UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Orodja za nadzor kakovosti okolja
Course title:	Tools for Environmental Quality Control

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Ekotehnologije, 3. stopnja	/	1	1
Ecotechnologies, 3rd cycle	/	1	1

Vrsta predmeta / Course type	Obvezni / Mandatory
Univerzitetna koda predmeta / University course code:	EKO3-766

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30	30			30	**210**	**10**

**Navedena porazdelitev ur velja, če je vpisanih vsaj 15 študentov. Drugače se obseg izvedbe kontaktnih ur sorazmerno zmanjša in prenese v samostojno delo. / This distribution of hours is valid if at least 15 students are enrolled. Otherwise the contact hours are linearly reduced and transferred to individual work.*

Nosilec predmeta / Lecturer:	prof. dr. Milena Horvat prof. dr. Nives Ogrinc Prof. dr. Sonja Lojen Prof. dr. Radmila Milačič Prof. dr. Janez Ščančar Doc. dr. Marko Štrok Doc. dr. Jože Kotnik Prof. dr. Ester Heath Doc. dr. Tina Kosjek Prof. dr. Tomaž Grušovnik Doc. dr. Branko Kontić

Jeziki / Languages:	**Predavanja / Lectures:**	slovenščina, angleščina Slovenian, English
	Vaje / Tutorial:	slovenščina, angleščina Slovenian, English

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Zaključen študij druge stopnje ustrezne naravoslovne ali tehniške smeri ali zaključen študij drugih smeri z dokazanim poznavanjem osnov področja predmeta (pisna dokazila, pogovor).	Completed second level studies in natural sciences or engineering or completed second level studies in other fields with proven knowledge of fundamentals in the field of this course (certificates, interview).

Vsebina:	**Content (Syllabus outline):**
Onesnaževala v okolju: • Viri onesnaževal v okolju • Razumevanje in prepoznavanje onesnaževanja	Presence of pollutants in the environment: • Sources of pollutants in the environment • Understanding and recognizing pollution of

biosfere, hidrosfere, litosfere in atmosfere
- Prepoznavanje, karakterizacija in remediacija kontaminiranih območij (poudarek na toksičnih kemijskih elementih, naravnih in umetnih radionuklidih ter organskih onesnaževalih)
- Uporaba zakonodaje in normativov pri reševanju izbranih okoljskih problemov
- Primeri bodo prilagojeni ciljem in vsebini raziskovalnega projekta podiplomca

Meritve v okolju - monitoring
- Načrtovanje izvajanja meritev, vzorčenje itd.
- Uvajanje metod za biološki in kemijski nadzor ter ugotavljanje vsebnosti onesnaževal v okolju in ostalih parametrov kvalitete okolja
- Nadzor nad organskimi onesnaževali, anorganskimi onesnaževali v sledovih in speciacijo elementov, naravnimi in umetnimi radionuklidi
- Prepoznavanje in uvajanje sledil v okolju
- Zagotavljanje kakovosti pri okoljskih meritvah

Obdelava podatkov in modeliranje
- Pridobivanje informacij z metodami preslikave podatkov (mapiranje)
- Kalibracija in modeliranje (linearno, nelinearno, metoda glavnih osi, umetne nevronske mreže)
- Optimizacija s pomočjo modelov (genetski algoritmi)
- Uporaba modela v sklopu podiplomskih projektov

Ocene posegov v okolje:
- Razvijanje usposobljenosti za ocenjevanje vplivov na okolje za plane, programe in politike
- Snovanje ocen vplivov na okolje s primerjavo različic ob upoštevanju razvojnih potreb in varstvenih interesov
- Usposabljanje za večparametrsko vrednotenje in odločanje

Osnove okoljske etike:
- Znanja o medsebojnem prežemanju znanosti in družbe z etično in okoljsko problematiko znanosti

biosphere, hydrosphere, lithosphere and atmosphere
- Identification, characterization and remediation of contaminated sites (emphasis on toxic chemical elements, natural and artificial radionuclides and organic pollutants)
- Application of legislation and norms in solving selected environmental problems
- Examples will be tailored to the goals and content of the postgraduate research project.

Environmental measurements
- Planning the performance of measurements, sampling etc.
- Introduction of methods for biological and chemical monitoring and identification of the content of pollutants in the environment, and other environmental quality parameters
- Control over organic pollutants, inorganic pollutants in trace amounts and element speciation, natural and artificial radionuclides
- Identification and introduction of tracers in the environment
- Assuring quality in environmental measurements

Data processing
- Acquisition of information by data mapping methods
- Calibration and modelling (linear, nonlinear, principal axes method, artificial neural networks)
- Optimization by means of models (genetic algorithms)
- Use of the model within the scope of postgraduate projects

Environmental impact assessment:
- Development of qualifications for the environmental impact assessment for plans, programmes and policies
- Devising and planning environmental impact assessments based on comparative evaluation of alternatives while taking into consideration both societal development needs and environmental protection interests
- Training for multi-parameter evaluation and decision-making

Introduction to environmental ethics:
- The basic knowledge on the internal relationship

	of science and society and on ethical and environmental problems in science will be given

Temeljni literatura in viri / Readings:

Knjiga / Book:

- Riki Therivel. Strategic Environmental Assessment In Action. London: Earthscan (2004), 276 p., ISBN -10: 1-84407-042-5
- Mlinar, Anton (2014): Okoljska etika in trajnostni razvoj. Annales, Koper.
- W.G.Landis, R.M.Sofield, M-H. Yu, Introduction to Environmental Toxicology, CRC Press 4th edition, 2011
- I:L: Pepper, C.P. Gerba, M. L. Brussea, Pollution Science, Academic Press, 1996, ISBN0-12-550660-0.
- Marsal, Soil Pollution: origin, monitoring, and remediation, 2nd Edition, 2008, Springer.
- J. Riewerts, The elements of environmental pollution, Routledge, NY, 2015.
- G.I. Sunahara, A.Y. Renoux, C. Thallen, C.L. Gaudet, A. Pilon (eds.). Environmental Analysis of Contaminated Sites. New York: Wiley&Sons (2001), 465 p., ISBN 0-471-98669-0

Revije / Periodicals:

- Pregledni članki, izbor v tekočem letu/Review articles, yearly selection.
- Environmental Reviews, Environmental Pollution, The Science of the Total Environment, Environmental Science and Technology, Environmental Management, Environmental Sciences, etc..

Cilji in kompetence:	**Objectives and competences:**
Predmet je namenjen neposredni podpori industriji pri uporabi orodij za nadzor kakovosti okolja v sklopu razvojnih projektov podiplomcev. Izbor vsebin, metod in tehnik za nadzor kakovosti okolja, nadzornih meritev (monitoringa), sistemov kakovosti in obdelave podatkov je v izvedbi programa načrtovan na specifičnih potrebah industrije. Prav tako se bodo študentje seznanili z razumevanje pravnega vidika varstva okolja, tako evropske, mednarodne kot nacionalne zakonodaje. Poudarek bo na pravilni uporabi pravil varstva okolja glede na posamezne prvine varstva okolja in narave. Kompetence študenta z uspešno zaključenim predmetom bodo vključevale razumevanje osnovnih pojmov področja ter sposobnost za: • obvladovanje in razumevanje temeljnih značilnosti onesnaženih in degradiranih okolij ter načrtovanja sanacije, • karakterizacijo in identifikacijo degradiranih in onesnaženih okolij in izvedbo nadzornih meritev (monitoring), • uporabo podatkovnih baz in okoljskega modeliranja, • razumevanja strateških ocen posegov v okolju, • razumevanje in analizo etičnih aspektov praks,	The course is intended to prepare students to integrate tools for environmental control in their research projects in industrial use and applications. The content, methods and techniques and monitoring strategies are based on specific industrial needs of the students. The understanding and proper use of the environmental legislation at the international, European and national level will also be integrated in the course. Students' competences with successful completion will include understanding the basic concepts of the field and the ability to: • mastering and understanding the basic characteristics of contaminated and degraded environments and remediation planning, • characterization and identification of degraded and contaminated sites and implementation of control measurements (monitoring), • use of databases and environmental modeling, • understanding of strategic assessments of environmental assessments, • understanding and analysis of ethical aspects of practices, institutions and evaluations related to the environment and systemic understanding of dynamic processes in nature and society, • and the ability to carry out preventive

institucij in vrednotenj, povezanih z okolje, in sistemsko razumevanje dinamičnih procesov v naravi in družbi, • sposobnost za izvajanje preventivnega okoljevarstvenega delovanja.	environmental protection.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: • razumevanje kemijskih, fizikalnih in bioloških dejavnikov okolja v najširšem smislu, s poudarkom na interakcijah med naravnimi procesi in človekovo dejavnostjo, • razumevanje družbeno ekonomskih dejavnikov pri nadzoru stanja v okolju, • sinteze, presojanja in uporabo okoljskih podatkov pri oceni vplivov na okolje, • usposobljenost za odkrivanje, analizo in presojo moralnih ter političnih stališč in argumentacija na področju okolja. Prenesljive/ključne spretnosti in drugi atributi: • razumevanje interdisciplinarnega pristopa pri okoljskih znanostih, • uporaba domače in tuje literature, • vključevanja znanja v gradnjo hipotez za reševanje problemov, ciljano k temi doktorata.	Knowledge and understanding: • understanding of chemistry, physics and biology in the context of environmental processes, with special emphasis on interactions between natural processes and human activities, • understanding the socio-economic factors in controlling the environmental status, • synthesis, evaluation and application of data and knowledge in the process of environmental impact assessments, • the student will be competent to discover, analyse and make judgments of moral and political views and argumentations regarding the environment. Transferable / Key Skills and other attributes: • understanding of the interdisciplinary approach in environmental sciences, • use of national and international literature, • incorporation of knowledge into the construction of hypotheses for problem solving, thematically linked to postgraduate thesis.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Interaktivno delo s študentom v obliki predavanj, ogledi na terenu in praktičnim izvajanjem dela tekom priprave seminarske naloge. Seminarske naloge bodo predstavljene vsem študentom z namenom vzpostavljanja medsebojnega sodelovanja pri obravnavi posameznih tematik, predvsem tistih, ki so povezane z raziskovalnimi nalogami študentov.	Interactive work with students in the form of lectures, field visits and practical work, and during the preparation of the seminar work. Seminar assignments will be presented to all students in order to establish mutual cooperation in the discussion of individual topics, particularly those that are related to the doctoral research work of the students.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Seminarska naloga. Ustni izpit. Zagovor projekta - reševanje primera.	30 % 30 % 40 %	Seminar. Oral examination. Presentation of the project - solving the case.

Reference nosilca / Lecturer's references:

- LOJEN, Sonja, KOCMAN, David, HORVAT, Milena. EGIDA methodology use case "Slovenia". V: NATIVI, Stefano (ur.), MAZZETTI, Paolo (ur.), PLAG, Hans Peter (ur.). *Towards a sustainable geoss : [global earth observation system of systems]. some results of the EGIDA project*, Environment and sustainability, [S. l.] AiónEdizioni. 2013, str. 91-103.
- MILAČIČ, Radmila, ZULIANI, Tea, VIDMAR, Janja, OPRČKAL, Primož, ŠČANČAR, Janez. Potentially toxic elements in water and sediments of the Sava River under extreme flow events. *Science of the total environment*, ISSN 0048-9697, 2017, vol. 605/606, str. 894-905, doi: 10.1016/j.scitotenv.2017.06.260.
- KOTNIK, Jože, SPROVIERI, Francesca, OGRINC, Nives, HORVAT, Milena, PIRRONE, Nicola. Mercury in the Mediterranean. Part 1, Spatialand temporal trends. Environmental science and pollution research international, ISSN 0944-1344, vol. 21, no. 6, 2014, Heidelberg: Springer. 2014, vol. 21, no. 6, str. 4063-4080, doi: 10.1007/s11356-013-2378-2
- KONTIĆ, Branko, DERMOL, Urška. Confronting reality in strategic environmental assessment in Slovenia - Costs and benefits. Environmental impact assessment review, ISSN 0195-9255. [Print ed.], 2015, vol. 50, str. 42-52, doi: 10.1016/j.eiar.2014.08.002.
- GRUŠOVNIK, Tomaž. Environmental denial: why we fail to change our environmentally damaging practices. *Synthesis philosophica*, ISSN 0352-7875. International ed., 2012, vol. 27, fasc. 1, str. 91-106. [COBISS.SI-ID 2358227]