

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	MERILNE TEHNIKE V VARSTVU OKOLJA
COURSE TITLE:	Measuring techniques in environmental protection

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Varstvo okolja in ekotehnologije, 1. stopnja	Modul: Ugotavljanje stanja okolja	2. in 3.	/
Environmental Protection and Eco-technologies, 1 st level	Module: Determination of the state of environment	2 nd and 3 rd	/

Vrsta predmeta / Course type Modularni predmet / Modular subject

Univerzitetna koda predmeta / University course code: MTV

Predavanja Lectures	Seminar Seminar	Sem. Vaje Tutorial	Lab. vaje Laboratory work	Teren. vaje Field work	Samost. delo Individ. work	ECTS
25	/	/	20	/	90	5

Nosilec predmeta / Lecturer: dr. Andrej Meglič

Jeziki / Languages:	Predavanja / Lectures:	Slovenski / Slovenian
	Vaje / Tutorial:	Slovenski / Slovenian

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Pogojev ni	No prerequisites

Vsebina:

- **Fizikalni in kemični senzorji** (mehanski, električni, elektrokemijski, svetlobni)
- **Temelji zajemanja in obdelave meritev** (zajemanje podatkov, filtriranje podatkov, obdelava podatkov, prikaz podatkov, zajemanje in obdelava slike)
- **Osnove programiranja** (programski jezik Octave, odprtokodni sistem programske opreme in mikrokontrolerja Arduino, FiJi)
- **Mikroskopija** (optična, elektronska, analitska)
- **Spektroskopske metode** (optična, XRF)

Content (Syllabus outline):

- **Sensors for physical and chemical parameters** (mechanical, electrical, electrochemical, light detectors)
- **Basics of data capturing and processing** (data capture, data filtering, data processing, data presentation, image capturing and processing)
- **Programming** (programming language Octave, open-source hardware and software Arduino, FiJi)
- **Microscopy** (optical, electron microscopy, analytical microscopy)
- **Spectroscopic methods** (optical, XRF)

Temeljni literatura in viri / Textbooks:

Anjum, N.A., Pereira, M.E., Ahmad, I., Duarte, A.C., Umar, S. and Khan, N.A., 2012. *Phytotechnologies: remediation of environmental contaminants*. CRC Press.

Humphreys, J., Beanland, R. and Goodhew, P.J., 2014. *Electron microscopy and analysis*. CRC Press.

Dempster, J., 2001. *The laboratory computer: a practical guide for physiologists and neuroscientists*. Academic Press.

Cilji in kompetence:**Predmetno specifični cilji in kompetence:**

- študente seznaniti s temeljnimi merilnimi tehnikami
- študenta usposobiti za samostojno delo in uporabo ustreznih metod in tehnik

Splošne kompetence:

- spodbuditi pridobivanje znanj o novih merilnih tehnikah

Objectives and competences:**Specific competences:**

- students are acquainted with basic measuring techniques
- students are qualified for individual work and usage of appropriate methods and techniques

General competences:

- to encourage the acquisition of knowledge of new measuring techniques

Predvideni študijski rezultati:**Znanje in razumevanje**

Študent bo ob zaključku tega predmeta sposoben:

- poznavanja temeljnih merilnih tehnik v varstvu okolja
- razumevanja principa delovanja izbranih metod in tehnik
- analize dobljenih podatkov

Prenesljive/ključne spretnosti in drugi atributi:

- uporaba ustreznih metod in tehnik pri reševanju konkretnih znanstvenih problemov na izbranem področju
- zbiranje in interpretacija podatkov
- poročanje
- spretnosti uporabe domače in tuje literature

Intended learning outcomes:**Knowledge and Understanding**

The student will be at the completion of this course able to:

- demonstrate knowledge about the basic measuring techniques in environmental protection
- understand principles of selected methods and techniques
- data analysis

Transferable/Key Skills and other attributes:

- use of appropriate research methods and techniques concerning concrete scientific problems within the field of investigation

Metode poučevanja in učenja:**Oblike dela:**

- predavanja
- seminarji

Metode dela:

- razlaga
- dialog, diskusija
- preučevanje praktičnih primerov
- aktivno skupinsko delo
- priprava, predstavitev in zagovor seminarske naloge

Learning and teaching methods:**Forms of teaching:**

- in-class lectures
- seminars

Teaching methods:

- explanation
- discussion, debate
- practical demonstration
- teamwork
- preparation, presentation of a seminar paper

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
<ul style="list-style-type: none"> - pisni izpit - priprava, predstavitev in zagovor seminarske naloge <p>Ocenjevalna lestvica:</p> <ul style="list-style-type: none"> • zadostno 6: 51-60 % • dobro 7: 61-70 % • prav dobro 8: 71-80 % • prav dobro 9: 81-90 % • odlično 10: 91-100 % 	<p>70</p> <p>30</p>	<ul style="list-style-type: none"> - written exam - preparation, presentation and defence of seminar paper <p>Grading system:</p> <ul style="list-style-type: none"> • Sufficient D (6): 51-60 % • Good C (7): 61-70 % • Very good B (8): 71-80 % • Very good B+ (9): 81-90 % • Excellent A (10): 91-100 %

Materialni pogoji za izvedbo predmeta :

<ul style="list-style-type: none"> - predavalnica z multimedijno opremo - laboratorij s specifično laboratorijsko opremo
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Material conditions for subject realization:

<ul style="list-style-type: none"> - classroom with the multimedia equipment - laboratory with specified laboratory equipment

Obveznosti študentov:

<ul style="list-style-type: none"> - Izdelana seminarska naloga
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Student's commitments:

<ul style="list-style-type: none"> - Seminar paper

Reference nosilca predmeta:

<p>Pedagoška in strokovna aktivnost:</p> <ul style="list-style-type: none"> - pomoč pri izvedbi vaj s področja fiziologije živali, biologije človeka in nevrobiologije pri različnih predmetih na univerzitetnih študijskih programih 1. in 2. bolonjske stopnje BF Univerze v Ljubljani - somentor pri magistrskih in diplomskih delih - strokovna pomoč – skrbništvo pri diplomskih, magistrskih nalogah in doktorskih nalogah ter gostovanj študentov iz tujine <p>Bibliografija:</p> <ul style="list-style-type: none"> - 12 izvernih znanstvenih člankov v revijah, ki jih citira SCI - 4 izvorni znanstveni članki v domačih revijah - 1 izvorni znanstveni članek v tuji reviji brez SCI - več objavljenih znanstvenih in strokovnih prispevkov in povzetkov prispevkov na mednarodnih in domačih konferencah - 1 patentna prijava (Method and system for simultaneous detection of micro-particle concentration in suspension and their morphological and physiological traits) <p>Raziskovalni projekti</p> <p>Trenutno:</p> <ul style="list-style-type: none"> - AFOSR »Optics and information processes of horsefly polarization vision that underlie visual searching« <p>Pretekli projekti:</p> <ul style="list-style-type: none"> - KROP C2130-12-000037 (Razvoj novih sistemov za čiščenje onesnaženih vod z BDD tehnologijo) - LIFE "Inovativna tehnologija kontrole cvetenja cianobakterij"
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Lecturer's references:

<p>Teaching and professional activity:</p> <ul style="list-style-type: none"> - participation in organisation of physiology, human biology and neurobiology courses in different subjects for BSc and MSc students in Biotechnical faculty and Faculty of Chemistry and Chemical Technology, University of Ljubljana - co-supervisor for master's and undergraduate theses - professional assistance during MSc, BSc and PhD theses preparation and student exchanges <p>Bibliography:</p> <ul style="list-style-type: none"> - 12 original scientific articles in journals cited by the SCI - 4 original scientific articles in national journals - 1 original scientific article in journals not cited by the SCI - several published scientific and professional conference contributions and contribution abstracts for national and international symposia - 1 patent application (Method and system for simultaneous detection of micro-particle concentration in suspension and their morphological and physiological traits) <p>Research projects:</p> <p>Current:</p> <ul style="list-style-type: none"> - AFOSR »Optics and information processes of horsefly polarization vision that underlie visual searching« <p>Past:</p> <ul style="list-style-type: none"> - KROP C2130-12-000037 (Development of new systems for cleaning polluted water using BDD technology)

- LIFE "Razgradnja farmacevtikov v odpadnih vodah iz domov za ostarele in bolnišnic"

Udeležbe na tečajih in kongresih

- praktično usposabljanje na mednarodni šoli Naprednih optičnih tehnik v Veliki Britaniji
- usposabljanje v laboratoriju dr. Toma Carterja na britanskem nacionalnem inštitutu za medicinske raziskave (NIMR)
- aktivne udeležbe na večih mednarodnih in domačih kongresih

- LIFE "Innovative technology for cyanobacterial bloom control"
- LIFE "Degradation of pharmaceuticals in wastewaters from nursing homes and hospitals"

Participation in courses and congresses:

- MRC Course in Advanced Optical Microscopy, Marine Biological Association, U.K.
- training at NIMR (London, U.K.) in dr. Tom Carter's group for physical biochemistry.
- active participations at national and international symposia