UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	LABORATORIJSKI IN TERENSKI PRAKTIKUM
Course title:	LABORATORY AND FIELD PRACTICUM

Študijski program in stopnja **Study programme and level**	**Študijska smer** **Study field**	**Letnik** **Academic year**	**Semester** **Semester**
Varstvo okolja in ekotehnologije, 2. stopnja	/	1.	/
Environmental Protection and Eco-technologies, 2nd level	/	1st	/

Vrsta predmeta / Course type Obvezni predmet / Obligatory course

Univerzitetna koda predmeta / University course code: LTP

Predavanja **Lectures**	**Sem. vaje** **Tutorial**	**Lab. vaje** **Laboratory work**	**Teren. vaje** **Field work**	**Samost. delo** **Individ. work**	**ECTS**
20	/	40	40	140	**8**

Nosilec predmeta / Lecturer: doc. dr. Anja Bubik / doc. dr. Samar Al Sayegh Petkovšek

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Pogojev ni.	No formal prerequisites.

Vsebina:	**Content (Syllabus outline):**
Glavni cilj predmeta je razviti celovit nabor laboratorijskih in terenskih veščin, ki študente usposobijo za samostojno, zanesljivo in raziskovalno delo na različnih področjih okoljske znanosti. Vsebina predmeta združuje delo z različnimi okoljskimi vzorci in zajema vse ravni analitskega procesa; od načrtovanja in izvedbe vzorčenja, priprave in obdelave vzorcev, do analize in interpretacije rezultatov. Pridobljene veščine temeljijo na razumevanju teoretičnega ozadja uporabljenih tehnik in analiz ter omogočajo prenos znanja v raziskovalno, strokovno in aplikativno prakso, kjer študenti učinkovito povezujejo laboratorijske in terenske pristope pri reševanju okoljskih izzivov. **<u>Poglavitne teme:</u>** **Eksperimentalne metode v laboratoriju** • Varnost in organizacija laboratorijskega dela	The main aim of the course is to develop a comprehensive set of laboratory and field skills that equip students for independent, reliable, and research-oriented work across different areas of environmental science. It integrates work with diverse environmental samples and covers all stages of the analytical process; from planning and conducting sampling, through sample preparation and processing, to analysis and interpretation of results. The acquired skills are grounded in an understanding of the theoretical background of the applied techniques and analyses, enabling students to transfer their knowledge into research, professional, and applied practice, where they effectively combine laboratory and field approaches to address environmental challenges. **<u>Main topics:</u>** **Experimental methods in the laboratory** • Laboratory safety and organization

- Načrtovanje eksperimenta in kakovost meritev (natančnost, zanesljivost, ponovljivost)
- Merilne tehnike, kvalitativne in kvantitativne analitske metode
- Kemijske in fizikalno-kemijske analize in tehnike
- Biološke in mikrobiološke analize in tehnike
- Molekularne in napredne analize in tehnike

Terensko delo

- Izvedba terenskih vaj s področij tal, površinskih voda, monitoringov dvoživk, upravljanja s populacijami prostoživečih živali, okoljske DNA

Projektno delo v praksi

- Povezovanje pridobljenih veščin z aktivnimi raziskovalnimi in aplikativnimi projekti
- Interpretacija in uporabnost rezultatov

- Experimental design and measurement quality (accuracy, reliability, repeatability)
- Measurement techniques; qualitative and quantitative analytical methods
- Chemical and physico-chemical analyses and techniques
- Biological and microbiological analyses and techniques
- Molecular and advanced analytical analyses and techniques

Fieldwork

- Implementation of field exercises in soil science, surface water assessment, amphibian monitoring, wildlife population management, and environmental DNA

Project-based practice

- Integrating acquired skills into ongoing research and applied projects
- Interpretation and practical relevance of results

Temeljna literatura in viri / Textbooks:

Obvezna / Required:

1. Študijsko gradivo, posredovano v obliki izročkov / Study materials provided as PowerPoint slides
2. Laboratorijski protokoli, mednarodni in nacionalni standardi (ISO, EN, SIST) / Laboratory protocols, international and national standards (ISO, EN, SIST)

Priporočena / Recommended:

1. Znanstveni in strokovni članki, metodološki članki / Scientific and professional articles, methodological papers
2. Tehnična dokumentacija proizvajalcev analitskih instrumentov / Technical documentation provided by analytical instrument manufacturers

Cilji in kompetence:

Predmetno specifični cilji in kompetence:

- študente seznaniti s teoretičnim ozadjem laboratorijskih tehnik, analitskih metod in terenskih pristopov
- Študente opremiti z raznolikimi praktičnimi veščinami za celovito delo v laboratoriju in na terenu, ki so temelj za strokovno samostojnost
- Študente naučiti pravilnega rokovanja z različnimi vrstami okoljskih vzorcev ter ustrezne priprave vzorcev za analizo
- študente usposobiti za načrtovanje, izvedbo in dokumentiranje laboratorijskih ter terenskih meritev
- študente opremiti z znanji za zagotavljanje zanesljivosti, ponovljivosti in točnosti meritev v laboratoriju in na terenu

Objectives and competences:

Specific competences:

- To familiarize students with the theoretical background of laboratory techniques, analytical methods, and field approaches
- To equip students with a diverse set of practical skills for comprehensive laboratory and field work, forming the basis for professional independence
- To teach students proper handling of different types of environmental samples and appropriate sample preparation for analysis
- To train students to plan, carry out, and document laboratory and field measurements
- To provide students with the knowledge needed to ensure the reliability, repeatability, and accuracy of measurements in both laboratory and field settings

• študente naučiti samostojno izbrati, izvesti in interpretirati ustrezne metode glede na vrsto vzorca in raziskovalni cilj • študente usmeriti k prenosu pridobljenega znanja v raziskovalno, strokovno in aplikativno prakso **Splošne kompetence:** • organiziranost, sistematičnost in natančnost pri načrtovanju, izvajanju in dokumentiranju strokovnih nalog • sposobnost samostojnega, odgovornega in strokovno utemeljenega dela v laboratorijskih, terenskih in projektnih okoljih • kritično mišljenje in reševanje kompleksnih okoljskih problemov na podlagi podatkov, dokazov in metodološke doslednosti	• To teach students to independently select, perform, and interpret appropriate methods based on sample type and research objectives • To guide students in transferring acquired knowledge into research, professional, and applied practice **General competences:** • Organization, systematic work, and precision in planning, performing, and documenting professional tasks • Ability to work independently, responsibly, and with sound professional judgment in laboratory, field, and project environments • Critical thinking and the ability to solve complex environmental problems based on data, evidence, and methodological consistency

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Študent bo ob zaključku predmeta sposoben: • razložiti teoretično ozadje laboratorijskih tehnik, analitskih metod in terenskih pristopov • opisati in kritično oceniti celoten potek dela z okoljskimi vzorci – od vzorčenja do interpretacije rezultatov • razumeti in analizirati dejavnike, ki vplivajo na zanesljivost, ponovljivost in točnost meritev • ovrednotiti primernost posameznih metod za različne vrste vzorcev in analitske cilje • načrtovati in izvesti laboratorijski oz. terenski eksperiment v skladu z raziskovalnim vprašanjem • integrirati rezultate laboratorijskih in terenskih analiz z okoljskimi procesi ter raziskovalnimi vprašanji	**Knowledge and understanding:** At the end of the subject, student will be able: • explain the theoretical background of laboratory techniques, analytical methods, and field approaches • describe and critically reflect on the complete workflow for handling environmental samples—from sampling to the interpretation of results • understand and analyse the factors that influence the reliability, repeatability, and accuracy of measurements • evaluate the suitability of specific methods for different sample types and analytical objectives • to design and carry out a laboratory or field experiment in accordance with a defined research question • integrate laboratory and field results with environmental processes and research questions
Prenosljive/ključne spretnosti in drugi atributi: • samostojno načrtovati, izvesti in strokovno dokumentirati laboratorijske ter terenske naloge na način, ki izkazuje organiziranost, odgovornost in metodološko doslednost • kritično uporabljati in presojati različne pristope pri zbiranju, obdelavi, vizualizaciji in interpretaciji podatkov ter jih smiselno vključevati v pripravo strokovnih poročil in predstavitev • sodelovati, strokovno komunicirati in argumentirano prispevati v interdisciplinarnih raziskovalnih in aplikativnih okoljih ter prenašati in integrirati pridobljeno znanje v prakso	**Transferable/key skills and other attributes:** • Independently plan, carry out, and professionally document laboratory and field tasks in a manner that demonstrates organization, responsibility, and methodological consistency • Critically apply and evaluate different approaches to data collection, processing, visualization, and interpretation, and meaningfully incorporate them into the preparation of professional reports and presentations • Collaborate effectively, communicate professionally, and contribute with arguments in interdisciplinary research and applied settings, and integrate acquired knowledge into practice

Metode poučevanja in učenja:	Learning and teaching methods:
Oblike dela: • Kratka interaktivna predavanja • Laboratorijsko delo • Terensko delo **Metode dela:** • Predavanja in razlaga teoretičnih osnov laboratorijskih in terenskih tehnik, metod in pristopov • Vključevanje strokovnjakov iz prakse oz. obiskov specializiranih laboratorijev • Sodelovanje v projektnem delu	**Forms of teaching:** • Short interactive lectures • Laboratory work • Filedwork **Teaching methods:** • Lectures and explanation of the theoretical foundations of laboratory and field techniques, methods, and approaches • Involvement of experts or visits to specialized laboratories • Participation in project-based work

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Pogoj za pristop k izpitu: Opravljene laboratorijske in terenske vaje v obsegu 100% Končna ocena pri predmetu je sestavljena iz • ustrezno zaključen laboratorijsko-terenski dnevnik • ustnega izpita Ocenjevalna lestvica: ▪ zadostno 6: 60–67 % ▪ dobro 7: 68–75 % ▪ prav dobro 8: 76–83 % ▪ prav dobro 9: 84–90 % ▪ odlično 10: 91–100 %	 **50** **50**	A prerequisite for access to the exam: Completion (100%) of laboratory and fieldwork tasks Final evaluation consists of … • A properly completed laboratory–field logbook • An oral examination Grading scale: ▪ Sufficient D (6): 60–67% ▪ Good C (7): 68–75% ▪ Very good B (8): 76–83% ▪ Very good B+ (9): 84–90% ▪ Excellent A (10): 91–100%

Materialni pogoji za izvedbo predmeta :	Material conditions for subject realization:
• Predavalnica z multimedijsko opremo • Laboratorij z ustreznim inventarjem in instrumenti • Terenska oprema	• Lecture room equipped with multimedia technology • Laboratory with appropriate equipment and instruments • Field equipment

Obveznosti študentov:	Student's commitments:
• prisotnost na laboratorijskih vajah • aktivna udeležba na terenskih vajah • redno vodenje laboratorijsko-terenskega dnevnika, ki ga študenti izpolnjujejo sproti po vnaprej določeni strukturi • oddaja popolnega in preglednega dnevnika ob zaključku vaj	• attendance at laboratory exercises • active participation in field exercises • regular maintenance of the laboratory–field logbook, completed continuously according to the predefined structure • submission of a complete and well-organized logbook at the end of the exercises

• ustni zagovor, ki vključuje razumevanje teoretičnih osnov in praktično uporabo pridobljenih laboratorijskih in terenskih veščin	• oral examination demonstrating understanding of theoretical foundations and the practical application of acquired laboratory and field skills

Reference nosilca predmeta:	**Lecturer's references:**
Pedagoško delo: • Sodelovanje pri izvedbi programa Varstvo okolja in ekotehnologije 1.stopnja: - Nosilka predmeta *Človek in okolje* (2014—) - Asistentka pri predmetih *Človek in okolje* (2008—2023), *Kemija in okolje* (2010—2023), *Ekotoksikologija* (2009—2025), *Molekularna ekologija v naravovarstvu* (2020—), *Čiščenje odpadni vod* (2021—2025), Kemija onesnaževal (2021—) - Sodelovanje pri izvedi laboratorijskih vaj pri predmetu *Ocena tveganja in varstvo pri delu* • Soavtorica priročnikov in navodil za izvajanje laboratorijskih vaj za predmetu Kemija in okolje (2014, 2015, 2019, 2022 ponatis) • Soavtorica navodil za vaje iz *Ekotoksikologije* za študente 2. in 3. letnika (2011). • Avtorica 5 spletnih tečajev s področja mikroplastike in okolja (2022) • Soavtorica 2 inovativnih učnih gradiv in delavnic v okviru projekta STE(A)M • Mentorica in somentorica diplomskih/magistrskih del • Mentorica Praktičnega usposabljanja študentov s področja Kemija in okolje ter Okolje in zdravje • Predsednica Komisije za študentske zadeve (2017—) • Predsednica Komisije za študijske zadeve (2023—) **Znanstveno-raziskovalno delo:** • Članica raziskovalne skupine *Inštitut za ekotehnologije in trajnostni razvoj* (2015 -) • Članica programa *Ekotoksiologija, toksikološka genomika in karcinogeneza* (2009 – 2012) • Vodenje projektnih aktivnosti v okviru projektov Erasmus+ KA2: MicPlaPROB (2021—2022), GreenGate (2021—2023), GreenGate II (2024—2026, Ecu4PlastiCircular (2023—2027) • Sodelovanje v mednarodnih, nacionalnih, regionalnih projektih: - PLASTIX – Plastics Revolution for European Regions (Interreg Europe) (2023—2027) - STE(A)M – Promocija študija za poklice prihodnosti s kakovostnimi aktivnostmi in vsebinami za mlade izven javnih univerzitetnih središč (2022—2024) - Tveganja zaradi okoljskih in naravnih nesreč na območjih Slovenske vojske (2023—2025) - Dvojna narava matičnih celic v raku in njihova uporaba v zdravljenju (2011—2014) • Vabljena predavanja na tujih univerzah	**Pedagogic activities:** • Participation in the implementation of the undergraduate study programme Environmental Protection and Ecotechnology: • Course holder and lecturer of *People and environment* (2014—) • Assistant in the courses *People and environment* (2008—2023), *Chemistry and the Environment* (2010—2023), *Ecotoxicology* (2009—2025), *Molecular Ecology in Nature Conservation* (2020—), *Wastewater Treatment* (2021—2025), *Chemistry of Pollutants* (2021—) • Participation in laboratory classes for the course *Ecological Risk and Work Safety* • Co-author of manuals and instructions for laboratory exercises for the course *Chemistry and the Environment* (2014, 2015, 2019, 2022 reprint) • Co-author of laboratory instructions for *Ecotoxicology* for 2nd- and 3rd-year students (2011) • Author of five online courses in the field of microplastics and the environment (2022) • Co-author of two innovative teaching materials and workshops within the STE(A)M project • Supervisor and co-supervisor of bachelor's and master's theses • Supervisor of student practical training in the fields *Chemistry and the Environment* and *Environment and Health* • Chair of the Student Affairs Committee (2017—) • Chair of the Academic Affairs Committee (2023—) **Scientific and research work:** • Member of the research group *Institute for Ecotechnology and Sustainable Development* (2015—) • Member of the research programme *Ecotoxicology, Toxicogenomics and Carcinogenesis* (2009—2012) • Management of project activities within Erasmus+ KA2 projects: MicPlaPROB (2021—2022), GreenGate (2021—2023), GreenGate II (2024—2026), Ecu4PlastiCircular (2023—2027) • **Participation in international, national, and regional projects:** - PLASTIX – *Plastics Revolution for European Regions* (Interreg Europe) (2023—2027) - STE(A)M – *Promotion of Future-Oriented Careers through High-Quality Activities and Content for Youth Outside Public University Centres* (2022—2024) - *Risks from Environmental and Natural Disasters in Areas of the Slovenian Armed Forces* (2023—2025)

- Aktivno sodelovanje na znanstvenih konferencah s področja mikroplastike, plastike, potencialno nevarnih kemikalij, fitoplanktona in njihovih metabolno aktivnih snovi ter zelenih in digitalnih veščin v izobraževanju

Strokovno delo in izbrane strokovne publikacije:

- Zunanja sodelavka Zveze potrošnikova Slovenije in avtorica strokovnih člankov s področja potencialno nevarnih kemikalij:

BUBIK, Anja (2026). Med učinkovitostjo, varnostjo in okoljsko odgovornostjo: silikoni v kozmetiki.
BUBIK, Anja (2025). Večne kemikalije, ki zastrupljajo naš svet: PFAS.
BUBIK, Anja (2025). Skriti formaldehid v kozmetičnih izdelkih : čeprav je prepovedan, je še vedno prisoten.
BUBIK, Anja (2025). Med dvema ognjema : zaviralci gorenja med varnostjo in tveganjem.
BUBIK, Anja (2025). V naše okolje prinašajo številna tveganja: obstojni in vseprisotni bisfenoli.
BUBIK, Anja (2024). So bleščice vredne svojega blišča? Oblačila s sijajem.

- Avtorica in urednica knjige G-book: *educational support for safe and responsible cosmetic product use*
- Soavtorica strokovne monografije *EDU4Plastic: handbook with innovative training methods for trainers: WP2 training methodology design*. (2025)
- Soavtorica video vsebin s področja mikroplastike

Priznanja in nagrade:

- /

- *Dual Nature of Stem Cells in Cancer and Their Use in Therapy* (2011—2014)
- Invited lectures at foreign universities
- Active participation in scientific conferences in the fields of microplastics, plastics, potentially hazardous chemicals, phytoplankton and their metabolically active substances, and green and digital skills in education

Professional work and selected professional publications:

- External expert of the Slovenian Consumers' Association on potentially hazardous chemicals:

BUBIK, Anja (2026). *Between effectiveness, safety and environmental responsibility: silicones in cosmetics.*
BUBIK, Anja (2025). *Forever chemicals poisoning our world: PFAS.*
BUBIK, Anja (2025). *Hidden formaldehyde in cosmetic products: although banned, it is still present.*
BUBIK, Anja (2025). *Caught between two fires: flame retardants between safety and risk.*
BUBIK, Anja (2025). *Persistent and ubiquitous bisphenols: bringing numerous risks to our environment.*
BUBIK, Anja (2024). *Are glittery clothes worth the sparkle?*

- Author and editor of the book *G-book: Educational Support for Safe and Responsible Cosmetic Product Use*
- Co-author of the professional monograph *EDU4Plastic: Handbook with Innovative Training Methods for Trainers: WP2 Training Methodology Design* (2025)
- Co-author of video materials in the field of microplastics

Awards:

- /

Izbrani znanstveni članki / Selected scientific papers:

Izvirni znanstveni članek (1.01)/ Original scientific article (1.01):

ŠPEH, Natalija, BUBIK, Anja. An interdisciplinary perspective of the karst springs' areas as drinking water : perusal from northeastern Slovenia. *Pollutants*. Sep. 2025, vol. 5, iss. 3, [article no.] 19, 16 str., ilustr. ISSN 2673-4672. https://www.mdpi.com/2673-4672/5/3/19, DOI: 10.3390/pollutants5030019. [COBISS.SI-ID 244279555]

ŠKOLNIK ŠKRABE, Katrin, BUBIK, Anja. Knowledge and learning preferences in circular economy and plastics : a case study from the Faculty of Environmental Protection. *Journal of Chemists, Technologists and Environmentalists*. 2024, vol. 5, iss. 1, str. 42-48, ilustr. ISSN 2712-1267. https://glasnik.tf.unibl.org/article/265, DOI: 10.59919/JCTE05202401009. [COBISS.SI-ID 224492035]

BUBIK, Anja, KOLAR, Lucija. Greening as a perspective solution for urban microclimate mitigation : a pilot study. *Annals of Faculty Engineering Hunedoara : international journal of engineering*. [Spletna izd.]. August 2019, tom. 7, str. 19-22, ilustr., graf. prikazi. ISSN 2601-2332. http://annals.fih.upt.ro/pdf-full/2019/ANNALS-2019-3-02.pdf. [COBISS.SI-ID 23547189]

Objavljeni znanstveni prispevek na konferenci (1.08)/ Published scientific conference contribution (1.08):

BUBIK, Anja, HOHKRAUT, Klara. From isolation to detection of microplastics in natural and industrially processed honey. V: *International Scientific and Professional Conference Politehnika 2025 : Belgrade, 28th November 2025 : conference proceedings*. Belgrade: The Academy of Applied Technical Studies, 2025. Str. 107-112, ilustr. ISBN 978-86-7498-146-7. https://drive.google.com/file/d/1kFypf_QZq03JM9bJBHBMJcUtPbyLPayY/view. [COBISS.SI-ID 265199363]

BUBIK, Anja, ŠKOLNIK ŠKRABE, Katrin. Chemical variability of personal care and cosmetic products. In: *International Scientific and Professional Conference Politehnika 2023 : Belgrade, 15th December 2023 : conference proceedings*. Belgrade: The Academy of Applied Technical Studies, 2023. Str. 112-117, ilustr. ISBN 978-86-7498-110-8. [COBISS.SI-ID 203187715]

BUBIK, Anja. Are we aware of microplastic contents in toothpastes?. V: *Proceedings*. X. International Conference Industrial Engineering and Environmental Protection (IIZS 2020), Zrenjanin, 8-9th October 2020. Zrenjanin: Technical Faculty "Mihajlo Pupin", 2020. Str. 313-318, ilustr. ISBN 978-86-7672-340-9. [COBISS.SI-ID 44230659]

BUBIK, Anja, KOLAR, Lucija. Greening as a perspective solution for urban microclimate mitigation : a pilot study. V: *Proceedings*. VIII International Conference Industrial Engineering and Environmental Protection (IIZS 2018), Zrenjanin, 11-12th October 2018. Zrenjanin: Technical Faculty "Mihajlo Pupin", 2018. Str. 351-355, ilustr. ISBN 978-86-7672-309-6. [COBISS.SI-ID 23497013]