj na konkretnem primeru.	The regular course will include lectures and exercises for the preparation of project work. Individual work with application of PLM knowledge is an important part of teaching methods.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Kandidat lahko pristopi k ustnemu izpitu po predložitvi pozitivno ocenjene seminarske naloge. Poročilo seminarske naloge	30,00 %	A candidate can do oral examination after submitting a favourable assessment of project work report. Project work report
Ustni zagovor	40,00 %	Oral examination
Uporabna vrednost in zahtevnost izvedenega primera	30,00 %	The use value and complexity of the case study

Reference nosilca/Lecturer's references:

Leon Kos

1. COBURN, Jonathan, LEHNEN, M., PITTS, Richard, SIMIČ, Gregor, ARTOLA, Francisco Javier, THOREN, E., RATYNSKAIA, S., IBANO, K., BRANK, Matic, KOS, Leon, KHAYRUTDINOV, R., LUKASH, V., STEIN-LUBRANO, B., MATVEEVA, E., PAUTASSO, G. Energy deposition and melt deformation on the ITER first wall due to disruptions and vertical displacement events. *Nuclear fusion*. Jan. 2022, vol. 62, no. 1, str. 1-12, ilustr. ISSN 0029-5515. https://iopscience.iop.org/article/10.1088/1741-4326/ac38c7, DOI: 10.1088/1741-4326/ac38c7. [COBISS.SI-ID 93299971], [JCR, SNIP, WoS do 12. 12. 2022: št. citatov (TC): 6, čistih citatov (CI): 6, čistih citatov na avtorja (CIAu): 0,51, Scopus do 6. 2023: št. citatov (TC): 6, čistih citatov (CI): 6, čistih citatov na avtorja (CIAu): 0,51]
2. BANDARU, Vinodh, HOELZL, Matthias, REUX, C., FICKER, O., SILBURN, S. A., LEHNEN, M., EIDIETIS, N. W., KOS, Leon, et al. Magnetohydrodynamic simulations of runaway electron beam termination in JET. *Plasma physics and controlled fusion*. Jan. 2021, 63, no. 3, str. 1-11, ilustr. ISSN 0741-3335. https://iopscience.iop.org/article/10.1088/1361-6587/abdbcf, DOI: 10.1088/1361-6587/abdbcf. [COBISS.SI-ID 93266691], [JCR, SNIP, WoS do 1. 1 2022: št. citatov (TC): 14, čistih citatov (CI): 10, čistih citatov na avtorja (CIAu): 0,33, Scopus do 7. 1. 2023: št. citatov (TC): 15, čistih citatov (CI): 11, čistih citatov na avtorja (CIAu): 0,37]
3. ARTOLA, Francisco Javier, LOARTE, A., MATVEEVA, E., HAVLIČEK, J., MARKOVIC, T., ADÁMEK, Jiří, CAVALIER, J., KRIPNER, L., HUIJSMANS, G. T. A., LEHNEN, M., HOELZL, Matthias, PANEK, Radomir, KOS, Leon. Simulations of COMPASS vertical displacement events with a self-consistent model for halo currents including neutrals and sheath boundary conditions. *Plasma physics and controlled fusion*. [Online ed.]. 2021, vol. 63, no. 6, str. 1-19, ilustr. ISSN 1361-6587. https://iopscience.iop.org/article/10.1088/1361-6587/abf620, https://iopscience.iop.org/journal/0741-3335/page/2020jointvarenna-lausannainternationworkshop, DOI: 10.1088/1361-6587/abf620. [COBISS.SI-ID 93326083], [JCR, SNIP, WoS do 24. 12. 2022: št. citatov (TC): 7, čistih citatov (CI): 5, čistih citatov na avtorja (CIAu): 0,45, Scopus do 2. 12. 2022: št. citatov (TC): 6, čistih citatov (CI): 4, čistih citatov na avtorja (CIAu): 0,36]
4. KOS, Leon, PITTS, Richard, SIMIČ, G., BRANK, Matic, ANAND, H., ARTER, W. SMITER : a field-line tracing environment for ITER. *Fusion engineering and design*, ISSN 0920-3796. [Print ed.], Sep. 2019, vol. 146, pt. B, str. 1796-1800, ilustr. https://www.sciencedirect.com/science/article/pii/S092037961930359X?via%3Dihub, doi: 10.1016/j.fusengdes.2019.03.037. [COBISS.SI-ID 16530203], [JCR, SNIP, WoS do 25. 10. 2019: št. citatov (TC): 0, čistih citatov (CI): 0, čistih citatov na avtorja (CIAu): 0, Scopus do 1. 2019: št. citatov (TC): 0, čistih citatov (CI): 0, čistih citatov na avtorja (CIAu): 0]
kategorija: 1A1 (Z, A', A1/2); uvrstitev: SCI, Scopus, MBP; tip dela je verificiral OSICN
točke: 16.67, št. avtorjev: **6**
5. ANAND, H., PITTS, Richard, VRIES, P. C. de, SNIPES, J. A., NESPOLI, F., LABIT, B., GALPERTI, C., CODA, S., BRANK, Matic, KOS, Leon. Experimental implementation of a real-time power flux estimator for the ITER first wall on the TCV tokamak. Fusion engineering and design. [Print ed.]. Oct. 2019, vol. 147, str. 1-7, ilustr. ISSN 0920-3796. https://www.sciencedirect.com/science/article/pii/S0920379619307203#!, DOI: 10.1016/j.fusengdes.2019.111242. [COBISS.SI-ID 16703771], [JCR, SNIP, WoS do 18. 10. 2019: št. citatov (TC): 0, čistih citatov (CI): 0, Scopus do 12. 7. 2019: št. citatov (TC): 0, čistih citatov (CI): 0]

6. KOS, Leon, JELIĆ, Nikola, GYERGYEK, Tomaž, KUHN, S., TSKHAKAYA, David. Modeling and simulations of plasma and sheath edges in warm-ion collision-free discharges. *AIP advances*, ISSN 2158-3226, Oct. 2018, vol. 8, no 10, str. 1-23, ilustr. https://aip.scitation.org/doi/pdf/10.1063/1.5044664?class=pdf, doi: 10.1063/1.5044664. [COBISS.SI-ID 12219988], [JCR, SNIP, WoS do 1 11. 2018: št. citatov (TC): 0, čistih citatov (CI): 0, čistih citatov na avtorja (CIAu): 0, Scopus do 27. 10. 2018: št. citatov (TC): 0, čistih citatov (CI): 0, čistih citatov na avtorja (CIAu): 0]
kategorija: 1A3 (Z); uvrstitev: SCI, Scopus, MBP; tip dela je verificiral OSICN
točke: 14.18, št. avtorjev: 5
7. TSKHAKAYA, D. D., KOS, Leon. Comprehensive kinetic analysis of the plasma-wall transition layer in a strongly tilted magnetic field. Physics of plasmas, ISSN 1070-664X, 2014, vol. 21, nr. 10, str. 1-13, ilustr., doi: 10.1063/1.4900765. [COBISS.SI-ID 13954331], [JCR, SNIP, WoS do 10. 3. 2019: št. citatov (TC): 15, čistih citatov (CI): 14, čistih citatov na avtorja (CIAu): 00, Scopus do 27. 1. 2019: št. citatov (TC): 14, čistih citatov (CI): 12, čistih citatov na avtorja (CIAu): 6.00] kategorija: 1A2 (Z, A1/2); uvrstitev: SCI, Scopus, MBP; tip dela je verificiral OSICN, točke: 47.69, št. avtorjev: 2
8. KOS, Leon, JELIĆ, Nikola, KUHN, S., TSKHAKAYA, David. Introduction to the theory and application of a unified Bohm criterion for arbitrary-ion-temperature collision-free plasmas with finite Debye lengths. Physics of plasmas. 2018, vol. 25, iss. 4, str. 1-16, ilustr. ISSN 1070-664X. https://aip.scitation.org/doi/10.1063/1.5030121, DOI: 10.1063/1.5030121. [COBISS.SI-ID 16310555], [JCR, SNIP, Scopus do 30. 11. 2018: št. citatov (TC): 1, čistih citatov (CI): 0]
9. TSKHAKAYA, D. D., KOS, Leon, TSKHAKAYA, D. D. Stability of the Tonks-Langmuir discharge pre-sheath. Physics of plasmas. Mar. 2016, vol. 23, iss. 3, str. 1-10, ilustr. ISSN 1070-664X. http://scitation.aip.org/content/aip/journal/pop/23/3/10.1063/1.4944916, DOI: 10.1063/1.4944916. [COBISS.SI-ID 14587675], [JCR, SNIP, WoS do 13. 1. 2019: št. citatov (TC): 4, čistih citatov (CI): 4, Scopus do 30. 11. 2018: št. citatov (TC): 4, čistih citatov (CI): 4]

TEHNOLOGIJE IN MEHANIZACIJA ZA PRIDOBIVANJE GOZDNE LESNE BIOMASE

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Tehnologije in mehanizacija za pridobivanje gozdne lesne biomase
Course title:	Technologies and mechanization for harvesting of forest biomass
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (od študijskega leta 2023/2024 dalje)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code: 0643580

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	25	0	0	100	5

Nosilec predmeta/Lecturer:	Matevž Mihelič

Izvajalci predavanj:	Matevž Mihelič
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:
Diplomanti enovitih magistrskih študijskih programov in študijskih programov 2. stopnje s področja biomedicinskih, biotehniških in naravoslovno matematičnih usmeritev.	Graduates of uniform master programmes and 2nd cycle programmes of biomedical, biotechnical, mathematical and natural sciences

Vsebina:	Content (Syllabus outline):
Predmet je zasnovan široko z namenom možnosti prilagajanja študentovemu zanimanju. Pri predmetu se boste seznanili s tehnologijami s področja pridobivanja gozdne lesne biomase. Pri predmetu se dotikamo tehnologij z vidika proizvoda (okrogli les, gozdna lesna biomasa, kakovost, vrednost) z vidika	The course is designed broadly with the aim of adapting to the student's interest. In the course, you will learn about technologies in the field of forest harvesting. In the subject, we touch on technologies from the point of view of the product (round wood, forest wood biomass, quality, value) from the point of

mehanizacjie (vrste in tipi strojev, lastnosti) in tehnologij ter tehnoloških verig (uporaba različnih strojev, njihove interakcije, različni pogoji, delovne in sestojne razmere, različni tipi gozdov in prilagojeni načini sečnje- varovalni gozd). Poleg samih tehnologij nas zanima tudi njihov vpliv na okolje. Pod to razumemo izpuste CO2 in primerjave med tehnologijami in verigami, energijske bilance, vplivi na tla, na sestoj, izlivi tekočin, načine sečnje in spravila, ki spodbujajo ponore CO2.	view of mechanization (kinds and types of machines, properties) and technologies and technological chains (use of different machines, their interactions, different conditions, working and standing conditions, different types of forests and adapted felling methods - protection forest). In addition to the technologies themselves, we are also interested in their impact on the environment. By this we mean CO2 emissions and comparisons between technologies, energy balances, impacts on the soil, on the stand, liquid outflows, felling and harvesting methods that promote CO2 sinks.

Temeljna literatura in viri/Readings:

Pregledni in izvirni članki iz področja. Review and original articles from the field.

Cilji in kompetence:	**Objectives and competences:**
Pridobitev znanja o zmožnosti izvedbe analiz tehnologij pridobivanja gozdne lesne biomase. Sposobnost zasnove, izvedbe in razumevanja ter povezovanja različnih tehnologij v tehnološke verige. Obdelava rezultatov, njihova interpretacija in sposobnost samostojnega dela v prihodnje. Študent se nauči kritične analize ugotovljenih lastnosti tehnologij in interakcij med njimi.	Acquisition of knowledge about the ability to conduct analysis of forest harvesting technologies. Ability to conceive, perform and understand different technologies and their connecting into forest harvesting chains. The student learns how to critically analyse and characterize properties of the studied technologies and their interactions.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Študent izvede individualno raziskovalno nalogo in na primeru spozna lastnosti tehnologije, ki ga zanima. Študent spozna kako zasnovati in analizirati pridobljene rezultate – predvideni študijski rezultat je uspešna analiza izbrane tehnologije pridobivanja gozdne lesne biomase. Rezultati analiz študentu omogočijo zasnovo nadaljnjih poskusov.	Knowledge and understanding: The student performs an individual research task and gains »hands on« experiences with forest harvesting technologies'. The student learns how to design and analyse the obtained results - the expected study result is a successful analysis of the selected forest harvesting technology. The results of the analyses enable the student to design further experiments.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Konzultacije in pomoč pri zasnovi, izvedbi in analizi poskusa. V dogovoru z mentorjem kandidata je mogoča izvedba dela raziskav v sklopu kandidatove doktorske naloge študenta v infrastrukturnem centru Oddelka za gozdarstvo in obnovljive gozdne vire.	Consultations and assistance in the design, implementation and analysis of the experiment. In agreement with the candidate's mentor, it is possible to carry out a part of the research work of the student's doctoral dissertation in the infrastructure center of the Department of forestry and renewable resources.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Ocenjuje se izvedba problemsko orientiranega individualnega raziskovalnega dela, ki ga kandidat odda v pisni obliki glede na tri sklope: zasnova eksperimenta, izvedba meritev, analiza in interpretacija pridobljenih rezultatov.	100,00 %	The implementation of problem-oriented individual research work is evaluated, which the candidate submits in writing according to three parts: the design of the experiment, the methods and experiment and the analysis of results and interpretation of results.

Reference nosilca/Lecturer's references:

Matevž Mihelič

1. A long-term follow-up study of slash bundling in fast-growing Eucalypt plantations [Elektronski vir]
Spinelli, Raffaele ; Magagnotti, Natascia ; Assirelli, Alberto ; Martins, João Pedro ; Mihelič, Matevž
Tip dela: 1.01 izvirni znanstveni članek
Leto: 2021
Vir: Forests [Elektronski vir]. - ISSN 1999-4907. - Vol. 12, iss. 11, 16 str.

2. A low-investment option for the integrated semi-mechanized harvesting of small-scale, short-rotation Poplar plantations
Spinelli, Raffaele ; Magagnotti, Natascia ; Lombardini, Carolina ; Mihelič, Matevž
Tip dela: 1.01 izvirni znanstveni članek
Leto: 2021
Vir: Small-scale forestry. - ISSN 1873-7617. - Vol. 20, iss. 1, str. 59-72

3. Influence of chain sharpness, tension adjustment and type of electric chainsaw on energy consumption and cross-cutting time [Elektronski vir]
Poje, Anton ; Mihelič, Matevž
Tip dela: 1.01 izvirni znanstveni članek
Leto: 2020
Vir: Forests [Elektronski vir]. - ISSN 1999-4907. - iss. 9, [article] 1017, 9 str.

4. Comparison of electric and petrol chainsaws in terms of efficiency and safety when used in young spruce stands in small-scale private forests
Poje, Anton ; Potočnik, Igor ; Mihelič, Matevž
Tip dela: 1.01 izvirni znanstveni članek
Leto: 2018
Vir: Small-scale forestry. - ISSN 1873-7617. - Vol. 17, iss. 3, str. 411-422

5. Intensifying the management of protection forests in the Alps
Mihelič, Matevž ; Spinelli, Raffaele ; Poje, Anton
Tip dela: 1.01 izvirni znanstveni članek
Leto: 2018
Vir: Drewno = Wood. - ISSN 1644-3985. - Vol. 61, no. 201, str. 23-37

6. Production of wood chips from logging residue under space-constrained conditions
Mihelič, Matevž ; Spinelli, Raffaele ; Poje, Anton
Tip dela: 1.01 izvirni znanstveni članek
Leto: 2018
Vir: Croatian journal of forest engineering = Nova mehanizacija šumarstva : [journal for theory and application of forestry engineering]; [časopis za teoriju i praksu šumarskoga inženjerstva]. - ISSN 1845-5719. - Vol. 39, no. 2, str. 223-232

7. The effect of feedstock, knife wear and work station on the exposure to noise and vibrations in wood chipping operations [Elektronski vir]
Poje, Anton ; Spinelli, Raffaele ; Magagnotti, Natascia ; Mihelič, Matevž
Tip dela: 1.01 izvirni znanstveni članek
Leto: 2018
Vir: Silva Fennica. - ISSN 2242-4075. - Vol. 52, no. 1, 14 str.

8. Influence of chain filing, tree species and chain type on cross cutting efficiency and health risk [Elektronski vir]
Marenče, Jurij ; Mihelič, Matevž ; Poje, Anton
Tip dela: 1.01 izvirni znanstveni članek
Leto: 2017
Vir: Forests [Elektronski vir]. - ISSN 1999-4907. - Vol. 8, [article]. 464, 10 str.

TEHNOLOGIJE V PROIZVODNJI IN PREDELAVI MESA

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Tehnologije v proizvodnji in predelavi mesa
Course title:	Technologies in meat production and processing
Članica nosilka/UL Member:	

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (od študijskega leta 2023/2024 dalje)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037334
Koda učne enote na članici/UL Member course code:	3837

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	5	85	5

Nosilec predmeta/Lecturer:	Lea Demšar

Izvajalci predavanj:	Lea Demšar, Tomaž Polak
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:**
Diplomanti enovitih magistrskih študijskih programov in študijskih programov 2. stopnje s področja biomedicinskih, biotehniških in naravoslovno matematičnih usmeritev.	Graduates of unified master's study programs and 2nd degree programs in biomedical, biotechnical, and scietific-mathematical orientations.

Vsebina:	**Content (Syllabus outline):**
Predklavne tehnologije- protistresni principi (zbiranje, nakladanje, transport, vhlevljanje živali) Primarna obdelava klavnih živali in perutnine – principi in tehnološke linije za omamljanje, zakol, razsek, kontrolo trupov.	Pre-slaughter technologies –principles of stress prevention (collection, loading, transport, stabling of animals) Primary processing of slaughtered animals and poultry – principles and technological lines for stunning, slaughter, cutting, control of carcasses.

Primarno konzerviranje mesa -principi in tehnologije - hlajenje, zmrzovanje (konvekcijski, kondukcijski, imerzijski, kriogeni postopki) Konzerviranje mesa -procesi in tehnološke linije (toplotni postopki-pasterizacija, sterilizacija; razsoljevanje, prekajevanje, radiacija, biološko konzerviranje, dehidracija, pakiranje- VP, CP MAP). Sodobni termični procesi obdelave mesa (omsko segrevanje, radiofrekvenčno dielektrično segrevanje, IR-segrevanje, UHT postopek, visokotlačno segrevanje). Nova oprema in tehnološke linije za predelavo mesa: razdevanje mesa (volk, kuter, mikrokuter), mehanski separatorji za prodobivanje MOM, mešalniki, polnilniki, zapiralniki, linije za oblikovanje sekljanin, prekajevalne (pirolizni, tekoči, elektrostatični dim) in zorilne komore. Sodobne metode pakiranja mesa in mesnin - modificirana atmosfera (MAP), aktivno pakiranje, inteligentno pakiranje Robotizacija kontrole kakovosti klavnih trupov-instrumentalne metode. Instrumentalna analiza senzoričnih parametrov kakovosti mesa in izdelkov–barva, vonj, okus (aroma), tekstura.	Primary preservation of meat – principles and technologies– cooling, freezing (convection, conduction, immersion, cryogenic methods) Preservation of meat – processes and technological lines (thermal processes – pasteurisation, sterilisation; salting, smoking, irradiation, biological preservation, dehydration, packaging – VP, , MAP). Modern thermal processing of meat (ohmic heating, radio frequency dielectric heating, IR-heating, UHT method, high pressure heating). New equipment and technological lines for meat processing: carcass cutting (cutters, microcutters), mechanical separators for the production of MSM, mixers, fillers, sealers, lines for the production of restructured meat, smoking equipment (pyrolytic wood smoke, liquid smoke, electrostatic smoke) and ripening chambers. Modern methods of packaging meat and meat products – modified atmosphere packing (MAP), active packaging, intelligent packaging. Robotization of quality control of slaughtered carcasses – instrumental methods. Instrumental analysis of sensory parameters of meat and meat product quality – colour, smell, taste (aroma), texture.

Temeljna literatura in viri/Readings:

Jensen, W. K., Devine, C. D., Dikeman, M. 2004. Encyklopedia of Meat Sciences. Elsevier Ac. Press. Amsterdam. Izbrana poglavja cca. 200 str.
Nolet, L. M., Toldra, F. 2006. Advanced Technologies for Meat Processing. CRC Taylor & Francis, Boca Raton. Cca. 120 str.
Hui Y. H. et al., 2012. Handbook of Meat and Meat Processing. CRC Press, Taylor & Francis group, New York. Part IV, V, VI (p. 447-700), Cca. 250 str.
Feiner F. 2016. Salami. Elsevier Science & Technology, 230 str.

Cilji in kompetence:	**Objectives and competences:**
Izobraževalni cilji: Cilj je seznaniti študenta s kompleksnostjo specifičnih tehnoloških procesov in strojne opreme v tehnologijah pridobivanja, konzerviranja in distribucije mesa različnih živalskih vrst, ter s procesi in sodobno tehnološko opremo za proizvodnjo, kontrolo kakovosti in distribucijo mesnih izdelkov. Kompetence: Študijski rezultat je pridobiti dobro osnovo za evidentiranje raziskovalnih problemov v okviru obravnavanih tehnoloških procesov vezanih na specifično strojno opremo in za načrtovanje ter izvedbo raziskovalnega dela na tem področju.	Pedagogical Objective: The objective is to familiarise students with the complexity of specific technological processes and machinery in the technologies of production, preservation and distribution of meat of different animal species, as well as with procedures and modern technological equipment for the production, quality control and distribution of meat products. Competencies: The intended learning outcome is to obtain a good basis for recording research problems in the framework of technological processes related to specific hardware and for planning and conducting research in this area.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Spoznati vso pestrost in kompleksnost strojne opreme in tehnoloških linij, ter poznavanje osnovnih fizikalno-kemijskih procesov, ki potekajo v	Knowledge and understanding: Knowledge of the variety and complexity of hardware and technological lines, as well as knowledge of the basic physical and chemical processes involved in the

tehnologijah proizvodnje, predelave in distribucije mesa in izdelkov.	technologies of production, processing, and distribution of meat and products.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, samostojen študij in izdelava projektne naloge.	Lectures, independent study and preparation of project assignments.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Seminar Študent na izbrani temi pripravi seminarsko nalogo, ki je predpogoj za opravljanje izpita.	50,00 %	The seminar: Students prepare a seminar paper on the chosen topic, which is a prerequisite for the exam.
ustni izpit	50,00 %	oral examination

Reference nosilca/Lecturer's references:

Lea Demšar

1. POLAK, Tomaž, LUŠNIC POLAK, Mateja, ZAHIJA, Iva, JAPELJ, Katja, KUHAR, Mojca, GOLOB, Eva, **DEMŠAR, Lea**. Oxidative stability of chicken meat at different oxygen concentrations in the packaging unit. Meso. May/Jun. 2022, vol. 24, no. 3, str. 249-260, ilustr. ISSN 1332-0025. https://hrcak.srce.hr/279284. [COBISS.SI-ID 111769859]
2. POLAK, Tomaž, **DEMŠAR, Lea,** RUKAVINA, Andrea, LUŠNIC POLAK, Mateja. Fatty acid profile of Slovenian farmed rainbow trout. Meso. 2021, vol. 23, no. 3, str. 202-209, ilustr. ISSN 1332-0025. https://hrcak.srce.hr/258747. [COBISS.SI-ID 67681539]
3. POLAK, Tomaž, LUŠNIC POLAK, Mateja, ZAHIJA, Iva, BABIČ, Katja, **DEMŠAR, Lea**. Comparison of the physico-chemical parameters and sensory properties of selected pasteurized meat products on Slovenian market. Meso. 2020, vol. 22, no. 3, str. 196-208, ilustr. ISSN 1332-0025. https://hrcak.srce.hr/238414. [COBISS.SI-ID 18358275]
4. ZAHIJA, Iva, POLAK, Tomaž, LUŠNIC POLAK, Mateja, KUHAR, Mojca, **DEMŠAR, Lea**. Quality parameters and oxidative stability of lamb during ageing. Meso. 2020, vol. 22, no. 5, str. 357-367, ilustr. ISSN 1332-0025. https://hrcak.srce.hr/245053. [COBISS.SI-ID 33729027]
5. POLAK, Tomaž, LUŠNIC POLAK, Mateja, ZAHIJA, Iva, LAZAR, Nežka, **DEMŠAR, Lea**. Quality parameters of different oils and fried foods after repeated deep-fat frying. Meso. 2020, vol. 22, no. 6, str. 460-474, ilustr. ISSN 1332-002 https://hrcak.srce.hr/247371. [COBISS.SI-ID 42518019]
6. **DEMŠAR, Lea**, LESAR, David, LUŠNIC POLAK, Mateja, POLAK, Tomaž. Sensory diversity of a traditional Slovenian dry-cured sausages (Suha klobasa). Meso. 2019, vol. 21, no. 6, str. 562-574, ilustr. ISSN 1332-0025. https://hrcak.srce.hr/230120. [COBISS.SI-ID 5139064]

Tomaž Polak

1. LUŠNIC POLAK, Mateja, DEMŠAR, Lea, ZAHIJA, Iva, **POLAK, Tomaž**. Influence of temperature on the formation of heterocyclic aromatic amines in pork steaks. Czech Journal of Food Sciences. 2020, vol. 38, no. 4, str. 248-254, ilustr. ISSN 1212-1800. DOI: 10.17221/144/2019-CJFS. [COBISS.SI-ID 32631299]
2. CAJZEK, Florijan, BERTONCELJ, Jasna, KREFT, Ivan, POKLAR ULRIH, Nataša, **POLAK, Tomaž**, POŽRL, Tomaž, PRAVST, Igor, POLIŠENSKÁ, Ivana, VACULOVÁ, Kateřina, CIGIĆ, Blaž. Preparation of [beta]-glucan and antioxidant-rich fractions by stone-milling of hull-less barley. International journal of food science & technology. [Online ed.]. 2020, vol. 55, iss. 2, str. 681-689, ilustr. ISSN 1365-2621. DOI: 10.1111/ijfs.1432 [COBISS.SI-ID 5083512]
3. JAVORNIK, Jernej, HOPKINS, John B., III, ZAVADLAV, Saša, LEVANIČ, Tom, LOJEN, Sonja, **POLAK, Tomaž**, JERINA, Klemen. Effects of ethanol storage and lipids on stable isotope values in a large mammalian omnivore. Journal of mammalogy. 2019, vol. 100, iss. 1, str. 150-157, ilustr. ISSN 0022-2372. https://doi.org/10.1093/jmammal/gyy187, DOI: 10.1093/jmammal/gyy187. [COBISS.SI-ID 5301926]
4. AVBERŠEK-LUŽNIK, Ivica, LUŠNIC POLAK, Mateja, DEMŠAR, Lea, GAŠPERLIN, Lenka, **POLAK, Tomaž.** Does type of bread ingested for breakfast contribute to lowering of glycaemic index?. Journal of nutrition & intermediary metabolism. 2019, vol. 16, str. [1-6], 100097, ilustr. ISSN 2352-3859. DOI: 10.1016/j.jnim.2019.100097. [COBISS.SI-ID 5049720]

5. DEMŠAR, Lea, LESAR, David, LUŠNIC POLAK, Mateja, **POLAK, Tomaž**. Sensory diversity of a traditional Slovenian dry-cured sausages (Suha klobasa). Meso : prvi hrvatski časopis o mesu. 2019, vol. 21, no. 6, str. 562-574, ilustr. ISSN 1332-002 https://hrcak.srce.hr/230120. [COBISS.SI-ID 5139064]
6. DUČIĆ, Miroslav, **POLAK, Tomaž**, LUŠNIC POLAK, Mateja, DEMŠAR, Lea, VRANIĆ, Danijela, BALTIĆ, Milan Ž. Effects of sodium nitrite and heat treatment on cholesterol oxidation products and sensorial characteristics of dry fermented sausages. Meat technology. 2017, vol. 58, no. 2, str. 110-117. ISSN 2466-4812. 33. MARTINOVIĆ, Neda, POLAK, Tomaž, MAKUC, Damjan, POKLAR ULRIH, Nataša, ABRAMOVIČ, Helena. A kinetic approach in the evaluation of radical-scavenging efficiency of sinapic acid and its derivates. Molecules. 2017, vol. 22, iss. 3, f. 1-17, 375, ilustr. ISSN 1420-3049. http://www.mdpi.com/1420-3049/22/3/375, DOI: 10.3390/molecules22030375. [COBISS.SI-ID 4761720]

TOKSINI IN BIOMEMBRANE

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Toksini in biomembrane
Course title:	Toxins and biomembranes
Članica nosilka/UL Member:	

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

Univerzitetna koda predmeta/University course code:	0037363
Koda učne enote na članici/UL Member course code:	3866

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	0	40	190	10

Nosilec predmeta/Lecturer:	Tom Turk

Izvajalci predavanj:	Gregor Anderluh, Igor Križaj, Kristina Sepčić, Tom Turk
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 2. stopenjski bolonjski študij iz širšega področja Naravoslovje, matematika in računalništvo 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):**
Predmet bo obravnaval delovanje izbranih toksinov na biokemijske in regulatorne procese v celicah. Poudarek bo na razvozlavanju mehanizma delovanja teh toksinov zlasti glede vezave, vrinjanja v membrane ter na odkrivanju specifičnih membranskih domen in strukturnih motivov	The subject will cover the activity of selected toxins in biochemical and regulatory processes in cells. Emphasis will be on unravelling mechanisms of these toxins, especially in relation to binding and insertion into the membranes, and on discovering specific membrane domains and structural motifs of toxins

toksinov, ki so odgovorni za poškodbo celic. Drug poudarek pa bo na preučevanju vpliva nekaterih toksinov na celične signalne poti in posledično na delovanje prizadetih celic (eksocitoza, apoptoza itd.). Na izbranih primerih bo prikazana tudi uporabnost membransko aktivnih proteinov ali njihovih derivatov v biomedicini, biotehnologiji in farmakologiji. Predmet bo ponudil vsebine, ki obravnavajo: (i) delovanje izbranih citolitičnih toksinov na membrane (aktinoporini iz morskih vetrnic, ostreolizin in podobni proteini iz gliv, bakterijski CDC citolizini, perforinu podobni proteini z MACPF domenami, alkilpiridinijevi polimeri iz spužev in njihovi sintetični analogi), njihove mehanizme delovanja in posledice za celico; (ii) toksične fosfolipaze iz kačjih strupov, njihov mehanizem delovanja, načini internalizacije, vezava na celične proteine ter vpliv na signalne poti v celici in eksocitozo.	responsible for cell damage. Another stress will be on studying the impact of certain toxins on cell signalling pathways and, consequently, on the functioning of affected cells (exocytosis, apoptosis etc.). The use of membrane-active toxins in biomedicine, biotechnology and pharmacology will be demonstrated on chosen examples. The subject will provide contents covering: (i) mechanisms of action of selected citolytic toxins on membranes i.e. (actinoporins from sea anemones, fungal proteins ostreolysins, bacterial CDC cytolysins, perforin and other MACPF proteins, alkylpyridiium polymers from marine sponges and their synthetic analogues), their mode of action and their impact on cell; (ii) toxic phospholipases from snake venoms, their mode of action, methods of internalisation, binding to cell proteins and influence on cell signalling pathways and exocitosis.

Temeljna literatura in viri/Readings:

Pregledni članki in novejši znanstveni članki s področja/Review papers and recent scientific papers

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

Predvideni študijski rezultati:	**Intended learning outcomes:**
Zgoraj opisan pristop se mora odraziti v pravilnem načrtovanju raziskav in poskusov, ki vodijo k preiskusu hipotez zastavljenih v temi doktorske disertacije.	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 naštetih nosilcev (vsak pet ur), priprava in vodenje Journal clubov; priprava problemskih nalog, diskusije in konzultacije glede njihovega reševanja. Pregled in poprava rešitev problemskih nalog.	Frontal ex-cathedra teaching (5 hr per lecturer); preparation and supervision of Journal clubs; preparation of problem tasks, discussion and consultation. Asesement and correction of problem solutions.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Oddaja rešene problemske naloge	50,00 %	Presentation of problem solution
sodelovanje na journal club-ih	50,00 %	participation at journal clubs

Reference nosilca/Lecturer's references:

Tom Turk

1. MIKELJ, Miha, PRAPER, Tilen, DEMIČ, Rok, HODNIK, Vesna, TURK, Tom, ANDERLUH, Gregor. Electroformation of giant unilamellar vesicles from erythrocyte membranes under low-salt conditions. Analytical biochemistry, ISSN 0003-2697, Apr. 2013, vol. 435, iss. 2, str. 174-180. http://www.sciencedirect.com/science/article/pii/S0003269713000031, doi: 10.1016/j.ab.2013.01.001. [COBISS.SI-ID 36978693]
2. ZOVKO, Ana, VIKTORSSON, Kristina, LEWENSOHN, Rolf, KOLOŠA, Katja, FILIPIČ, Metka, XING, Hong, KEM, William R., PALEARI, Laura, TURK, Tom. APS8, a polymeric alkylpyridinium salt blocks [alpha]7 nAChR and induces apoptosis in non-small cell lung carcinoma. Marine drugs, ISSN 1660-3397, 2013, vol. 11, no. 7, str. 2574-2594. http://www.mdpi.com/1660-3397/11/7/2574, doi: 10.3390/md11072574. [COBISS.SI-ID 2854223]
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Igor Križaj

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3. OTA, Katja, LEONARDI, Adrijana, MIKELJ, Miha, SKOČAJ, Matej, WOHLSCHLAGER, Therese, KÜNZLER, Markus, AEBI, Markus, NARAT, Mojca, KRIŽAJ, Igor, ANDERLUH, Gregor, SEPČIĆ, Kristina, MAČEK, Peter. Membrane cholesterol and sphingomyelin, and ostreolysin A are obligatory for pore-formation by a MACPF/CDC-like pore-forming protein, pleurotolysin B. Biochimie, ISSN 0300-9084, 2013, vol. 95, iss. 10, str. 1855-1864, doi: 10.1016/j.biochi.2013.06.012. [COBISS.SI-ID 26868007]
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Kristina Sepčić

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6. RESNIK, Nataša, SEPČIĆ, Kristina, PLEMENITAŠ, Ana, WINDOFFER, Reinhard, LEUBE, Rudolf, VERANIČ, Peter. Desmosome assembly and cell-cell adhesion are membrane raft-dependent processes. The Journal of biological chemistry, ISSN 0021-9258, 2011, vol. 286, issue 2, str. 1499-1507, ilustr., doi: 10.1074/jbc.M110.189464. [COBISS.SI-ID 27616729]

Gregor Anderluh

1. ROJKO, Nejc, KRISTAN, Katarina, VIERO, Gabriella, ŽEROVNIK, Eva, MAČEK, Peter, DALLA SERRA, Mauro, ANDERLUH, Gregor. Membrane damage by an [alpha]-helical pore forming protein Equinatoxin II proceeds through succesion of ordered steps. The Journal of biological chemistry, ISSN 0021-9258, 2013, vol. 288, issue 33, 23704-23715, ilustr., doi: 10.1074/jbc.M113.481572. [COBISS.SI-ID 2836815]
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3. BAVDEK, Andrej, KOSTANJŠEK, Rok, ANTONINI, Valeria, LAKEY, Jeremy H., DALLA SERRA, Mauro, GILBERT, Robert J., ANDERLUH, Gregor. pH dependence of listeriolysin O aggregation and pore-forming ability. FEBS journal, ISSN 1742-464X, 2012, vol. 279, iss. 1, str. 126-141. http://onlinelibrary.wiley.com/doi/10.1111/j.1742-4658.2011.08405.x/pdf, doi: 10.1111/j.1742-4658.2011.08405.x. [COBISS.SI-ID 4881690]
4. PRAPER, Tilen, SONNEN, Andreas F.- P., VIERO, Gabriella, KLADNIK, Aleš, FROELICH, Christopher J., ANDERLUH, Gregor, DALLA SERRA, Mauro, GILBERT, Robert J., et al. Human perforin employs different avenues to damage membranes. The Journal of biological chemistry, ISSN 0021-9258, 2011, vol. 286, issue 4, str. 2946-2955. http://www.jbc.org/cgi/doi/10.1074/jbc.M110.169417, doi: 10.1074/jbc.M110.169417. [COBISS.SI-ID 2282319]
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TRAJNOSTNO OBLIKOVANJE DELOVNIH PROCESOV

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Trajnostno oblikovanje delovnih procesov
Course title:	Sustainable design of work processes
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (od študijskega leta 2023/2024 dalje)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code: 0643581

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

Nosilec predmeta/Lecturer: Anton Poje

Izvajalci predavanj:	Anton Poje
Izvajalci seminarjev:	Anton Poje
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:
Diplomanti enovitih magistrskih študijskih programov in študijskih programov 2. stopnje s področja biomedicinskih, biotehniških in naravoslovno matematičnih usmeritev.	Graduates of unified master's study programs and 2nd-level study programs in the fields of biomedical, biotechnical and natural science and mathematics.

Vsebina:	Content (Syllabus outline):
Spoznavanje konceptov trajnostnega oblikovanja delovnih procesov, katerega glavni namen je multikriterialno optimiziranje vplivov dela na ekonomiko, okolje in delavca. Spoznavanje vplivov delovnih procesov na ekonomiko, okolje in delavca. Spoznavanje osnov organizacije dela.	Getting to know the concepts of sustainable design of work processes, the main purpose of which is the multi-criteria optimization of the impact of work on the economy, the environment and the worker. Learning about the effects of work processes on the economy, the environment and the worker. Getting to know the basics of work organization.

Temeljna literatura in viri/Readings:

Znanstveni in pregledni članki s področja organizacije dela, varstva okolja, ekonomike in ergonomije Scientific and overview articles in the field of work organization, environmental protection, economics and ergonomics.

Cilji in kompetence:	**Objectives and competences:**
Pridobiti znanja, ki so potrebna za razumevanje trajnostnega oblikovanja dela, ki delo obravnava z več vidikov (EEE - ekonomika, ekologija, ergonomija) ter uporaba znanja za kritično presojo delovnih procesov. Sposobnost priprave zasnove poskusa, izvedbe meritev ter obdelavo in evalvacijo rezultatov v povezavi z dosedanjimi raziskavami. Spoznavanje vsebine povezane z dispozicijo doktorske naloge	To acquire the knowledge necessary to understand the sustainable design of work, which deals with work from several aspects (EEE - economics, ecology, ergonomics) and the use of knowledge for critical assessment of work processes. The ability to prepare an experiment design, perform measurements, and process and evaluate results in connection with previous research. Getting to know the content related to the disposition of the doctoral thesis.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje medsebojnega vpliva različnih vidikov dela na ekonomiko, okolje in delavca. Uspešna izvedba poskusa, ki mu omogoča nadaljnjo samostojno delo.	Knowledge and understanding of the mutual influence of various aspects of work on the economy, the environment and the worker. Successful execution of the experiment, which enables him to continue working independently.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Priprava seminarske naloge na osnovi pregleda literature za izbrano tematiko in podatkov posnetih na terenu. Laboratorijske vaje vsebujejo prikaz delovanja merilnih instrumentov, spoznavanje metod dela ter način obdelave podatkov. Terenski pouk je namenjen spoznavanju postopkov meritev. Individualni študij s konzultacijami.	Preparation of a seminar paper based on a review of the literature for the selected topic and data recorded in the field. Laboratory exercises include demonstration of the operation of measuring instruments, learning about work methods and data processing. The field lesson is aimed at getting to know measurement procedures. Individual study with consultations.

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

Reference nosilca/Lecturer's references:

Anton Poje

POJE, Anton, MIHELIČ, Matevž. Influence of chain sharpness, tension adjustment and type of electric chainsaw on energy consumption and cross-cutting time. Forests. [Online ed.]. 2020, iss. 9, [article] 1017, 9 str. ISSN 1999-4907. https://doi.org/10.3390/f11091017, https://www.mdpi.com/1999-4907/11/9/1017, https://repozitorij.uni-lj.si/IzpisGradiva.php?id=120633, DOI: 10.3390/f11091017. [COBISS.SI-ID 29310467]

POJE, Anton, GRIGOLATO, Stefano, POTOČNIK, Igor. Operator exposure to noise and whole-body vibration in a fully mechanised CTL forest harvesting system in Karst terrain. Croatian journal of forest engineering : [journal for theory and application of forestry engineering]. 2019, vol. 40, iss. 1, str. 139-150, ilustr. ISSN 1845-5719. http://www.crojfe.com/site/assets/files/4295/poje.pdf. [COBISS.SI-ID 5381542]

MIHELIČ, Matevž, SPINELLI, Raffaele, POJE, Anton. Production of wood chips from logging residue under space-constrained conditions. Croatian journal of forest engineering : [journal for theory and application of forestry engineering]. 2018, vol. 39, no. 2, str. 223-232, ilustr. ISSN 1845-5719. https://hrcak.srce.hr/index.php?show=toc&id_broj=16386&lang=hr. [COBISS.SI-ID 5152678]

MIHELIČ, Matevž, SPINELLI, Raffaele, POJE, Anton. Intensifying the management of protection forests in the Alps. Drewno. 2018, vol. 61, no. 201, str. 23-37, graf. prikazi, tabele. ISSN 1644-3985. http://drewno-wood.pl/archiwum/nr-201-2018, DOI: 10.12841/wood.1644-3985.D03.07. [COBISS.SI-ID 5120166]
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POJE, Anton, POTOČNIK, Igor, MIHELIČ, Matevž. Comparison of electric and petrol chainsaws in terms of efficiency and safety when used in young spruce stands in small-scale private forests. Small-scale forestry. Sep. 2018, vol. 17, iss. 3, str. 411-422, tabele, graf. prikazi. ISSN 1873-7617. https://link.springer.com/article/10.1007%2Fs11842-018-9395-4, DOI: 10.1007/s11842-018-9395-4. [COBISS.SI-ID 5071270]

UPRAVLJANJE GOZDNIH EKOSISTEMOV

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Upravljanje gozdnih ekosistemov
Course title:	Forest ecosystem management
Članica nosilka/UL Member:	

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (od študijskega leta 2023/2024 dalje)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037342
Koda učne enote na članici/UL Member course code:	3845

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
20	70	0	0	0	160	10

Nosilec predmeta/Lecturer:	Andrej Bončina

Izvajalci predavanj:	Andrej Bončina, Andrej Ficko, Klemen Jerina, Matjaž Mikoš
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):
Koncepti in metode upravljanja gozdnih ekosistemov. Večnamensko in trajnostno upravljanje. Kontrolna in druge metode upravljanja. Upravljanje s tveganji. Participacija. Upravljanje gozdnega prostora. Funkcije. Ekosistemske storitve. Rabe gozda. Prednostna območja. Zaraščanje in krčitve. Struktura in razvoj gozdnih sestojev.	Concepts and methods of forest management. Multi-objective and sustainable forest management. Adaptive forest management. Risk management. Participation. Forest land-use management. Forest functions. Ecosystem services. Priority areas. Multiple forest land use. Changes of forest cover. Structure and development of forest stands.

Viri podatkov. Sestojna dinamika. Rast. Modeliranje, spremembe na krajinski in regionalni ravni. Vplivni dejavniki. Upravljanje gozdnih sestojev. Načrtovanje, spremljava, analiza gospodarjenja. Večnamensko gospodarjenje. Metode optimizacije in negotovost. Primeri. Upravljanje voda v gozdnem prostoru. Celostno upravljanje z vodami v gozdnatih povirjih in hudourniških območjih ter gozdna hidrologija. Upravljanje populacij živalskih vrst. Načrtovanje. Spremljanje. Orodja. Prepoznavanje deležnikov in njihovih potreb. Vključevanje deležnikov. Optimizacija učinkov od populacij divjadi. Večnamensko upravljanje. Posebnosti upravljanja zavarovanih vrst. Ohranjanje narave/biodiverzitete v gozdnem prostoru. Gozdovi in okolje. Primeri upravljanja. Zasebni gozdovi. Varovalni gozdovi. Natura 2000. Urbani gozdovi. Prebiralni gozdovi. Sanacije itn. Upravljavska orodja. Viri podatkov. Metode za podporo odločanju. Strukturno modeliranje. Metode pridobivanja podatkov. Monitoringi. Informacijski sistemi. Primeri.	Data sources. Stand dynamics. Growth. Modelling. Changes at landscape and regional level. Influential factors. Forest management. Planning, monitoring, evaluation. Multi-objective forest management. Optimization methods and uncertainty. Cases. Water management in forests. Integrated water management in forested watersheds and forest hydrology. Wildlife management. Planning. Monitoring. Tools. Identification of stakeholders and their interests. Involvement of stake-holders. Optimization of the effects of wildlife. Multi objective management. Specifics of management of protected species. Nature/biodiversity conservation. Forests and environment. Management cases. Private forests. Protection forests. Natura 2000 sites. Urban forests. Uneven-aged forests etc. Management tools. Data sources. Methods of collecting data. Decision support methods. Structural equation modelling. Monitoring. Information systems. Cases.

Temeljna literatura in viri/Readings:

Amatya, D.M., Williams, T.M., Bren, L., de Jong, C., 2016. Forest Hydrology – Processes, Management and Assessment, CABI, 280 str.

Betting, P., Boston, K., Siry, J.P., Grebner, D.L., 2009. Forest Management and Planning. Academic Press, Elsevier, San Diego, 331str.

Chang, M., 2013. Forest Hydrology – An Introduction to Water and Forests, 3rd Ed., CRC Press, Taylor and Francis Group, 569 str.

Franklin, J.F., Johnson, K.N., Johnson, D.L., 2018. Ecological Forest Management. Waveland Press, Long Grove, Illinois.

Kangas, A., Kangas, J., Kurttila, M., 2008. Decision Support for Forest Management. Springer, 217 str.

Krausman, P.R., James, W.C (eds.). 2003. Wildlife Management and Conservation: Contemporary Principles and Practices. Johns Hopkins University Press, 360 str.

Krebs, C.J. 1999. Ecological Methodology, 2nd ed. Addison-Wesley Educational Publishers, Inc,. 620 str.

Levia, D.F., Carlyle-Moses, D.E., Iida, S., Michalzik, B., Nanko, K., Tischer, A., 2020. Forest-Water Interactions, Springer International Publishing, 628 str., https://link.springer.com/book/10.1007/978-3-030-26086-6

Meng, F-R., Li, Q., Arain, A., Pisaric, M., (eds.) 2019. Forest Hydrology and Watershed. MDPI, Basel, 192 str.

Putman, Rory, Marco Apollonio, and Reidar Andersen, (eds.). 2011. Ungulate management in Europe: problems and practices. Cambridge University Press, 2011. 396 str.

Williams, B.K., Szaro, R.C., Shapiro, C.D., 2007. Adaptive management: the U.S. Department of the Interior. Technical guide. Adaptive working group, U.S. Department of the Interior, Washington, DC.

Tekoča znanstvena periodika / Current scientific periodicals

Cilji in kompetence:	**Objectives and competences:**
Temeljni cilji: osvojiti zasnovo celovitega upravljanja gozdnih ekosistemov, poglobiti znanja o upravljanju posameznih gozdnih virov in spoznati aktualne raziskovalne vsebine s področja upravljanja gozdnih ekosistemov.	The main objective: to gain an insight into the concept of integral forest management (FM), to deepen knowledge on management of forest resources, to gain an insight into relevant research topics in the field of ecosystem forest management.

Predvideni študijski rezultati:	Intended learning outcomes:
Znanje in razumevanje: Kandidat spozna koncepte upravljanja gozdnih ekosistemov. Seznani se z gozdnimi viri (gozdni sestoji, populacije živalskih in rastlinskih vrst, voda) in posebnostmi njihovega upravljanja. Spozna trende, probleme in perspektive pri upravljanju gozdnih ekosistemov. Spozna problematiko ohranjanja narave pri upravljanju gozdnih ekosistemov. Seznani se z nekaterimi metodami in orodji za podporo upravljanju.	Knowledge and understanding: A student gets acquainted with the concept of ecosystem forest management, masters the model of adaptive forest management, is introduced to selected forest resources and their management. A student is introduced to problems and perspectives in ecosystem forest management. A student is acquainted with problems concerning nature conservation, and environmental management, and is introduced to some of the management tools.

Metode poučevanja in učenja:	Learning and teaching methods:
Predavanja (izbrane vsebine), konzultacije, vodeni seminar, terensko delo, vključitev v raziskovalni projekt. Vsebine se delno prilagodijo raziskovalnemu interesu kandidata/kandidatke.	Lectures (selected chapters), guided seminars, lab work, fieldwork, participation in research projects. The content of the subject is adapted to the profile of PhD students.

Načini ocenjevanja:	Delež/Weight	Assessment:
Ocena izpita je tehtano povprečje: 1) ocene seminarja in ocene raziskovalne uspešnosti	50,00 %	The final grade is an average of: 1) average grade of seminars
2) zaključnega pisnega izpita.	50,00 %	2) final written examination

Reference nosilca/Lecturer's references:

Andrej Bončina

BONČINA, Andrej, KLOPČIČ, Matija, TRIFKOVIĆ, Vasilije, FICKO, Andrej, SIMONČIČ, Primož. Tree and stand growth differ among soil classes in semi-natural forests in Central Europe. *Catena : an interdisciplinary journal of soil science, hydrology- geomorphology focusing on geology and landscape evolution.* [Print ed.]. 2023, vol. 222, art. 106854, 13 str. ISSN 0341-8162.

TRIFKOVIĆ, Vasilije, BONČINA, Andrej, FICKO, Andrej. Recruitment of European beech, Norway spruce and silver fir in uneven-aged forests : optimal and critical stand, site and climatic conditions. *Forest Ecology and Management.* [Online ed.]. 2023, vol. 529, art. 120679, 13 str. ISSN 1872-7042.

TRIFKOVIĆ, Vasilije, BONČINA, Andrej, FICKO, Andrej. Analyzing asymmetries in the response of European beech to precipitation anomalies in various stand and site conditions using decadal diameter censuses. *Agricultural and forest meteorology*. [Print ed.]. 2022, vol. 327, art. 109195, 15 str., ilustr. ISSN 0168-1923.

PACH, Maciej, BIELAK, Kamil, BONČINA, Andrej, COLL, Lluis, HÖHN, Maria, KAŠANIN-GRUBIN, Milica, LESIŃSKI, Jerzy, PRETZSCH, Hans, SKRZYSZEWSKI, Jerzy, SPATHELF, Peter, TONON, Giustino, WEATHERALL, Andrew, ZLATANOV, Tzvetan. Climate-smart silviculture in mountain regions. V: TOGNETTI, Roberto, SMITH, Melanie, PANZACCHI, Pietro. Climate-smart forestry in mountain regions. Cham: Springer, cop. 2022. Str. 263-315. Managing forest ecosystems (Online), vol. 40, Managing forest ecosystems (Print), vol. 40.

KLOPČIČ, Matija, ROZMAN, Andrej, BONČINA, Andrej. Evidence of a climate-change-induced shift in European beech distribution : an unequal response in the elevation, temperature and precipitation gradients. *Forests.* [Online ed.]. vol. 13, art. 1311, 16 str. ISSN 1999-4907.

PRETZSCH, Hans, HILMERS, Torben, UHL, Enno, BIELAK, Kamil, BOŠELA, Michal, DEL RIO, Miren, DOBOR, Laura, FORRESTER, David I., NAGEL, Thomas Andrew, PACH, Maciej, AVDAGIĆ, Admir, BELLAN, Michal, BINDER, Franz, BONČINA, Andrej, BRAVO, Felipe, DE-DIOS-GARCÍA, Javier, DINCA, Lucian, DROZDOWSKI, Stanislaw, GIAMMARCHI, Francesco, HOEHN, Maria, IBRAHIMSPAHIĆ, Aida, JAWORSKI, Andrzej, KLOPČIČ, Matija, KURYLYAK, Viktor, LÉVESQUE, Mathieu, LOMBARDI, Fabio, MATOVIĆ, Bratislav, ORDÓÑEZ, Cristóbal, PETRÁŠ, Rudolf, RUBIO-CUADRADO, Alvaro, STOJANOVIĆ, Dejan, SKRZYSZEWSKI, Jerzy, STAJIĆ, Branko, SVOBODA, Miroslav, VERSACE, Soraya, ZLATANOV, Tzvetan, TOGNETTI, Roberto. European beech stem diameter

grows better in mixed than in mono-specific stands at the edge of its distribution in mountain forests. *European journal of forest research (Internet)*. 2021, vol. 140, iss. 1, str. 127-145.
BONČINA, Andrej, SIMONČIČ, Tina, ROSSET, Christian. Assessment of the concept of forest functions in Central European forestry. *Environmental science & policy*. 2019, vol. 99, str. 123-135, ilustr. ISSN 1462-9011.]
FICKO, Andrej, ROESSIGER, Joerg, BONČINA, Andrej. Optimizing silviculture in mixed uneven-aged forests to increase the recruitment of browse-sensitive tree species without intervening in ungulate population. *IForest*. 2018, vol. 11, str. 227-236.
O'HARA, K. L., BONČINA, Andrej, DIACI, Jurij, ANIĆ, Igor, BOYDAK, M., CUROVIC, M., GOVEDAR, Zoran, GRIGORIADIS, N., IVOJEVIĆ, Sead, KEREN, Srdjan, et al. Culture and silviculture : origins and evolution of silviculture in Southeast Europe. *The international forestry review*. Mar. 2018, vol. 20, num. 1, str. 130-143.
KLOPČIČ, Matija, POLJANEC, Aleš, DOLINAR, Mojca, KASTELEC, Damijana, BONČINA, Andrej. Ice-storm damage to trees in mixed Central European forests : damage patterns, predictors and susceptibility of tree species. *Forestry*. Jan. 2020, vol. 93, iss. 3, str. 430-443.
HILMERS, Torben, AVDAGIĆ, Admir, BARTKOWICZ, Leszek, BIELAK, Kamil, BINDER, Franz, BONČINA, Andrej, DOBOR, Laura, FORRESTER, David I., HOBI, Martina, IBRAHIMSPAHIĆ, Aida, KLOPČIČ, Matija, NAGEL, Thomas Andrew, et al. The productivity of mixed mountain forests comprised of Fagus sylvatica, Picea abies, and Abies alba across Europe. *Forestry*. 2019, vol. 92, iss. 5, str. 512-522.
SIMONČIČ, Tina, BONČINA, Andrej, JARNI, Kristjan, KLOPČIČ, Matija. Assessment of the long-term impact of deer on understory vegetation in mixed temperate forests. *Journal of vegetation science : official organ of the International Association for Vegetation Science (IAVS)*. [Print ed.]. 2019, vol. 30, iss. 1, str. 108-120.

Klemen Jerina

BOMBIERI, Giulia, PENTERIANI, Vincenzo, DEL MAR DELGADO, M., GROFF, Claudio, PEDROTTI, L., JERINA, Klemen. Towards understanding bold behaviour of large carnivores: the case of brown bears in human-modified landscapes. Animal conservation. 2021, vol. 24, iss. 5, str. 783-797.
BAUTISTA, Carlos, REVILLA, Eloy, NAVES, Javier, ALBRECHT, Jörg, FERNANDEZ, Nestor, OLSZANSKA, Agneszka, ADAMEC, Michal, BEREZOWSKA-CNOTA, Teresa, CIUCCI, Paolo, GROFF, Claudio, JERINA, Klemen, JONOZOVIČ, Marko, et al. Large carnivore damage in Europe : analysis of compensation and prevention programs. Biological Conservation. [Print ed.]. July 2019, vol. 235, str. 308-316.
FLEŽAR, Urša, COSTA, Beatriz, BORDJAN, Dejan, JERINA, Klemen, KROFEL, Miha. Free food for everyone : artificial feeding of brown bears provides food for many non-target species. European journal of wildlife research. 2019, vol. 65, iss. 1, 13 str.
SEBASTIÁN-GONZÁLEZ, Esther, MAGALHÃES BARBOSA, Jomar, PÉREZ-GARCÍA, Juan M., MORALES-REYES, Zebensui, BOTELLA, Francisco, OLEA, Pedro P., MATEO-TOMÁS, Patricia, MOLEÓN, Marcos, HIRALDO, Fernando, ARRONDO, Eneko, JERINA, Klemen, KROFEL, Miha, et al. Scavenging in the Anthropocene : human impact drives vertebrate scavenger species richness at a global scale. Global change biology. Print ed. 2019, vol. 25, iss. 9, str. 3005-3017
PENTERIANI, Vincenzo, HUBER, Đuro, JERINA, Klemen, KROFEL, Miha, LÓPEZ-BAO, José Vicente, ORDIZ, Andrés, ZARZO-ARIAS, Alejandra, DALERUM, Fredrik. Trans-boundary and trans-regional management of a large carnivore : managing brown bears across national and regional borders in Europe. V: HOVARDAS, Tasos (ur.). Large carnivore conservation and management : human dimensions. 1 ed. Abingdon (Oxon); New York (NY): Routledge, 2018. Str. 291-313.
RELJIĆ, Slaven, JERINA, Klemen, NILSEN, Erlend B., HUBER, Đuro, KUSAK, Josip, JONOZOVIČ, Marko, LINNELL, John. Challenges for transboundary management of a European brown bear population. Global ecology and conservation. 2018, vol. 16, e00488, 13 str.

Matjaž Mikoš

ŽABOTA, Barbara, MIKOŠ, Matjaž, KOBAL, Milan. Rockfall modelling in forested areas - the role of digital terrain model grid cell size. *Applied sciences*. febr. 2021, vol. 11, iss. 4, 1461, str. 1-20, ilustr. ISSN 2076-3417. https://www.mdpi.com/2076-3417/11/4/1461, DOI: 10.3390/app11041461. [COBISS.SI-ID 50777091]
BEZAK, Nejc, MIKOŠ, Matjaž. Changes in the rainfall event characteristics above the empirical global rainfall thresholds for landslide initiation at the pan-European level. *Landslides: Journal of the international consortium on landslides*. [Print ed.]. 2021, letn. 18, št. maj, str. 1859-1873, ilustr. ISSN 1612-510X. https://link.springer.com/article/10.1007%2Fs10346-020-01579-0. DOI: 10.1007/s10346-020-01579-0. [COBISS.SI-ID 46956547]
BEZAK, Nejc, JEMEC AUFLIČ, Mateja, MIKOŠ, Matjaž. Reanalysis of soil moisture used for rainfall thresholds for rainfall-induced landslides: the Italian case study. *Water*. 2021, letn. 13, št. 14, 1977, str. 1-16, ilustr. ISSN 2073-4441. https://www.mdpi.com/2073-4441/13/14/1977, DOI: 10.3390/w13141977. [COBISS.SI-ID 70755075]

BEZAK, Nejc, JEŽ, Jernej, SODNIK, Jošt, JEMEC AUFLIČ, Mateja, MIKOŠ, Matjaž. An extreme may 2018 debris flood case study in northern Slovenia: analysis, modelling, and mitigation. *Landslides: Journal of the international consortium on landslides*. [Print ed.]. okt. 2020, letn. 17, št. 10, str. 2373-2383, ilustr. ISSN 1612-510X. https://link.springer.com/content/pdf/10.1007%2Fs10346-019-01325-1.pdf, DOI: 10.1007/s10346-019-01325-1. [COBISS.SI-ID 9010529]

BEZAK, Nejc, JEMEC AUFLIČ, Mateja, MIKOŠ, Matjaž. Application of hydrological modelling for temporal prediction of rainfall-induced shallow landslides. *Landslides: Journal of the international consortium on landslides*. [Print ed.]. jul. 2019, letn. 16, št. 7, str. 1273-1283, ilustr. ISSN 1612-510X. https://link.springer.com/article/10.1007/s10346-019-01169-9, DOI: 10.1007/s10346-019-01169-9. [COBISS.SI-ID 8770401]

BEZAK, Nejc, GRIGILLO, Dejan, URBANČIČ, Tilen, MIKOŠ, Matjaž, PETROVIČ, Dušan, RUSJAN, Simon. Geomorphic response detection and quantification in a steep forested torrent. *Geomorphology: an international journal of pure and applied geomorphology*. [Print ed.]. avg. 2017, letn. 291, str. 33-44, ilustr. ISSN 0169-555X. DOI: 10.1016/j.geomorph.2016.06.034. [COBISS.SI-ID 7507041]

BEZAK, Nejc, ŠRAJ, Mojca, MIKOŠ, Matjaž. Copula-based IDF curves and empirical rainfall thresholds for flash floods and rainfall-induced landslides. *Journal of Hydrology*. [Print ed.]. 2016, letn. 541, št. okt., str. 272-284, ilustr. ISSN 0022-1694. DOI: 10.1016/j.jhydrol.2016.02.058. [COBISS.SI-ID 7402849]

Ficko Andrej

Trifković, V., Bončina, A., Ficko, A., 2023. Recruitment of European beech, Norway spruce and silver fir in uneven-aged forests: optimal and critical stand, site and climatic conditions. Forest Ecology and Management 529, 120679.

Trifković, V., Bončina, A., Ficko, A., 2022. Analyzing asymmetries in the response of European beech to precipitation anomalies in various stand and site conditions using decadal diameter censuses. Agricultural and Forest Meteorology 327, 109195.

Chreptun, C., Ficko, A., Gosling, E., Knoke, T., 2022. Optimizing forest landscape composition for multiple ecosystem services based on uncertain stakeholder preferences. Science of The Total Environment 857, 159393.

Ficko, A., Bončina, A., 2019. Public attitudes toward environmental protection in the most developed countries: The Environmental Concern Kuznets Curve theory. Journal of Environmental Management 231, 968-981.

Ficko, A., Lidestav, G., Ní Dhubháin, Á., Karppinen, H., Zivojinovic, I., Westin, K., 2019. European private forest owner typologies: A review of methods and use. Forest Policy and Economics 99, 21-31.

Ficko, A., Roessiger, J., Bončina, A., 2016. Can the use of continuous cover forestry alone maintain silver fir (*Abies alba* Mill.) in central European mountain forests? Forestry 89, 412–421.

UVOD V ZNANOST O PODATKIH

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Uvod v znanost o podatkih
Course title:	Introduction to data science
Članica nosilka/UL Member:	

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (od študijskega leta 2023/2024 dalje)	Ni členitve (študijski program)		Celoletni	obvezni

Univerzitetna koda predmeta/University course code:	0041833
Koda učne enote na članici/UL Member course code:	3948

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	20	0	0	95	5

Nosilec predmeta/Lecturer:	Blaž Zupan

Izvajalci predavanj:	Janez Demšar, Blaž Zupan
Izvajalci seminarjev:	
Izvajalci vaj:	
Izvajalci kliničnih vaj:	
Izvajalci drugih oblik:	
Izvajalci praktičnega usposabljanja:	

Vrsta predmeta/Course type:	teoretični/theoretical course

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

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

Vsebina:	Content (Syllabus outline):
1. Uvod v vizualno programiranje in razvoj shem za podatkovno analitiko. Branje podatkov, vizualizacija, izbor. Razsevni diagrami, izbor projekcije podatkov. 2. Klasifikacija. Klasifikacijska drevesa. Ocenjevanje napovedne točnosti (klasifikacijska točnost, AUC). Pregled ostalih metod, vključno z	1. Introduction to visual programming and data mining workflows. Data input, visualization, data selection and interactive data exploration. Scatterplot visualization, choice of projection. 2. Classification. Classification trees. Confusion matrix. Scoring of classification models. Classification accuracy and AUC. Data sampling, training and test sets. Cross-validation. A glimpse

logistično regresijo, SVM in naključnimi gozdovi. Statistična primerjava klasifikacijskih metod. 3. Regresija. Metoda linearne in polinomske regresije. Vpliv regularizacije na uspešnost napovedi na učni in testni množici. Določanje parametrov učnih algoritmov. 4. Razvrščanje v skupine. Tehnika hierarhičnega razvrščanja v skupine, metoda voditeljev in metoda DBSCAN. Računske in prostorske kompleksnosti posameznih metod. 5. Projekcije podatkov. Metoda glavnih komponent, večrazredno lestvičenje in metoda TSNE. Analiza nestrukturiranih podatkovnih virov, kot so slike in zaporedja. Vložitev objektov v vektorskih prostor. Globoki modeli.	into logistic regression, random forests, and SVM. Statistical comparison of classifiers. 3. Regression. Linear and polynomial regression. Regularization. Effects of regularization on accuracy in training and test sets. Parameter search. Other regression techniques (random forests). 4. Clustering. Hierarchical clustering. Explorative data analysis with clustering and data projections. k-means clustering. DBSCAN clustering. Time and space complexity. Cluster scoring and selection of number of clusters. 5. Data projections. Principal component analysis. Multi-dimensional scaling. TSNE. Analysis of unstructured data, like images and sequences. Data embedding. Deep models.

Temeljna literatura in viri/Readings:

Video tečaji za programski paket Orange na YouTube-u (http://bit.ly/21E8Vt8).
Delovna skripta Zupan B, Demšar J: Introduction to Data Science.

Cilji in kompetence:	**Objectives and competences:**
Cilj predmeta je spoznati osnovne tehnike strojnega učenja in odkrivanja znanj iz podatkov ternjihovo uporabo v biomedicini. Tehnike bodo predstavljene intuitivno preko praktičnega dela z orodjem za podatkovno rudarjenje; tečaj ne bo vključeval predstavitve matematičnih oziroma formalnih podlag za algoritme. Po uspešnem zaključku predmeta bodo študenti znali urediti in z osnovnimi tehnikami podatkovnega rudarjenja analizati svoje podatke. Tehnike bodo spoznali v obsegu, ki jim bo olajšal komunikacijo s statistiki in eksperti s področja znanosti o podatkih.	The course will familiarize graduate students with basic techniques in machine learning and data mining and will illustrate their utility on a range of case studies from biomedicine. Teaching will present data mining techiques on the intuitive level, and will not venture into mathematical foundations. After completing the course, students should be able to gain insight into their own data, access and use key public bioinformatics databases, and creatively collaborate with statisticians and expert bioinformaticians on advanced data analysis projects.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Poznavanje osnovnih tehnik s področja znanosti o podatkih in analize biomedicinskih podatkov. Konstrukcija shem za podatkovno analitiko. Razumevanje ustreznosti posameznih postopkov v podatkovnem rudarjenju za izbran problem oziroma podatkovni nabor. **Uporaba:** Predmet bo potekal praktično, v obliki delavnice; študenti bodo med spoznavanjem metod reševali probleme iz analitike podatkov iz biomedicine. Pridobljena znanja bodo po zaključku predmeta lahko uporabili pri svojem raziskovalnem delu. **Refleksija:** Spoznavanje osnov algoritmičnega razmišljanja. **Prenosljive spretnosti:** Poznavanje in učinkovita uporaba vizualnega programiranje in konstrukcije shem za podatkovno analitiko.	**Knowledge and understanding:** Understanding of basic data science methods and their utility on analysis of biomedical data sets. Design of data mining workflows. Understanding of which type of data mining is appropriate for specific data analysis problem. **Application:** The course will be carried out as a hands-on tutorial; students will apply data mining procedures on real data sets. They will gain knowledge on application of data analytics methods in their own research. **Reflection:** Understanding of basics of analytical thinking. **Transferable skills:** Understanding and use of visual programming and data analysis workflows.

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

Predavanja bodo izvedena v obliki praktičnih delavnic. Študenti bodo na predavanjih spoznavali tehnike podatkovnega rudarjenja preko praktične uporabe orodja Orange (http://orange.biolab.si), ki za razvoj shem podatkovne analitike uporablja vizualno programiranje.	This is a hands-on workshop style course. The students will learn about data mining procedures through designing data analysis workflows in a visual programming environment Orange (http://orange.biolab.si).

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Sprotno preverjanje (domače naloge, kolokviji in projektno delo). Ocene: 6-10 pozitivno, 1-5 negativno (v skladu s Statutom UL)	100,00 %	Continuing work (homeworks) Grading: 6-10 pass, 1-5 fail.

Reference nosilca/Lecturer's references:

Blaž Zupan

1. POLIČAR, Pavlin Gregor, STRAŽAR, Martin, ZUPAN, Blaž. Embedding to reference t-SNE space addresses batch effects in single-cell classification. Machine learning. [Print ed.]. Feb. 2023, vol. 112, iss. 2, str. 721-740 [COBISS.SI-ID 76932867]
2. GODEC, Primož, PANČUR, Matjaž, ILENIČ, Nejc, ČOPAR, Andrej, STRAŽAR, Martin, ERJAVEC, Aleš, PRETNAR ŽAGAR, Ajda, DEMŠAR, Janez, STARIČ, Anže, TOPLAK, Marko, ŽAGAR, Lan, HARTMAN, Jan, HAMILTON, Wang, BELLAZZI, Riccardo, PETROVIČ, Uroš, GARAGNA, Silvia, ZUCCOTTI, Maurizio, PARK, Dongsu, SHAULSKY, Gad, ZUPAN, Blaž. Democratized image analytics by visual programming through integration of deep models and small-scale machine learning. Nature communications. 2019, vol. 10, str. 4551-1-4551-7. ISSN 2041-1723. DOI: 10.1038/s41467-019-12397-x. [COBISS.SI-ID 32755751]
3. KATOH-KURASAWA, Mariko, HROVATIN, Karin, HIROSE, Shigenori, WEBB, Amanda Nicole, HO, Hsing-I, ZUPAN, Blaž, SHAULSKY, Gad. Transcriptional milestones in Dictyostelium development. Genome research. Aug. 2021, vol. 31, no. 8, str. 1498-1511 [COBISS.SI-ID 100098819]
4. HOČEVAR, Tomaž, ZUPAN, Blaž, STÅLRING, Jonna. Conformal prediction with Orange. Journal of statistical software. May 2021, vol. 98, no. 7, str. 1-22 [COBISS.SI-ID 66423811]
5. DEMŠAR, Janez, ZUPAN, Blaž. Hands-on training about overfitting. PLoS computational biology. [Print ed.]. Mar. 2021, vol. 17, no. 3, str. 1-19, ilustr. ISSN 1553-734X. https://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1008671, DOI: 10.1371/journal.pcbi.1008671. [COBISS.SI-ID 54159875]
6. STRAŽAR, Martin, ŽAGAR, Lan, KOKOŠAR, Jaka, TANKO, Vesna, ERJAVEC, Aleš, POLIČAR, Pavlin Gregor, STARIČ, Anže, DEMŠAR, Janez, SHAULSKY, Gad, MENON, Vilas, LEMIRE, Andrew, PARIKH, Anup, ZUPAN, Blaž. ScOrange-a tool for hands-on training of concepts from single-cell data analytics. Bioinformatics. [Print ed.]. Jul. 2019, vol. 35, no. 14, str. 4-12, ilustr. ISSN 1367-4803. https://academic.oup.com/bioinformatics/article/35/14/i4/5529249?searchresult=1, DOI: 10.1093/bioinformatics/btz348. [COBISS.SI-ID 1538307523]

Janez Demšar

1. DEMŠAR, Janez, ZUPAN, Blaž. Hands-on training about overfitting. PLoS computational biology. [Print ed.]. 2021, vol. 17, no. 3, str. 1-19 [COBISS.SI-ID 54159875]
2. MAVER VODIČAR, Polona, OŠTRBENK VALENČAK, Anja, ZUPAN, Blaž, AVŠIČ-ŽUPANC, Tatjana, KURDIJA, Slavko, KORVA, Miša, PETROVEC, Miroslav, DEMŠAR, Janez, KNAP, Nataša, ŠTRUMBELJ, Erik, VEHOVAR, Vasja, POLJAK, Mario. Low prevalence of active COVID-19 in Slovenia : a nationwide population study on a probability-based sample. Clinical microbiology and infection : the official publication of the European society of clinical microbiology and infectious dieseases. 2020, vol. 26, iss. 11, str. 1514-1519 [COBISS.SI-ID 23262211]
3. COLNERIČ, Niko, DEMŠAR, Janez. Emotion recognition on Twitter : comparative study and training a unison model. IEEE transactions on affective computing. Jul.-Sep. 2020, vol. 11, no. 3, str. 433-446 [COBISS.SI-ID 1537725635]
4. STRAŽAR, Martin, ŽAGAR, Lan, KOKOŠAR, Jaka, TANKO, Vesna, ERJAVEC, Aleš, POLIČAR, Pavlin Gregor, STARIČ, Anže, DEMŠAR, Janez, SHAULSKY, Gad, MENON, Vilas, LEMIRE, Andrew,

PARIKH, Anup, ZUPAN, Blaž. ScOrange-a tool for hands-on training of concepts from single-cell data analytics. Bioinformatics. [Print ed.]. Jul. 2019, vol. 35, no. 14, str. 4-12, ilustr. ISSN 1367-4803. https://academic.oup.com/bioinformatics/article/35/14/i4/5529249?searchresult=1, DOI: 10.1093/bioinformatics/btz348. [COBISS.SI-ID 1538307523]

5. MOŽINA, Martin, DEMŠAR, Janez, BRATKO, Ivan, ŽABKAR, Jure. Extreme value correction : a method for correcting optimistic estimations in rule learning. Machine learning. [Print ed.]. Feb. 2019, vol. 108, no. 2, str. 297-329 [COBISS.SI-ID 1537841603]

6. GODEC, Primož, PANČUR, Matjaž, ILENIČ, Nejc, ČOPAR, Andrej, STRAŽAR, Martin, ERJAVEC, Aleš, PRETNAR ŽAGAR, Ajda, DEMŠAR, Janez, STARIČ, Anže, TOPLAK, Marko, ŽAGAR, Lan, HARTMAN, Jan, HAMILTON, Wang, BELLAZZI, Riccardo, PETROVIČ, Uroš, GARAGNA, Silvia, ZUCCOTTI, Maurizio, PARK, Dongsu, SHAULSKY, Gad, ZUPAN, Blaž. Democratized image analytics by visual programming through integration of deep models and small-scale machine learning. Nature communications. 2019, vol. 10, str. 4551-1-4551-7. ISSN 2041-1723. DOI: 10.1038/s41467-019-12397-x. [COBISS.SI-ID 32755751]

VAROVANJE LOKALNIH ELEMENTOV NARAVNE DEDIŠČINE V ŠIRŠEM EVROPSKEM KONTEKSTU

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Varovanje lokalnih elementov naravne dediščine v širšem evropskem kontekstu
Course title:	Conservation of local elements of natural heritage within wider European context
Članica nosilka/UL Member:	

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (od študijskega leta 2023/2024 dalje)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037346
Koda učne enote na članici/UL Member course code:	3849

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	25	90	5

Nosilec predmeta/Lecturer:	Ivan Kos

Izvajalci predavanj:	Ivan Kos
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):
Naravoslovna in družboslovna izhodišča elementov naravne dediščine. Vplivi lokalnih razmer. Različnost uspešnih ravnanj starih kultur Etični, zakonodajni in drugi vidiki pomembni za varstvo	Natural history and sociological conception of natural heritage elements. Influences of local specifics. Variety of successful management cases of old cultures Ethical, legislative, emotional and other aspects important for nature conservation

Lokalne, nacionalne in meddržavne regulative ravnanj z okoljem in varstvo naravne dediščine Pomen empiričnega znanja pri zagotavljanju lokalno optimiziranega upravljanja v večdržavnih skupnostih Primeri negativnih vplivov na varstvo naravne dediščine kot posledica homogenizacije zakonodaje Vključevanje lokalnih deležnikov v varovanje naravne dediščine	Local, national and international legislation regarding environment and natural heritage conservation Role of science based knowledge in establishing local optimized management in trans-boundary integrations Cases of negative influences on natural heritage conservation due to homogenization of European legislation Involvement of local stakeholders into conservation of natural heritage

Temeljna literatura in viri/Readings:

Naeem, S., Bunker, D. E., Hector, A., Loreau, M. & Perrings, C. (Eds) (2009). Biodiversity, Ecosystem Functioning, and Human Wellbeing : An Ecological and Economic Perspective. Oxford University Press, Oxford, ISBN-13: 978 0199547951

Menzies, C. R., (Eds.) (2006). Traditional Ecological Knowledge and Natural Resorce Management. University of Nebraska Press., ISBN-13: 978 0803283190

revijalni članki s področja, tekoča periodika, domača in tuja zakonodaja, dogovori

Cilji in kompetence:	**Objectives and competences:**
Pridobiti razumevanje o osnovah varstva elementov naravne dediščine kot sinteze naravoslovnih in družbenih zakonitosti Pridobiti kompetence vrednotenja učinkovitosti lokalnega, evropskega in globalnega ravnanja z konkretnimi elementi naravne dediščine Pridobiti kompetentnost za sodelovanje pri nastajanju domače in mednarodne zakonodaje in dogovorov Razvoj izkušenj pri sintezi različnega obstoječega znanja in ravnanj	To establish basic understanding on importance of synthesis of natural and social sciences as base of natural heritage conservation Acquire competences for evaluation of efficiency of local, European and global management with particular elements of natural heritage Acquire competences for participation in development of national and international legislation and agreements To make a progress in synthesis of different knowledge and management practices.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Razumeti izhodišča lokalnih posebnosti naravne dediščine Razumevanje pomena lokalnega ravnanja- nesnovne kulturne dediščine pri varstvu elementov naravne dediščine Razumevanje pridobivanja lokalnega empiričnega znanja za razvoj ustreznega ravnanja v prostoru Poznavanje postopkov umeščanja spoznanj v nacionalne in evropske zakonodajne okvire	Knowledge and understanding: Understanding of background of local specifics of natural heritage Understanding of local specific treatment- intangible cultural heritage on conservation of elements of natural heritage Understanding of importance of local empiric based knowledge for development of local-specific management goals Knowledge of principles of positioning of local specifics into national and European legislation and rules.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Aktivni razgovor, sinteza obstoječih informacij in kritična evalvacija obstoječih praks.	Lecture (selected contents), consultation, comparison and critical evaluation of actual legislation and implementation into practices

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

Ocena seminarskega dela	75,00 %	Seminar grade
Predstavitev seminarskega dela	25,00 %	Presentation of a seminar work

Reference nosilca/Lecturer's references:

Ivan Kos

DEVETAK, Dušan, MIHELAK, Katarina & KOS, Ivan. Gregarines (Apicomplexa: Eugregarinida) of Chilopoda and Diplopoda in Slovenia. *Acta zoologica bulgarica*. 2019, vol. 71, no. 1, str. 121-128, ilustr. ISSN 0324-0770. [COBISS.SI-ID 5037903]

KURALT, Žan, RATAJC, Urška, PAJEK ARAMBAŠIĆ, Neža, FERLE, Maja, GABOR, Matic & KOS, Ivan. Inventory and DNA-barcode library of ground-dwelling predatory arthropods from Krokar virgin forest, Slovenia. *Biodiversity Data Journal*. 2022, vol. 8, str. 1-19, ilustr. ISSN 1314-2828. https://bdj.pensoft.net/article/77661/, DOI: 10.3897/BDJ.10.e77661. [COBISS.SI-ID 101968131]

KOS, Anja & KOS, Ivan. Clinopodes vesubiensis : new species of centipede (Chilopoda: Geophilomorpha: Geophilidae) from Slovenia. *Acta Societatis zoologicae Bohemicae*. 2018, vol. 82, str. 79-87, ilustr. ISSN 1211-376X. http://www.zoospol.cz/ixadmin/app/webroot/uploads/ASZB-2018_1-2/aszb_2018_1-2-79-88.pdf. [COBISS.SI-ID 16713987]

STRONEN, Astrid Vik, KONEC, Marjeta, BOLJTE, Barbara, BOŠKOVIĆ, Ivica, GAČIĆ, Dragan P., GALOV, Ana, HELTAI, Miklós, JELENČIČ, Maja, KLJUN, Franc, KOS, Ivan, KOVAČIČ, Tamara, LANSZKI, József, PINTUR, Krunoslav, POKORNY, Boštjan, SKRBINŠEK, Tomaž, SUCHENTRUNK, Franz, SZABÓ, László, ŠPREM, Nikica, TOMLJANOVIĆ, Kristijan, POTOČNIK, Hubert. Population genetic structure in a rapidly expanding mesocarnivore : golden jackals in the Dinaric-Pannonian region. *Global ecology and conservation*. 2021, vol. 28, str. 1-11. ISSN 2351-9894. https://www.sciencedirect.com/science/article/pii/S2351989421002572?via%3Dihub, DOI: 10.1016/j.gecco.2021.e01707. [COBISS.SI-ID 68526339]

RAŽEN, Nina, KURALT, Žan, FLEŽAR, Urša, BARTOL, Matej, ČERNE, Rok, KOS, Ivan, KROFEL, Miha, LUŠTRIK, Roman, MAJIĆ SKRBINŠEK, Aleksandra, POTOČNIK, Hubert. Citizen science contribution to national wolf population monitoring : what have we learned?. *European journal of wildlife research*. 2020, iss. 3, article 45, 9 str. ISSN 1612-4642. https://doi.org/10.1007/s10344-020-01383-0, https://repozitorij.uni-lj.si/IzpisGradiva.php?id=116758, DOI: 10.1007/s10344-020-01383-0. [COBISS.SI-ID 18488835]

VARSTVO GOZDOV

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Varstvo gozdov
Course title:	Forest protection
Članica nosilka/UL Member:	

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (od študijskega leta 2023/2024 dalje)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037343
Koda učne enote na članici/UL Member course code:	3846

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	10	80	5

Nosilec predmeta/Lecturer:	Maja Jurc

Izvajalci predavanj:	Maja Jurc
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:**
1. Pogoji za vključitev v delo: - vpis v ustrezni letnik študijskega programa 2. Pogoji za opravljanje študijskih obveznosti: - opravljen seminar (pogoj)	1. Condition for inclusion in the work: - Inscription to adequate academic year 2. Condition for performing study obligations - Seminar

Vsebina:	**Content (Syllabus outline):**
- Slušatelj pridobi in poveže znanja o škodljivih dejavnikih abiotskega (ujme, požari, suše, onesnaženi zrak ...) in biotskega (škodljivci, bolezni, parazitske cvetnice ...) izvora v gozdu s poškodbami, ki jih le-ti povzročajo ter ga uporabi v spoznavanju možnosti za	- Student will acquire and integrate knowledge about damaging abiotic factors in forests (weather damage, sleet, snow, fire, draught, pollution etc.) and biotic factors (pests, diseases, parasites) and injuries caused by these factors. Students will be capable of using

preprečevanje in nadzorovanje škode. Za razumevanje kompleksnih vzrokov poškodb drevja v gozdu spozna: - škodljive fitofage: populacijsko dinamiko najpomembnejših herbivorov (predvsem žuželk) in sicer ključne dejavnike za njihov pojav v gozdu, dejavnike, ki regulirajo dinamiko njihovih populacij, mehanizme kontrole, epidemiologijo pomembnih gozdnih škodljivcev, njihove naravne sovražnike ter patogene. - bolezni: vpliv kompleksnih bolezni na propadanje gospodarsko najpomenbnejših gostiteljev (hrasti, bori, navadna smreka, navadna jelka in bukev). - vpliv klimatskih razmer na odnos patogen / herbivor / drevo. - invazivne tujrodne organizme: strategije in metode varstva pred škodljivimi invazivnimi vrstami v gozdovih Slovenije. - sledi področje načel in strategij integralnega varstva gozda, metod (tehnične, biotične, biotehniške) ter integriranih ukrepov varstva gozda. -pri biotičnih metodah je poudarek na novih znanjih o prehranjevalnih verigah in nekaterih živalskih skupinah (členonožci) in glivah v varstvu gozda. Simbioze in koevolucija. Razdelitve simbioz (komenzalizem, mutualizem, parazitizem); forezije in inkvilinizem. Paraziti živalskega izvora: ogorčice (Nematoda) in parazitoidi (Hymenoptera, Diptera). Pojem parazitizma v gozdarstvu (poškodbe in sušenje sestojev, razvoj biotičnih metod zatiranja škodljivih organizmov). Borova ogorčica (*Bursaphelenchus xylophilus*): mutualistična simbioza bora in hroščev. Forezije (glive, pršice) in pomen za lesne rastline na primeru ofiostomatoidnih gliv (Ascomycota: Ophiostomataceae). Razvoj raziskav gostitelj-parazit in učinkovitih strategij za biotične kontrole parazitov.	their knowledge for supervising and controlling damage in forests. For understanding the complex causes of forest tree injuries, student will be introduced to: - Harmful phytophagous species; population dynamics of the most important herbivores, especially insects, key factors for their appearance in forest, factors regulating the dynamics of their populations, mechanisms of control, epidemiology of important forest pests, their natural enemies and their pathogens. - Diseases: influence of complex diseases to decline of economically important host (oak, pine, Norway spruce, silver fir, beech). - Influence of climatic conditions to the pathogen / herbivore / tree relationship. - Invasive alien organisms: strategies and methods of protection against harmful invasive species in the forests of Slovenia. - The next topic concerns principles and strategies of integral forest protection), methods (technical, biotical, biotechnical) and integrated forest protection measurements. -Considering biotical methods the emphasis is on new knowledge with regard to the importance of food chains and on some of the animal groups (arthropods) and fungi in forest protection. Symbiosis and coevolution. Classification of symbiosis (commensalism, mutualism, parasitism); phoresis and inquilinism. Animal parasitism: nematodes and parasitoids (Hymenoptera, Diptera). Importance of parasitism in the forest (injuries and death of stands, the development of biological methods for pest control). Pine wood nematode (*Bursaphelenchus xylophilus*): beetle-pine mutualistic symbiosis. Phoresis (fungi, mites) and their importance to the woody plants in the case of ophiostomatoid fungi (Ascomycota: Ophiostomataceae). Development of host-parasite relationship research and effective strategies for parasite control.

Temeljna literatura in viri/Readings:

AGRIOS, G. N., 1995. Plant Pathology.- Third Edition, Academic Press INC, 803 str., (izbrana poglavja).

LIEUTIER, F., DAY, R. K., BATTISTI, A., GRÉGOIRE, J-C. EVANS, F. H., 2004. Bark and Wood Boring Insects in Living Trees in Europe, a Synthesis.- Kluwer Academic Publishers, 569 str., (izbrana poglavja).

Paracer, S., Ahmadjian, V., 2000. Symbiosis, An Introduction to Biological Associations. Second edition. Oxfprd University Press, Inc., 291 str., (izbrana poglavja).

SPEIGHT, R. M., WAINHOUSE, D., 1989. Ecology and Management of Forest Insects. Oxford University Press, 374 str., (izbrana poglavja.)

SMITH, I. M., McNAMARA, D. G., SCOTT, P. R., HOLDERNESS, M., BURGER, B., 1997. Quarantine Pests for Europe. Data sheets on quarantine pests for the Europe Union and for the European and Mediteranean Plant Protection Organization.- Second Edition. CAB International & European and Mediterranean Plant Protection Organization (EPPO), 1425 str., (izbrana poglavja).

KRAIGHER, H., JURC, M., PIŠKUR, B., KAVČIČ, A., De Groot, M., OGRIS, N., 2021. *Najpomembnejši povzročitelji poškodb tujerodnih vrst gozdnega drevja in sadik domačih vrst gozdnega drevja ter ukrepi na sadikah*. Ljubljana: Gozdarski inštitut Slovenije, Založba Silva Slovenica, 2021. 280 str., ilustr. Studia Forestalia Slovenica, 179. ISBN 978-961-6993-70-8. ISSN 0353-6025. http://dirros.openscience.si/IzpisGradiva.php?id=14199, https://doi.org/10.20315/SFS.179, DOI: 10.20315/SFS.179. [COBISS.SI-ID 67247619]

Cilji in kompetence:	Objectives and competences:
Razumevanje odnosov gostiteljska rastlina-parazit in razvoj učinkovitih strategij za kontrolo parazitov. Razumevanje pomena sobivanja številnih organizmov v gozdnih ekosistemih, pomen interakcij med njimi v okrnjenih ekosistemih - možnosti namnožitve, vrstna pestrost živalskih parazitov in patogenov in njihovi odnosi v antropogenih ekosistemih.	Understanding of host plant-parasite relationship and development effective strategies for parasite control. Understanding of the importance of coexistence of a number of organisms in forest ecosystems, the importance of interaction between them in the truncated ecosystems - potentials of over-multiplication, species diversity of animal parasites and harmful pathogens and their relationships in anthropogenic ecosystems.

Predvideni študijski rezultati:	Intended learning outcomes:
Znanje in razumevanje: Specifični škodljivi organizmi za drevesne vrste (predvsem živalski paraziti, njihove asociacijske glive in pršice, tujerodne unvazivne vrste), vpliv okolja na spremembe občutljivosti posameznih avtohtonih gostiteljev. S sintezo tujih in lastnih spoznanj postanejo sposobni identificirati probleme in iskati rešitve (sodelovanje pri izdelavi sanacijskih načrtov). Pridobijo sposobnosti komuniciranja in argumentirane razlage absolviranih znanj v praksi.	Knowledge and understanding: Specific harmful organisms for tree species (particularly animal parasites, their associatied fungi and mites, non-native invasive species), the impact of the environment to change the sensitivity of specific indigenous hosts. With their own and other syntheses of knowledge, students will be capable of problem identification and finding solutions (taking part in the development of sanitation plans), with acquired skills of communication, and argument interpretation of knowledge to practice.

Metode poučevanja in učenja:	Learning and teaching methods:
Metode poučevanja in učenja: predavanja v kombinaciji s splošnimi razgovori / posvetovanji, seminar, vključitev v raziskovalno delo (laboratorijske vaje, delo na terenu).	Methods of teaching and learning: lectures in combination with general consultations, seminar, inclusion in research work (laboratory work, field work).

Načini ocenjevanja:	Delež/Weight	Assessment:
Pisni ali ustni izpit z ocenjevanjem posameznih vprašanj (1-5 točk). Študent lahko doseže 20 točk – pod 10 točkami je ocenjen negativno, nad 10 točkami je ocenjen pozitivno. Končna ocena je tehtana sredina: 1. izpita	80,00 %	Written or oral examination with scoring of individual questions (1-5 points). One can reach 20 points, under 10 points - the assessment is negative (1-5), over 10 points a positive assessment. Final evaluation of the course is weighted arithmetic mean of : 1. the assessment exam
2. seminarske naloge	20,00 %	2. the assessment of seminar work

Reference nosilca/Lecturer's references:

Prof. dr. Maja Jurc

JURC, M., PAVLIN, R., HAUPTMAN, T., BORKOVIČ, D. *Bursaphelenchus xylophilus* (Steiner & Buhrer) Nickle*, Monochamus* spp. : borova ogorčica in njeni vektorji (žagovinarji). V: OGRIS, Nikica (ur.). *Najpomembnejši povzročitelji poškodb tujerodnih vrst gozdnega drevja in sadik domačih vrst gozdnega drevja ter ukrepi na sadikah*. Ljubljana: Gozdarski inštitut Slovenije, Založba Silva Slovenica, 2021. Str. 71-73, ilustr. Studia Forestalia Slovenica, 179. ISBN 978-961-6993-70-8. ISSN 0353-6025. http://dirros.openscience.si/IzpisGradiva.php?id=14199, https://doi.org/10.20315/SFS.179. [COBISS.SI-ID 84946179]

CSÓKA, G., HIRKA, A., MUTUN, S., GLAVENDEKIĆ, M., MIKÓ, Á., SZŐCS, L., PAULIN, M., CSABA BÉLA, E., CSABA, G., CSEPELÉNYI, M., JURC, M., JURC, D., et al. Spread and potential host range of the invasive oak lace bug [*Corythucha arcuata* (Say, 1832) - Heteroptera: Tingidae] in Eurasia. *Agricultural and Forest Entomology*. 2020, vol. 22, iss. 1, str. 61-74. ISSN 1461-9563. https://doi.org/10.1111/afe.12362, DOI: 10.1111/afe.12362. [COBISS.SI-ID 5559206], [JCR, SNIP, WoS do 26. 10. 2022: št. citatov (TC): 16, čistih

citatov (CI): 14, čistih citatov na avtorja (CIAu): 1,00, Scopus do 10. 8. 2022: št. citatov (TC): 14, čistih citatov (CI): 14, čistih citatov na avtorja (CIAu): 1,00]

OGRIS, N., FERLAN, M., HAUPTMAN, T., PAVLIN, R., KAVČIČ, A., JURC, M., DE GROOT, M. Sensitivity analysis, calibration and validation of a phenology model for *Pityogenes chalcographus* (CHAPY). *Ecological modelling*. [Print ed.]. 2020, vol. 430, article 109137, 13 str. ISSN 0304-3800. https://doi.org/10.1016/j.ecolmodel.2020.109137, https://www.sciencedirect.com/science/article/pii/S0304380020302088?via%3Dihub, http://dirros.openscience.si/IzpisGradiva.php?id=12017, DOI: 10.1016/j.ecolmodel.2020.109137. [COBISS.SI-ID 17752323], [JCR, SNIP, WoS, Scopus]

OGRIS, N., FERLAN, M., HAUPTMAN, T., PAVLIN, R., KAVČIČ, A., JURC, M., DE GROOT, M. RITY - a phenology model of *Ips typographus* as a tool for optimization of its monitoring. *Ecological modelling*. [Print ed.]. vol. 410, article 108775, 12 str., ilustr. ISSN 0304-3800. https://doi.org/10.1016/j.ecolmodel.2019.108775, DOI: 10.1016/j.ecolmodel.2019.108775. [COBISS.SI-ID 5450150], [JCR, SNIP, WoS do 26. 10. 2022: št. citatov (TC): 8, čistih citatov (CI): 4, čistih citatov na avtorja (CIAu): 0,57, Scopus do 16. 10. 2022: št. citatov (TC): 9, čistih citatov (CI): 5, čistih citatov na avtorja (CIAu): 0,71]

HAUPTMAN, T., PIŠKUR, B., FACCOLI, M., REKANJE, B., MARINČ, A., JURC, M. The first record of two non-native ambrosia beetles in Slovenia: *Ambrosiodmus rubricollis* (Eichhoff, 1875) and *Ambrosiophilus atratus* (Eichhoff, 1875) (Coleoptera: Curculionidae, Scolytinae). *Zootaxa*. 2019, vol. 4657, no. 2, str. 397-400, ilustr. ISSN 1175-5326. https://doi.org/10.11646/zootaxa.4657.2.13, DOI: 10.11646/zootaxa.4657.2.13. [COBISS.SI-ID 5452966], [JCR, SNIP, WoS do 26. 10. 2022: št. citatov (TC): 3, čistih citatov (CI): 2, čistih citatov na avtorja (CIAu): 0,33, Scopus do 30. 11. 2022: št. citatov (TC): 2, čistih citatov (CI): 2, čistih citatov na avtorja (CIAu): 0,33]

NÈVE REPE, A., DE GROOT, M., JURC, M. Assemblages of ophiostomatoid fungi vectored by *Ips amitinus* (Coleoptera: Scolytinae) on Norway spruce depend on colonization time, position on the host tree and development stage. *Šumarski list*. 2018, vol. 142, no. 3/4, str. 171-178, graf. prikazi. ISSN 0373-1332. https://hrcak.srce.hr/index.php?show=clanak&id_clanak_jezik=293580. [COBISS.SI-ID 5094310], [JCR, SNIP, WoS, Scopus do 11. 8. 2022: št. citatov (TC): 2, čistih citatov (CI): 2, čistih citatov na avtorja (CIAu): 0,67]

JURC, M., BOJOVIĆ, S., JURC, D. Non-native insects in urban and forest areas of Slovenia and the introduction of *Torymus sinensis* with *Dryocosmus kuriphilus*. *Open Journal of Forestry*. 2017, vol. 7, vol. 7, str. 416-427, ilustr. ISSN 2163-0437. https://doi.org/10.4236/ojf.2017.74025, DOI: 10.4236/ojf.2017.74025. [COBISS.SI-ID 4893094]

HAUPTMAN, T., PAVLIN, R., GROŠELJ, P., JURC, M. Distribution and abundance of the alien *Xylosandrus germanus* and other ambrosia beetles (Coleoptera: Curculionidae, Scolytinae) in different forest stands in central Slovenia. *IForest*. 2019, vol. 12, iss. 5, str. 451-458, ilustr. ISSN 1971-7458. https://doi.org/10.3832/ifor3114-012, https://iforest.sisef.org/abstract/?id=ifor3114-012, DOI: 10.3832/ifor3114-012. [COBISS.SI-ID 5520038], [JCR, SNIP, WoS do 31. 1. 2023: št. citatov (TC): 6, čistih citatov (CI): 5, čistih citatov na avtorja (CIAu): 1,25, Scopus do 13. 1. 2023: št. citatov (TC): 6, čistih citatov (CI): 6, čistih citatov na avtorja (CIAu): 1,50]

JURC, M., HAUPTMAN, T., PAVLIN, R., JERINA, K., DIACI, J., LEBAN, V., POJE, A., KRČ, J., DE GROOT, M., KAVČIČ, A., OGRIS, N. *Ekspertiza, ki je proučila objektivno nevarnost širjenja podlubnikov iz gozdnega rezervata v sosednje večnamenske gozdove*. Ljubljana: Biotehniška fakulteta, Oddelek za gozdarstvo in obnovljive gozdne vire, 2021. 1 spletni vir (1 datoteka PDF (73 str.)). https://repozitorij.uni-lj.si/IzpisGradiva.php?id=138381. [COBISS.SI-ID 115752451]

VEDENJE PORABNIKOV IN TRŽENJSKE STRATEGIJE V BIOTEHNIKI

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Vedenje porabnikov in trženjske strategije v biotehniki
Course title:	Consumer Behaviour and Marketing Strategies in Biosciences
Članica nosilka/UL Member:	

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (od študijskega leta 2023/2024 dalje)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037302
Koda učne enote na članici/UL Member course code:	3804

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:	Leon Oblak

Izvajalci predavanj:	Leon Oblak
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):
• Sprejemanje potrošnih odločitev in mehanizmi procesiranja informacij • Poznavanje izdelkov in vpletenost v nakup • Modeliranje vedenja porabnikov • Vplivi okolja na vedenje porabnikov • Analiza porabnikov in trženjska analiza	• Consumer decision making and processing mechanisms • Consumer product knowledge and involvement • Modelling consumer behaviour • Environmental forces and consumer behaviour • Consumer analysis and marketing strategy

Temeljna literatura in viri/Readings:

- Peter, J.P., Olson, J.C. 2010. Consumer Behavior and Marketing Strategy. McGraw-Hill Higher Education, 9th International ed. 554 str.
- Oblak, L. 2013. Trženje lesnih izdelkov in storitev. Biotehniška fakulteta, Ljubljana, 175 str.
- Vida, I., Kos Koklič, M., Bajde, D., Kolar, T., Čater, B., Damjan, J. 2010. Vedenje porabnikov. Ekonomska fakulteta, Ljubljana, 299 str.
- Schiffman, L., Wisenblit, J. 2019. Consumer Behavior (What's New in Marketing). 12th Edition, Harlow: Pearson Edication Limited, New York, 508 str.
- Schiffman, L., Kanuk, L., Hansen, H. 2012. Consumer behaviour : a European outlook. Harlow: Pearson Financial Times/Prentice Hall, 460 str.

Cilji in kompetence:	**Objectives and competences:**
Cilji: Študent bo spoznal proces in načine nakupnega odločanja ter sodobne teorije in aplikacije na multidisciplinarnem področju proučevanja vedenja porabnikov. Kompetence: Študent bo usposobljen za identifikacijo in povezovanje različnih notranjih in zunanjih dejavnikov in vidikov, ki vplivajo na nakupno vedenje. Znal bo izvesti empirične raziskave na tem področju.	Objectives: The students will get familiar with the processes related to purchase decision-making as well as with theories and applications in a multidisciplinary field of consumer behaviour studies. Competencies: Student will be able to identify and integrate multiple internal and external factors that determine purchase behaviour. He/she will be capable of designing and executing empirical research in the consumer behaviour field.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Študent bo razumel in znal celovito obravnavati vsebine in probleme na področju vedenja porabnikov.	Knowledge and understanding: The student will understand and be able to adopt holistic view of issues in the field of consumer behaviour

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

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Pisni/ustni izpit	50,00 %	Written/Oral exam
Seminar	50,00 %	Term paper

Reference nosilca/Lecturer's references:

Prof. Dr. Leon Oblak

1. OBLAK, L., GLAVONJIĆ, B., PIRC BARČIĆ, A., BIZJAK, T., GROŠELJ, P. 2020. Preferences of different target groups of consumers in case of furniture purchase = Sklonosti kupaca pri donošenju odluke o kupnji namještaja. Drvna industrija : Znanstveno stručni časopis za pitanja drvne tehnologije, vol. 71, iss. 1, str. 79-87.
2. JOŠT, M., KAPUTA, V., NOSÁL'OVÁ, M., PIRC BARČIĆ, A., PERIĆ, I., OBLAK, L. 2020. Changes in customer preferences for furniture in Slovenia = Promjene sklonosti kupaca namještaja u Sloveniji. Drvna industrija : Znanstveno stručni časopis za pitanja drvne tehnologije, vol. 71, iss. 2, str. 149-156.
3. KITEK KUZMAN, M., OBLAK, L., GLAVONJIĆ, B., PIRC BARČIĆ, A., OBUĆINA, M., HAVIAROVA, E., GROŠELJ, P. 2022. Impact of COVID-19 on wood-based products industry : an exploratory study in Slovenia, Croatia, Serbia, and BiH. Wood material science & engineering, vol. 18 , no. 1, str. 1-12.
4. KROPIVŠEK, J., GROŠELJ, P., OBLAK, L., JOŠT, M. 2021. A comprehensive evaluation model for wood companies websites based on the AHP/R-TOPSIS method. Forests. [Online ed.], vol. 12, iss. 12, article 706, 24 str.

5. JOŠT, M., KAPUTA, V., NOSÁL'OVÁ, M., PIRC, A., PERIĆ, I., OBLAK, L. 2019. Changes in customer preferences for wooden furniture in Slovenia from 2010 to 2019. V: BELJO LUČIĆ, Ružica (ur.). Implementation of wood science in woodworking sector : proceedings : 70th anniversary of Drvna industrija journal. Zagreb: University of Zagreb, Faculty of Forestry, str. 249.
6. GLAVONJIĆ, B., LAZAREVIĆ, A., OBLAK, L., KALEM, M., SRETENOVIĆ, P. 2020. Competitiveness of selected South-Eastern European countries in European Union wood flooring market = Konkurentnost odabranih zemalja jugoistočne Europe na tržištu drvenih podova Europske unije. Drvna industrija : Znanstveno stručni časopis za pitanja drvne tehnologije. vol. 71, iss. 3, str. 281-288.

VEDENJSKE RAZISKAVE V EKONOMIKI IN OKOLJSKIH DRUŽBOSLOVNIH ZNANOSTIH

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Vedenjske raziskave v ekonomiki in okoljskih družboslovnih znanostih
Course title:	Behavioural research in economics and environmental social sciences
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: 0644178

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	0	85	5

Nosilec predmeta/Lecturer: Šumrada Tanja

Izvajalci predavanj:	Šumrada Tanja
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 vpis v doktorski študij.	General requirements for admission to doctoral programme.

Vsebina:	Content (Syllabus outline):
1. Vedenjske raziskave v ekonomiji in okoljskih družboslovnih znanostih • Odločanje in omejena racionalnost • Hevristika in kognitivne pristranskosti • Uporabnost v praksi 1. Teorije vedenja in procesov odločanja • Teorije motivacije, kognicije in presojanja	1. Behavioural research in economics and environmental social sciences • Decision-making and bounded rationality • Heuristics and cognitive biases • Real-world applications 1. Behavioural theories and the decision-making process

• Identiteta, kultura in morala • Zaupanje, pogajanja, tveganje in organiziranje • Teorije socialnih sistemov 1. Vedenjski dejavniki, ki vplivajo na odločitve ekonomskih agentov • Dispozicijski dejavniki • Socialni dejavniki • Kognitivni dejavniki 1. Metodološki pristopi k raziskavam vedenja na področju okolja in rabe naravnih virov • Opisne, kvalitativne in mešane raziskave • Korelacijske raziskave in modeliranje strukturnih enačb • Ekonomski eksperimenti in kvazi-eksperimenti Vrednotenje vplivov	• Theories of motivation, cognition and reasoning • Identity, culture and morals • Trust, negotiation, risk and organisation • Social systems theories 1. Behavioural factors affecting the decisions of economic agents • Dispositional factors • Social factors • Cognitive factors 1. Behavioural research methods in the field of environment and natural resources • Descriptive, qualitative and mixed research • Correlational research and structural equation modelling • Economic experiments and quasi-experiments Impact evaluations

Temeljna literatura in viri/Readings:

Drouvelis, M. 2021. Social Preferences. An Introduction to Behavioural Economics and Experimental Research. Agenda Publishing. 199 str. ISBN: 978-1-78821-417-9.
Grbich, C. 2011. Qualitative Data Analysis. An Introduction. SAGE Publications. 334 str. ISBN 978-1-4462-0296-8.
Gertler, P.J., Martinez, S., Premand, P., Rawlings, L.B., & Vermeersch, C.M.J. 2016. Impact evaluation in practice. World Bank Publications. 335. str. ISBN 978-1-4648-0779-4.
Glennerster, R. & Takavarasha, K. 2013. Running Randomized Evaluations: a Practical Guide. Princeton University Press. 480 str. ISBN 978-0-6911-5927-0.
Priporočena literatura:
Stern, M.J. 2018. Social Science Theory for Environmental Sustainability. A practical guide. Oxford University Press. 295 str. ISBN: 978-0-19-879319-9.
Leary M.R. 2016. Introduction to behavioural research methods. 7th ed. Pearson. 351 str. ISBN 978-0-13-441440-9

Cilji in kompetence:	**Objectives and competences:**
Cilj predmeta je predstaviti temeljne koncepte, teorije, metodološke pristope in orodja za raziskave vedenja na področju okoljske trajnosti in upravljanja z naravnimi viri. Študentje bodo pridobili osnovni pregled nad družboslovnimi teorijami in metodami, ki se uporabljajo v vedenjskih raziskavah v ekonomiki in okoljskih družboslovnih znanostih.	The objective of the course is to introduce the main concepts, theories, methodological approaches and tools of behavioural research in the field of environmental sustainability and management of natural resources. The students will gain a basic overview of relevant social science theories and methods, which are used for behavioural research in economics and environmental social sciences.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Spozna značilnosti procesov odločanja ekonomskih agentov in vedenjske dejavnike, ki vplivajo nanje; Razume koncept omejene racionalnosti in njegove posledice v praksi; Spozna uporabnost študija hevristike in kognitivnih pristranskosti; Spozna aktualne metodološke pristope k raziskavam vedenja na področju okoljske trajnosti in upravljanja z naravnimi viri; Razume razlike med analizami opazovanih podatkov in orodji za analizo vzročnosti, ki se uporabljajo za vrednotenje učinkov programov in intervencij politik.	*Knowledge and understanding:* Explores characteristics of decision-making processes in economic agents and behavioural factors that influence them; Understands the concept of bounded rationality and its real-world implications; Explores the applicability of research on heuristics and cognitive biases; Explores state-of-the-art behavioural research approaches in the field of environmental sustainability and management of natural resources; Understands the difference between observational data analyses and

	causal inference tools for analysing the impacts of programs and policy interventions.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja (15 ur) Seminar (30 ur) Samostojno delo (80 ur)	Lectures (15 hours) Seminar (30 hours) Individual work (80 hours)

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
pisni izpit	50,00 %	• written exam
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:

1. **ŠUMRADA, Tanja,** JAPELJ, Anže, VERBIČ, Miroslav, ERJAVEC, Emil. Farmers' preferences for result-based schemes for grassland conservation in Slovenia. *Journal for nature conservation*. Apr. 2022, 66, no. 126143, 12 pp. COBISS.SI-ID 96358403]
2. **ŠUMRADA, Tanja,** VREŠ, Branko, ČELIK, Tatjana, ŠILC, Urban, RAC, Ilona, UDOVČ, Andrej, ERJAVEC, Emil. Are result-based schemes a superior approach to the conservation of High Nature Value grasslands? : evidence from Slovenia. *Land Use Policy*. 2021, 111, 105749, str. 1-14. [COBISS.SI-ID 82532099]
3. ALIF, Živa, NOVAK, Ana, MIHELIČ, Rok, JUVANČIČ, Luka, **ŠUMRADA, Tanja.** Can knowledge transfer speed up climate change mitigation in agriculture? A randomized experimental evaluation of participatory workshops. *Environmental science & policy*. 2024, vol. 152, 103662, str. 1-11. [COBISS.SI-ID 179496707].
4. ROMMEL, Jens, **ŠUMRADA, Tanja,** et al. Farmers' risk preferences in 11 European farming systems : a multi-country replication of Bocquého et al. (2014). *Applied economic perspectives and policy*. 2023, vol. 45, iss. 3, str. 1374-1399. [COBISS.SI-ID 127693315]
5. NOVAK, Ana, **ŠUMRADA, Tanja,** ČERNIČ ISTENIČ, Majda, ERJAVEC, Emil. Odločanje kmetov z območja Haloz o vključevanju v kmetijsko-okoljske ukrepe za ohranjanje ekstenzivne rabe travinja. *Acta agriculturae Slovenica*. [Spletna izd.]. 2022, letn. 118, št. 1, str. 1-16. [COBISS.SI-ID 104027907]
6. LEFEBVRE, Marianne, BARREIRO-HURLÉ, Jesus, BLANCHFLOWER, Ciaran, COLEN, Liesbeth, KUHFUSS, Laure, ROMMEL, Jens, **ŠUMRADA, Tanja,** THOMAS, Fabian, THOYER, Sophie. Can economic experiments contribute to a more effective CAP?. *EuroChoices*. 2021, vol. 20, no. 3, str. 42-49. [COBISS.SI-ID 73305347]

VODA KOT NARAVNI VIR V KMETIJSTVU

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Voda kot naravni vir v kmetijstvu
Course title:	Water as a natural resource for agriculture
Članica nosilka/UL Member:	

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (od študijskega leta 2023/2024 dalje)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037255
Koda učne enote na članici/UL Member course code:	3757

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	0	0	15	95	5

Nosilec predmeta/Lecturer:	Marina Pintar

Izvajalci predavanj:	Marina Pintar
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.	Common conditions for the application on the doctoral study.

Vsebina:	Content (Syllabus outline):
Pomen vode kot naravnega vira za kmetijstvo. Zakonski okvir povezave vode in kmetijstva. Voda za hrano in ekosisteme. Omejitve kmetijstva zaradi preveč ali premalo vode. Ugodne vodne talne razmere za rast rastlin. Retenzijske površine in kmetijstvo. Osuševanje in namakanje. Odvisnost svetovnega in slovenskega kmetijstva od namakanja. Različne tehnologije namakanja in njihov vpliv na	Water as a natural resource important for agriculture. Legislative framework of water and agriculture connection. Water for food and ecosystems. Water as a restriction factor for agriculture – too much or to less water. Appropriate soil water status for plant production. Water retention areas and agriculture. Drainage and irrigation. Dependency of world and Slovene plant production on irrigation.

okolje. Namakanje nekmetijskih površin.Sistemi za podporo odločanja o namakanju. Kakovost vode za rabo v kmetijstvu. Vodni viri za namakanje (površinske vode, podzemne vode, voda iz čistilnih naprav). Nabira vode. Problematika vodnih zadrževalnikov. Ukrepi za zmanjšano porabo vode v rastlinski pridelavi. Vpliv kmetijstva na vodno okolje. Mehanizmi prenosa onesnažil v površinske in podzemne vode. Mehanizmi preprečevanja vnosa onesnažil v vodno okolje in mehanizmi čiščenja voda onesnažil iz kmetijstva. Računalniško modeli prenosa onesnažil v vodno okolje. Vodovarstvena območja in kmetijstvo. Celovito urejanje voda v kmetijskem okolju.	Irrigation of non agricultural land. Different irrigation technologies and their impact on the environment. Decision support systems for irrigation. Water quality for the use in agriculture. Water resources for irrigation (surface waters, groundwater, and treated waste water) Water harvesting. Water reservoirs. Measurements for water use reduction in plant production. Mechanisms of pollutants transfer to surface and ground waters. Mechanisms of pollution prevention and mechanisms of agriculture pollutants reduction. Computer models dealing with agriculture and water quality. Water protection zones and agriculture. Holistic approach to water management in agricultural environment.

Temeljna literatura in viri/Readings:

- Chin, D. A. 2006. Water-quality engineering in natural systems. John Wiley & Sons, New Jersey. 609. s, ISBN -13: 978-0-471-71830-7. Chapter 1, Chapter 6, Chapter 9.
- Lazarova, V., Bahri A. 2005. Water Reuse for Irrigation. CRC Press, Boca Raton. 408 s.; ISBN 1-56670-649-1. Chapter 1-9.
- Molden D., 2007. Water for Food, Water for Life. Earthscan, London. 645 s., ISBN: 978-1-84407-396-2. Chapter 3 in 4.:
- Revijalni članki s področja, tekoča periodika, druga učna gradiva, ipd.

Cilji in kompetence:	**Objectives and competences:**
Spoznati pomen vode v in za kmetijstvo ter vpliv kmetijstva na kakovost in količine vode z vsemi pomembnimi procesi in potmi prenosa onesnažil iz kmetijstva v vodno okolje.	To realize a meaning of water in and for agriculture and the impact of agriculture to water quality and quantity inclusively all important processes and paths of pollutant transport from agriculture to water media.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: študent pridobi znanje o vodi kot o naravnem viru, pomembnem za kmetijstvo, na katerega kakovostno in količinsko stanje pa kmetijstvo posredno ali neposredno s svojimi dejavnostmi vpliva. Spozna, kakšni so možni ukrepi za čim manjši vpliv kmetijstva na vodno okolje in za trajnostno upravljanje z vodo v kmetijstvu.	Knowledge and understanding: students get knowledge about water as a natural resource important for agriculture. Agriculture activities impact water quality and quantity status. Students get knowledge on measurements to diminish the negative impact of agriculture to water environment and for sustainable management of water in agriculture.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja oz. konzultacije in projektno oz. seminarsko delo.	Lectures or consultation and project work or seminars.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Ocena seminarja (če je mogoče v povezavi s študentovo doktorsko nalogo).	100,00 %	Evaluation of the seminar (if possible connected with the doctoral work)

Reference nosilca/Lecturer's references:

Pintar Marina

1. PEČAN, Urša, KASTELEC, Damijana, **PINTAR, Marina**. Evaluation of default, soil-specific, and clay content correction calibration functions for dielectric sensors in soils with differing properties. Journal of irrigation and drainage engineering. [Print ed.]. 2022, vol. 148, iss. 6 (04022016), 11 str., ilustr. ISSN 0733-

9437. https://ascelibrary.org/doi/epdf/10.1061/%28ASCE%29IR.1943-4774.0001677, DOI: 10.1061/(ASCE)IR.1943-4774.0001677. [COBISS.SI-ID 102113795]
2. CVEJIĆ, Rozalija, **PINTAR, Marina**, ZUPANC, Vesna. Advancing irrigation development in the European Union*. Irrigation and drainage : International commission on irrigation and drainage. [Print ed.]. 2021, vol. 70, no. 4, str. 887-899. ISSN 1531-0353. DOI: 10.1002/ird.2585. [COBISS.SI-ID 57059331]
3. MIHELIČ, Rok, PEČNIK, Jure, GLAVAN, Matjaž, **PINTAR, Marina**. Impact of sustainable land management practices on soil properties : Example of organic and integrated agricultural management. Land. 2021, vol. 10, iss. 1, art. 8, str. 1-17, ilustr. ISSN 2073-445X. https://dx.doi.org/10.3390/land10010008, DOI: 10.3390/land10010008. [COBISS.SI-ID 44509187]
4. CVEJIĆ, Rozalija, ČERNIČ ISTENIČ, Majda, HONZAK, Luka, PEČAN, Urša, ŽELEZNIKAR, Špela, **PINTAR, Marina**. Farmers try to improve their irrigation practices by using daily irrigation recommendations - The Vipava Valley case, Slovenia. Agronomy. 2020, vol. 10, iss. 9, str. 1-27, 1238. ISSN 2073-4395. https://www.mdpi.com/2073-4395/10/9/1238, DOI: 10.3390/agronomy10091238. [COBISS.SI-ID 26263043]
5. GLAVAN, Matjaž, CVEJIĆ, Rozalija, ZUPANC, Vesna, KNAPIČ, Matej, **PINTAR, Marina**. Agricultural production and flood control dry detention reservoirs: Example from Lower Savinja Valley, Slovenia. Environmental science & policy. 2020, vol 114, str. 394-402. ISSN 1462-9011. https://www.sciencedirect.com/science/article/pii/S1462901120303531?via%3Dihub. [COBISS.SI-ID 29840387]
6. ZUPANC, Vesna, BRAČIČ-ŽELEZNIK, Branka, **PINTAR, Marina**, ČENČUR CURK, Barbara. Assessment of groundwater recharge for a coarse-gravel porous aquifer in Slovenia. Hydrogeology journal. 2020, vol. 28, iss. 5, str. 1773-1785. ISSN 1431-2174. https://doi.org/10.1007/s10040-020-02152-8, DOI: 10.1007/s10040-020-02152-8. [COBISS.SI-ID 16385539]

ZAJEM IN RAČUNALNIŠKO PODPRTA ANALIZA SLIK

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Zajem in računalniško podprta analiza slik
Course title:	Image Acquisition and Computer-Assisted Analysis
Članica nosilka/UL Member:	

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski (od študijskega leta 2023/2024 dalje)	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037266
Koda učne enote na članici/UL Member course code:	3768

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	20	0	0	95	5

Nosilec predmeta/Lecturer:	Franjo Pernuš

Izvajalci predavanj:	Boštjan Likar, Franjo Pernuš, Žiga Špiclin, Tomaž Vrtovec
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.	Genaral conditions for enrolment in doctoral studies.

Vsebina:	Content (Syllabus outline):
- Zajemanje digitalnih slik: optično-zaznavne lastnosti človeškega vida, vrste in definicije digitalnih slik, predstavitve barv in barvni prostori, parametri kakovosti, tehnologije zajemanja vizualnih podatkov na makro in mikroskopski ravni z digitalnimi fotoaparati in kamerami, osnove rentgenskega slikanja, računalniške tomografije, magnetne resonance in ultrazvoka, razumevanje vsebine slik.	- Acquisition of digital images: optical and perceptual characteristics of human vision, types and definitions of digital images and videos, color representation and color spaces, quality parameters, technologies for image acquisition with digital photography and cameras for visible and invisible light, on macro- and microscopic levels, fundamentals of radiographic imaging, computed tomography, magnetic resonance

- Prikazovanje, manipulacija in zgoščevanje sivinskih, barvnih in večdimenzionalnih slik - Analiza slik: upragovanje, opisovanje s poravnavo topoloških, fizikalnih ali statističnih modelov, regresija in razvščanje slik z globokimi samoučečimi modeli, izločanje značilnic objektov zanimanja, analiza rasti in gibanja. - Načrtovanje in uporaba slikovnih informacijskih sistemov: programska orodja za pridobivanje in analizo slik, načrtovanje, integracija in uporaba slikovnih informacijskih sistemov v biotehniških raziskavah in aplikacijah (mikroskopija, kontrola kakovosti živil, spremljanje rasti in gibanja živali, rastlin in mikroorganizmov, itn).	imaging and ultrasound, image content understanding. - Visualization, manipulation and compression of grayscale, color and multidimensional images. - Image analysis: thresholding, registration-driven (physical, topological, statistical) model based description, regression and analysis based on deep learning models, region-of-interest description and measurement, growth and motion analysis. - Design and implementation of imaging information systems: software tools for image acquisition and analysis, design, integration and implementation of imaging information systems in bioengineering research and applications (microscopy, food quality control, monitoring of growth and motion of animals, plants and microorganisms, etc.).

Temeljna literatura in viri/Readings:

- Thomas M. Deserno. Biomedical Image Processing. Springer, 2011.
- Klaus D. Tonnies. Guide to Medical Image Analysis: Methods and Algorithms. Springer, 2012.
- Deep Learning (Ian J. Goodfellow, Yoshua Bengio and Aaron Courville), MIT Press, 2016.
- Boštjan Likar. Biomedicinska slikovna informatika in diagnostika, 1. izdaja, Založba FE in FRI, Ljubljana: Fakulteta za elektrotehniko, 2008.

Cilji in kompetence:	**Objectives and competences:**
Seznaniti študente s področjem zajemanja in računalniško podprte analize biomedicinskih slik; posredovati znanje o sodobnih postopkih za zajemanje biomedicinskih slik, za njihovo prikazovanje, manipulacijo, zgoščevanje, ter kvantitativno analizo; posredovati znanje o strojnem in globokem strojnem učenju in uporabo teh orodij za regresijo in razvrščenje na podlagi biomedicinskih slik ter njihovo analizo; seznanjanje s pristopi k načrtovanju in uporabi slikovnih informacijskih sistemov v biotehniških raziskavah in aplikacijah.	To provide an introduction to biomedical image acquisition, computer-assisted image analysis; to develop basic understanding of digital image processing, restoration, calibration and quantitative analysis; to develop basic understanding of machine and deep learning based tools for digital image regression, classification and analysis; and to develop understanding of image processing and analysis methods, which enable objective and quantitative evaluation of the environment, space, objects and subjects in bioengineering.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Študenti, ki bodo izbrali ta predmet, bodo pridobili znanja o zajemanju digitalnih slik; znali prikazovati, manipulirati in zgoščevati slike; znali izbrati in uporabljati obstoječe postopke; digitalne analize slik; znali načrtovati, učiti in vrednotiti globoke samoučeče modele za regresijo in razvrščanje na podlagi slikovne informacije; znali načrtovati in uporabljati slikovne informacijske sisteme v bioznanostih.	Students completing this course will gain a fundamental understanding of biomedical image acquisition and computer-assisted image processing and analysis; will gain hands-on knowledge of applications of image processing and analysis and be able to apply existing image processing algorithms, and design, train and validate deep learning based models for image-based regression and classification tasks in the field of biosciences.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Teoretične osnove in širši pregled nad področjem predmeta študentje pridobijo na predavanjih, praktična znanja in izkušnje pa pri laboratorijskih vajah in izdelavi izbrane projektne ali seminarske naloge z njihovega področja zanimanja.	An overview of the area and basic theory will be provided through lectures, while practical knowledge and experience will be provided through lab work and projects or seminars, selected by the students to best match their specific interests.

Načini ocenjevanja:	Delež/Weight	Assessment:
Pisno poročilo o projektu	70,00 %	Writen report on assigned project
Predstavitev (PPT) projekta	30,00 %	Oral (PPT) presentation

Reference nosilca/Lecturer's references:

Žiga Špiclin

1. BIZJAK, Žiga, PERNUŠ, Franjo, ŠPICLIN, Žiga. Deep shape features for predicting future intracranial aneurysm growth. Frontiers in physiology, vol. 12, article 644349, str. 1-10, 202
2. SAVŠEK, Lina, STERGAR, Tamara, STROJNIK, Vojko, IHAN, Alojz, KOREN, Aleš, ŠPICLIN, Žiga, ŠEGA, Saša. Impact of aerobic exercise on clinical and magnetic resonance imaging biomarkers in persons with multiple sclerosis : an exploratory randomized controlled trial. Journal of rehabilitation medicine, vol. 53, iss. 4, str. 1-9, 2021.
3. MADAN, Hennadii, BERLOT, Rok, RAY, Nicola J., PERNUŠ, Franjo, ŠPICLIN, Žiga. Practical priors for Bayesian inference of latent biomarkers. IEEE journal of biomedical and health informatics, vol. 24, no. 2, str. 396-406, 2020.
4. JERMAN, Tim, CHIEN, Aichi, PERNUŠ, Franjo, LIKAR, Boštjan, ŠPICLIN, Žiga. Automated cutting plane positioning for intracranial aneurysm quantification. IEEE transactions on bio-medical engineering, vol. 67, no. 2, str. 577-587, 2020.
5. MADAN, Hennadii, PERNUŠ, Franjo, ŠPICLIN, Žiga. Reference-free error estimation for multiple measurement methods. Statistical methods in medical research, vol. 28, issue 7, str. 2196-2209, 2019.
6. MITROVIĆ, Uroš, LIKAR, Boštjan, PERNUŠ, Franjo, ŠPICLIN, Žiga. 3D-2D registration in endovascular image-guided surgery : evaluation of state-of-the-art methods on cerebral angiograms. International journal of computer assisted radiology and surgery : a journal for interdisciplinary research, developemnt and applications of image guided diagnosis and therapy, vol. 13, no. 2, str. 193-202, 2018.

Tomaž Vrtovec

1. KOREZ, Robert, PUTZIER, Michael, VRTOVEC, Tomaž. A deep learning tool for fully automated measurements of sagittal spinopelvic balance from X-ray images : performance evaluation. European spine journal, vol. 29, no. 9, str. 2295-2305, 2020.
2. KHOLIAVCHENKO, M., SIRAZITDINOV, I., KUBRAK, K., BADRUTDINOVA, R., KULEEV, R., YUAN, Y., VRTOVEC, Tomaž, IBRAGIMOV, Bulat. Contour-aware multi-label chest X-ray organ segmentation. International journal of computer assisted radiology and surgery : a journal for interdisciplinary research, developemnt and applications of image guided diagnosis and therapy, vol. 15, iss. 4, str. 425-436, 2020.
3. BRINK, Rob C., VAVRUCH, Ludvig, SCHLÖSSER, Tom P. C., ABUL-KASIM, Kasim, OHLIN, Acke, TROPP, Hans, CASTELEIN, René M., VRTOVEC, Tomaž. Three-dimensional pelvic incidence is much higher in (thoraco)lumbar scoliosis than in controls. European spine journal, vol. 28, no. 3, str. 544-550, 2019.
4. KNEZ, Dejan, NAHLE, Imad S., VRTOVEC, Tomaž, PARENT, Stefan, KADOURY, Samuel. Computer-assisted pedicle screw trajectory planning using CT-inferred bone density : a demonstration against surgical outcomes. Medical Physics, vol. 46, no. 8, str. 3543-3554, 2019.
5. PINHEIRO, Alan Petrônio, COELHO, Júlio Cézar, PASCHOARELLI VEIGA, Antônio C., VRTOVEC, Tomaž. A computerized method for evaluating scoliotic deformities using elliptical pattern recognition in X-ray spine images. Computer methods and programs in biomedicine, vol. 161, str. 85-92, 2018.
6. MOČNIK, Domen, IBRAGIMOV, Bulat, XING, Lei, STROJAN, Primož, LIKAR, Boštjan, PERNUŠ, Franjo, VRTOVEC, Tomaž. Segmentation of parotid glands from registered CT and MR images. Physica medica, vol. 52, str. 33-41, 2018.

Boštjan Likar

1. NAGLIČ, Peter, ZELINSKYI, Yevhen, LIKAR, Boštjan, BÜRMEN, Miran. Determination of refractive index, size, and solid content of monodisperse polystyrene microsphere suspensions for the characterization of optical phantoms. Biomedical optics express. Apr.1, 2020, vol. 11, no. 4, str. 1901-1918 [COBISS.SI-ID 12953940]
2. ZELINSKYI, Yevhen, NAGLIČ, Peter, PERNUŠ, Franjo, LIKAR, Boštjan, BÜRMEN, Miran. Fast and accurate Monte Carlo simulations of subdiffusive spatially resolved reflectance for a realistic optical fiber probe tip model aided by a deep neural network. Biomedical optics express. 1 Jul. 2020, vol. 11, no. 7, str. 3875-3889 [COBISS.SI-ID 26951939]

3. JERMAN, Tim, CHIEN, Aichi, PERNUŠ, Franjo, LIKAR, Boštjan, ŠPICLIN, Žiga. Automated cutting plane positioning for intracranial aneurysm quantification. IEEE transactions on bio-medical engineering. Feb. 2020, vol. 67, no. 2, str. 577-587 [COBISS.SI-ID 12543316]
4. PODREKAR, Gregor, KITAK, Domen, MEHLE, Andraž, LAVRIČ, Zoran, LIKAR, Boštjan, TOMAŽEVIČ, Dejan, DREU, Rok. In-line film coating thickness estimation of minitablets in a fluid-bed coating equipment. AAPS PharmSciTech. [Online ed.]. Nov. 2018, vol. 19, iss. 8, str. 3440-3453 [COBISS.SI-ID 4611953]
5. MITROVIĆ, Uroš, LIKAR, Boštjan, PERNUŠ, Franjo, ŠPICLIN, Žiga. 3D-2D registration in endovascular image-guided surgery : evaluation of state-of-the-art methods on cerebral angiograms. International journal of computer assisted radiology and surgery : a journal for interdisciplinary research,
developemnt and applications of image guided diagnosis and therapy. Feb. 2018, vol. 13, no. 2, str. 193-202 [COBISS.SI-ID 11878228]
6. MEHLE, Andraž, KITAK, Domen, PODREKAR, Gregor, LIKAR, Boštjan, TOMAŽEVIČ, Dejan. Inline agglomeration degree estimation in fluidized bed pellet coating processes using visual imaging. International journal of pharmaceutics. [Print ed.]. 30 Jul. 2018, vol. 546, no. 1/2, str. 78-85 [COBISS.SI-ID 12164180].

Franjo Pernuš

1. BÜRMEN, Miran, PERNUŠ, Franjo, NAGLIČ, Peter. MCDataset : a public reference dataset of Monte Carlo simulated quantities for multilayered and voxelated tissues computed by massively parallel PyXOpto Python package. Journal of biomedical optics. Aug. 2022, no. 8, 083012, str. 1-20 [COBISS.SI-ID 110538243]
2. NAGLIČ, Peter, PERNUŠ, Franjo, BÜRMEN, Miran. Reflectance calibration of multimode optical fiber probes by probe-to-target distance reflectance profile modeling. Measurement : journal of the International Measurement Confederation. [Print ed.]. 15. Nov. 2022, vol. 203, 112002, str. 1-14 [COBISS.SI-ID 126338051]
3. BIZJAK, Žiga, PERNUŠ, Franjo, ŠPICLIN, Žiga. Deep shape features for predicting future intracranial aneurysm growth. Frontiers in physiology. Jul. 2021, vol. 12, article 644349, str. 1-10 [COBISS.SIID 69012739]
4. ZELINSKYI, Yevhen, NAGLIČ, Peter, PERNUŠ, Franjo, LIKAR, Boštjan, BÜRMEN, Miran. Fast and accurate Monte Carlo simulations of subdiffusive spatially resolved reflectance for a realistic optical fiber probe tip model aided by a deep neural network. Biomedical optics express. 1 Jul. 2020, vol. 11, no. 7, str. 3875-3889 [COBISS.SI-ID 26951939]
5. IVANČIČ, Matic, NAGLIČ, Peter, PERNUŠ, Franjo, LIKAR, Boštjan, BÜRMEN, Miran. Efficient estimation of subdiffusive optical parameters in real time from spatially resolved reflectance by artificial neural networks. Optics letters, vol. 43, no. 12, str. 2901-2904, 2018.
6. LESJAK, Žiga, GALIMZIANOVA, Alfiia, KOREN, Aleš, LUKIN, Matej, PERNUŠ, Franjo, LIKAR, Boštjan, ŠPICLIN, Žiga. A novel public MR image dataset of multiple sclerosis patients with lesion segmentations based on multi-rater consensus. Neuroinformatics, vol. 16, no. 1, str. 51-63, 2018.