

Učni načrti

Univerzitetni študijski program prve stopnje

VODARSTVO IN OKOLJSKO INŽENIRSTVO (UN)

Course Syllabi

1st Cycle Academic Study

**WATER SCIENCE AND
ENVIRONMENTAL ENGINEERING (BA)**

Velja od 2025/2026 | Valid from 2026/2027

Veljavni študijski program na dan 1.10.2026 | Valid study programme at October 1, 2026

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UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	MATEMATIKA I
Course title:	
	MATHEMATICS I

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni	Ni členitve (študijski program)	1. letnik	Zimski

Univerzitetna koda predmeta/University course code:

1629

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
75	0	75	0	0	150	10

Nosilec predmeta/Lecturer:

Marjeta Kramar Fijavž, Gašper Jaklič

Vrsta predmeta/Course type:

Obvezni splošni /Obligatory general

Jeziki/Languages:

Predavanja/Lectures:

Slovenščina

Vaje/Tutorial:

Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

Prerequisites:

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Vsebina:

Content (Syllabus outline):

Množice in preslikave: operacije z množicami, definicijsko območje, zaloga vrednosti, enakost preslikav, kompozitum, graf, injektivnost, surjektivnost, bijektivnost, inverzna preslikava. Naravna, realna in kompleksna števila: princip popolne indukcije, natančna spodnja in natančna zgornja meja (*inf* in *sup*), absolutna vrednost, kompleksna števila: geometrijska predstavitev, računske operacije, polarni zapis, de Moivreova formula, osnovni izrek algebre. Geometrijski vektorji: vsota, produkt s skalarjem, linearna kombinacija, linearna neodvisnost, baza, skalarni produkt, vektorski produkt, mešani produkt, analitična

Sets and mappings: operations with sets, domain, range, equality of maps, composition, graph, injectivity, surjectivity, bijectivity, inverse map. Natural, real and complex numbers: induction principle, exact upper and lower bound (*inf* and *sup*), absolute value, complex numbers: geometric representation, operations, polar form, de Moivre formula, fundamental theorem of algebra. Geometric vectors: sum, product with scalars, linear combination, linear independence, basis, scalar product, vector product, mixed product, analytic geometry. Numerical sequences and series: boundedness and convergence, Cauchy criterium,

geometrija v prostoru. Številski zaporedja in vrste: omejenost in konvergenca, Cauchyjev kriterij, limita, računska pravila, konvergenca številskih vrst, geometrijska in harmonična vrsta, konvergenčni kriteriji. Limita in zveznost funkcije realne spremenljivke: limita funkcije v dani točki, računska pravila, posplošene limite, asimptota, zveznost funkcije, lastnosti zveznih funkcij na zaprtem omejenem intervalu. Odvedljivost funkcije realne spremenljivke: definicija odvoda, tangenta na graf funkcije, računska pravila, Rolleov in Lagrangeov izrek, stacionarne točke in lokalni ekstremi, globalni ekstrem na zaprtem intervalu, l'Hospitalovo pravilo, višji odvodi, Taylorjeva formula, diferencial, konkavnost, konveksnost, prevoj, risanje grafov funkcije. Matrike: matrične operacije, inverzna matrika, matrični zapis sistema linearnih enačb, struktura rešitev, Gaussova metoda eliminacije, matrične enačbe, determinante, lastne vrednosti in lastni vektorji, karakteristični polinom, diagonalizacija. Integral funkcije realne spremenljivke: določen integral, Riemannova vsota, integrabilnost, lastnosti, Newton-Leibnizov izrek, primitivna funkcija, nedoločen integral, uvedba nove spremenljivke, integracija po delih (per partes), posplošeni (izlimitirani) integral, uporaba določenega integrala. Potenčne vrste: konvergenčni polmer, odvajanje, integriranje.	limit, computation rules, convergence of a series, geometric and harmonic series, convergence criteria. Limit and continuity of functions of one real variable: limit of a function at a given point, computation rules, generalized limits, asymptotae, continuity of a function, properties of continuous functions on closed bounded interval. Derivative of functions of one real variable: definition, tangent on a graph of a function, computation rules, theorem of Rolle and Lagrange, stationary points and local extrema, global extremum on a closed interval, l'Hospital rule, higher derivatives, Taylor formula, differential, concavity, convexity, inflection point, plotting graphs. Matrices: matrix operations, inverse matrix, matrix form of a system of linear equations, structure of solutions, Gauss elimination method, matrix equations, determinant, eigenvalues and eigenvectors, characteristic polynomial, diagonalization. Integral of functions of one real variable: definite integral, Riemannian sum, integrability, properties, Newton-Leibniz formula, primitive function, indefinite integral, substitution, integration by parts (per partes), application of definite integral. Power series: convergence radius, derivation, integration.
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Temeljna literatura in viri/Readings:

Foerster, G.O. 1984. Analysis 1 Vieweg Studium.

Kolar, M.B. 1996. Zgrablić, Več kot nobena, a manj kot ... rešena naloga iz LA. Ljubljana. Pedagoška fakulteta.

Lampret, V. 2012. Matematika 1 - prvi del: Preslikave, števila in vektorski prostori. Ljubljana, UL FGG.

Leon, S. J. 2006. Linear Algebra With Applications, Prentice Hall, Pearson International Edition.

Mizori-Oblak, P. 1987. Matematika za študente tehnike in naravoslovja I. Ljubljana, UL FS.

Vidav, I. 1973. Višja matematika I, II. Ljubljana. DMFA Slovenije.

Cilji in kompetence:

Cilji

- podati osnovna znanja, na katerih lahko grade strokovni predmeti,
 - zagotoviti obvladovanje osnovnih računskih veščin,
 - omogočiti razumevanje matematičnega aparata, ki ga uporabljajo strokovni predmeti.
- Pridobljene kompetence

Objectives and competences:

Objectives

- to provide general basic knowledge for the engineering courses,
 - to ensure mastering of basic computational skills,
 - to enable understanding of mathematical tools used by engineering courses.
- Gained competences

• sposobnost abstraktne formulacije konkretnih problemov, • krepiti smisel za sistematičnost, jasnost in preciznost formulacij, • razvijanje matematičnega mišljenja - sklepanje od splošnega k posebnemu in obratno.	• to be able of abstract formulation of practical problems, • to improve the capacity to establish systematical, clear and precise formulation, • to develop mathematical thinking - reasoning from general to special and vice versa.
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Predvideni študijski rezultati:**Intended learning outcomes:**

• Poznavanje in razumevanje osnovnih znanj iz algebre geometrijskih vektorjev, linearne algebre in iz matematične analize, • obvladovanje osnovnih računske spretnosti, • doseženo matematično znanje uporabljajo strokovni predmeti in omogoča nadaljevanje študija matematike, ki jo uporablja tehnika, • sposobnost abstraktne formulacije konkretnih problemov, • spretnost sistematičnega, jasnega in preciznega formuliranja problemov, • sposobnost sklepanja od splošnega k posebnemu in obratno, • spretnost uporabe literature.	• Basic knowledge and understanding of the algebra of geometric vectors, linear algebra and mathematical analysis, • mastering basic computational skills, • the achieved mathematical knowledge is used by the engineering courses and enables the study of mathematics used in technology, • ability of abstract formulation of practical problems, • capability of systematical, clear and precise formulation of problems, • ability of reasoning from general to special and vice versa, • skills in using literature.
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Metode poučevanja in učenja:**Learning and teaching methods:**

predavanja, seminarske vaje, konzultacije, internet	lectures, tutorials, consultations, internet
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Načini ocenjevanja:**Delež/Weight****Assessment:**

Računske naloge in sprotno delo	70,00 %	Exercises and homework
Izpit (teoretični del)	30,00 %	Exam (theoretical part)

Reference nosilca/Lecturer's references:

ENGEL, Klaus, KRAMAR FIJAVŽ, Marjeta, KLÖSS, Bernd, NAGEL, Rainer, SIKOLYA, Eszter. Maximal controllability for boundary control problems. Appl. math. optim., 2010, vol. 62, no. 2, str. 205-227.

KRAMAR FIJAVŽ, Marjeta, MUGNOLO, Delio, SIKOLYA, Eszter. Variational and semigroup methods for waves and diffusion in networks. Appl. math. optim., 2007, vol. 55, no. 2, str. 219-240.

KRAMAR FIJAVŽ, Marjeta, SIKOLYA, Eszter. Spectral properties and asymptotic periodicity of flows and networks. Math. Z., 2005, vol. 249, no. 1, str. 139-162.

JAKLIČ, Gašper, KOZAK, Jernej, KNEZ, Marjetka, VITRIH, Vito, ŽAGAR, Emil. High-order parametric polynomial approximation of conic sections, Constructive Approximation, 2013, vol. 38, iss. 1, 1-18.

JAKLIČ, Gašper, KOZAK, Jernej, KNEZ, Marjetka, VITRIH, Vito, ŽAGAR, Emil. Hermite geometric interpolation by rational Bezier spatial curves. SIAM Journal on Numerical Analysis, 2012, vol. 50, no. 5, 2695-2715.

JAKLIČ, Gašper, ŽAGAR, Emil. Planar cubic G1 interpolatory splines with small strain energy. Journal of Computational and Applied Mathematics, 2011, vol. 235, iss. 8, 2758-2765.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	FIZIKA
Course title:	
	PHYSICS

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni	Ni členitve (študijski program)	1. letnik	Zimski

Univerzitetna koda predmeta/University course code:

1581

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
75	15	45	0	0	135	9

Nosilec predmeta/Lecturer:

Zvonko Jagličić

Vrsta predmeta/Course type:

Obvezni splošni /Obligatory general

Jeziki/Languages:

Predavanja/Lectures:

Slovenščina

Vaje/Tutorial:

Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

Prerequisites:

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Vsebina:

Content (Syllabus outline):

Merske napake; (*) kinematika; sile, navori, dinamika; gibalna in vrtilna količina; delo, moč, energija; gravitacija: keplerjevi zakoni, newtonov gravitacijski zakon, potencialna energija, gibanje satelitov; nihanje in valovanje; (*) zgradba snovi; deformacije (*); mirujoče tekočine: težni tlak, manometri, vzgon (*); temperatura: temperaturne skale, razteznost, plinska enačba; energijski zakon: notranja energija, toplota, prenos toplote, spremembe agregatnega stanja, vlažnost; elektrostatika (*); električni tok: Ohmov zakon, delo in moč, električni instrumenti (*); magnetizem;

Physics and measurements; (*) kinematics; forces, torques, dynamics; momentum and angular momentum; work, power, energy; gravitation (Kepler's laws, Newton's gravity law, potential energy, motion of satellites); oscillations and waves; (*) structure of matter; (*) elastic deformations; (*) static of fluids: pressure, pressure measurements, Buoyant forces; temperature, various temperature scales, thermal expansion, equation of state for ideal gas; the first law of thermodynamics, internal energy, heat transfer(*), phase changes; electrostatics (*); electric current (Ohm's law, work

indukcija (*); elektromagnetno valovanje; sevanje segrelih teles; svetloba; svetlobni izvori: sonce, prehod svetlob skozi ozračje, fotometrija; geometrijska optika: odboj svetlobe, zrcala, lom svetlobe, leče, optični instrumenti; valovna optika: polarizacija, interferenca; fotonska teorija svetlobe; posebna teorija relativnosti. Vsebine označene z (*) bodo podrobneje obravnavane na seminarjih ali kot računski zgledi na seminarskih vajah.	and power, electric instruments (*); magnetism; (*) induction; electromagnetic waves; radiation of heated bodies; visible light; light sources (Sun, absorption of light in atmosphere, photometry); geometric optics (reflection and refraction of light, mirrors, lenses, optic instruments); wave optics: polarization and interference of light; photons as quanta of light; special theory of relativity. Topics labelled with (*) will be discussed in more detail at seminars or as assigned exercises.
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Temeljna literatura in viri/Readings:

Kladnik, R.. 1979. Osnove fizike I. in II. del. Ljubljana, DZS. Kladnik, R.. 1989. Visokošolska fizika, del I., II. in III. 1989. Ljubljana, DZS. R.A. Serway. 1996. Physics for Scientists & Engineers with Modern Physics. Saunders College Publ., Philadelphia. R. Kladnik, H. Šolinc. 1996. Zbirka fizikalnih nalog z rešitvami, I. del. R. Kladnik, H. Šolinc. 1991. Zbirka fizikalnih problemov z rešitvami, II. del. Učno gradivo (zbirka vaj) na spletnih straneh www.kmf.fgg.uni-lj.si/fizika. J. Peternelj, T. Kranjc: Osnove fizike, UL FGG 2014.

Cilji in kompetence:

- Spoznati osnovne zakonitosti in pomen fizikalnih metod pri opisu naravnih pojavov,
- fizikalni način razmišljanja pri formulaciji in reševanju tehničnih problemov,
- obvladovanje praktične in teoretične osnove fizike, potrebne za študij in razumevanje stroke.

Objectives and competences:

- To learn the basic physical laws and will become acquainted with the methods used for the description of natural laws,
- to recognize, formulate and solve engineering problems using the methods of physics,
- to manage practical and theoretical basics of physics necessary for study and understanding of the profession.

Predvideni študijski rezultati:

- Poznavanje in razumevanje osnovnih znanj iz poglavij fizike, ki so opisana v vsebini predmeta,
- študenti se bodo naučili uporabljati osnovne fizikalne zakonitosti pri računski obravnavi zgledov, ki so povezani s prakso v tehniki,
- cilj dela pri vajah in seminarju je, da se študenti naučijo, kako določen zahteven fizikalno-tehniški problem smiselno poenostavijo in s preprostimi računskimi operacijami ocenijo velikost neznane količine,
- s pridobljenim znanjem bodo študenti sposobni prepoznati fizikalno ozadje različnih naravnih

Intended learning outcomes:

- Solid knowledge and understanding of the topics listed in the content section,
- the students will learn to apply the methods of physics in order to solve engineering problems,
- the seminars and problem solving classes are structured so as to teach the students how to simplify complex problems and obtain an approximate solution,
- with gained knowledge, students will be able to recognize the physical background of various natural phenomena and technological processes and gain the ability to critically analyze them.

pojavov in tehnoloških procesov ter pridobili sposobnost kritične analize le teh.	
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Metode poučevanja in učenja:**Learning and teaching methods:**

Predavanja in seminar z demonstracijskimi poskusi in računalniškimi simulacijami.	Lectures and seminars together with laboratory demonstrations and computer simulations.
Računski zgledi na seminarskih vajah.	Problem solving classes.
Individualne naloge ali seminarji.	Individual assignments or seminars

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

Teoretični del (pisno in ustni zagovor)	40,00 %	Written or oral answers to selected theoretical questions
Projekt (seminarska naloga)	10,00 %	Written seminar report
Računski del (pisno)	50,00 %	Written solution of assigned problems

Reference nosilca/Lecturer's references:

ZORKO, Andrej, PREGELJ, Matej, GOMILŠEK, Matjaž, JAGLIČIĆ, Zvonko, PAJIĆ, Damir, TELLING, M., ARČON, Iztok, MIKULSKA, Iuliia, VALANT, Matjaž. Strain-induced extrinsic high-temperature ferromagnetism in the Fe-doped hexagonal barium titanate. 2015. Scientific reports 5, 7703-1-7703-7.

COTIČ, Patricia, KOLARIČ, Dejan, BOKAN-BOSILJKOV, Violeta, BOSILJKOV, Vlatko, JAGLIČIĆ, Zvonko. 2015. Determination of the applicability and limits of void and delamination detection in concrete structures using infrared thermography. NDT & E International 74, 87-93.

JAGLIČIĆ, Zvonko, PAJIĆ, Damir, TRONTELJ, Zvonko, DOLINŠEK, Janez, JAGODIČ, Marko. 2013. Magnetic memory effect in multiferroic K3Fe5F15 and K3Cr2Fe3F15. Appl. phys. lett., 102.

COTIČ, Patricia, JAGLIČIĆ, Zvonko, NIEDERLEITHINGER, Ernst, EFFNER, Ute, KRUSCHWITZ, Sabine, TRELA, Christiane, BOSILJKOV, Vlatko. 2013. Effect of moisture on the reliability of void detection in brickwork masonry using radar, ultrasonic and complex resistivity tomography. Materials and Structures 46, 1723–1735.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	OSNOVE EKOLOGIJE CELINSKIH VODA
Course title:	
	FUNDAMENTALS OF FRESHWATER ECOLOGY

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni (od študijskega leta 2025/2026 dalje)	Ni členitve (študijski program)	1. letnik	1. semester	obvezni

Univerzitetna koda predmeta/University course code:	0038800
Koda učne enote na članici/UL Member course code:	1020

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
30	0	20	0	10	60	4

Nosilec predmeta/Lecturer:	Gorazd Urbanič
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Vrsta predmeta/Course type:	Obvezni strokovni /Obligatory professional
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Jeziki/Languages:	Predavanja/Lectures:	Slovenščina
	Vaje/Tutorial:	Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:

Vsebina:	Content (Syllabus outline):
Razlaga pojmov biologija, mikrobiologija, ekologija, varstvo okolja; abiotске značilnosti tekočih in stoječih celinskih voda, fizikalna struktura ekosistema, habitata in ekološke niše; kemizem celinskih voda, kroženje snovi, poudarek na organskih in hranilnih snoveh; biotske značilnosti stoječih voda, življenjske združbe planktona in bentosa; trofičnost, vzroki in posledice evtrofnosti;	Clarification of the following terms: biology, microbiology, ecology, environmental protection; abiotic characteristics of the running and standing inland waters, the physical structure of ecosystems, habitats and ecological niches; Inland water chemistry, circulation of matter, with an emphasis on organic matter and nutrients; biotic characteristics of standing water, biological

biotske značilnosti tekočih voda, življenjske združbe perifitona, bentoških nevretenčarjev; saprobnost, samočistilni procesi; metode vrednotenja ekološkega stanja celinskih voda; onesnaževanje in obremenjevanje vodnih ekosistemov; biološka čiščenja in vloga mikroorganizmov pri procesih razgradnje; ekosistemski pristop k upravljanju voda.	communities of plankton and benthos; trophic status, causes and consequences of eutrophication; biotic characteristics of running water, biological communities of periphyton and benthic invertebrates; saprophytic status, self-cleaning processes; methods of biological evaluation of the ecological status of inland waters; pollution and loading of aquatic ecosystems; biological treatments and the role of microorganisms in decomposition processes; river basin management - ecosystem approach..
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Temeljna literatura in viri/Readings:

Moss, B. (2010). Freshwater Ecology. A view for the Twenty-first Century. Wiley-Blackwell, A John-Wiley and Sons, Ltd. Publication, 470 pages. Poglavja: 7, 8, 9, 10, 11, 16

Allan J.D., Castillo M. M. 2007. Stream Ecology, Structure and function of running waters. 2nd ed. Springer, 436 str.

Tarman, K. 1992. Osnove ekologije in ekologija živali. Ljubljana, DZS, 547 str.

Urbanič, G., Toman, M. J. 2003. Varstvo celinskih voda. Ljubljana, Študentska založba, 94 str.

Priporočena literatura/Recommended reading list:

Urbanič, G. (2011). Ecological status assessment of the rivers in Slovenia – an overview. Nat Slov 13:5-16

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

Cilji - Podajanje osnovnih naravoslovnih znanj, na katerih grade strokovni predmeti, - obvladovanje osnov biologije z ekologijo. Pridobljene kompetence - Znati kritično presojati podatke okoljskih analiz in meritev, - znati sodelovati pri reševanju konkretnih ekoloških problemov v okolju, - razviti ekološko in okoljsko razmišljanje o inženirskih problemih in posegih v okolje.	Objectives - To deliver basic environmental knowledge, which provides adequate foundations for subsequent classes, - to manage basics of biology and ecology. Gained competences - To be able to critically assess environmental data, - to be able to participate in solving ecological problems in the environment, - to develop ecological and environmental reflections on engineering problems and interventions in the environment.
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Predvideni študijski rezultati:**Intended learning outcomes:**

- Poznavanje in razumevanje osnovnih znanj iz biologije, mikrobiologije in ekologije, - uporaba ekoloških zakonitosti pri reševanju okoljskih problemov, - razumevanje metod vrednotenja okolja, - spodobnost kritične presoje podatkov dobljenih pri okoljskih raziskavah,	- Knowledge and understanding of basics in biology, microbiology and ecology, - the use of ecological principles in solving environmental problems, - understanding the methods of environmental evaluation, - the ability for critical analysis of data obtained in environmental studies,
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• sposobnost sklepanja od splošnega ekološkega k posebnemu in obratno, • spretnost uporabe in razumevanje okoljske literature.	• the ability of reaching conclusions from the general to the specific and vice versa, • the ability to use and understand environmental literature.
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Metode poučevanja in učenja:**Learning and teaching methods:**

Predavanja, delo v laboratoriju in terensko delo.	Lectures, laboratory work and field work.
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Načini ocenjevanja:**Delež/Weight****Assessment:**

ustni/pisni izpit	50,00 %	oral/written exam
kolokvij iz vaj	50,00 %	mid-term exam

Ocenjevalna lestvica:**Grading system:**

5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10
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Reference nosilca/Lecturer's references:

URBANIČ, Gorazd, MIHALJEVIČ, Zlatko, PETKOVSKA, Vesna, PAVLIN URBANIČ, Maja. Back to ecology : reference conditions as a basis for assessment, restoration and sustainable management of large rivers. *Water*. 2 Sep. 2021, iss. 18, [article] 2596, str. 1-19, ilustr. <https://www.mdpi.com/2073-4441/13/18/2596>, DOI: [10.3390/w13182596](https://doi.org/10.3390/w13182596)

URBANIČ, Gorazd, POLITTI, Emilio, RODRÍGUEZ-GONZÁLEZ, Patricia María, PAYNE, Robin, SCHOOK, Derek, ALVES, Maria Helena, ANĐELKOVIČ, Ana, BRUNO, Daniel, CHILIKOVA-LUBOMIROVA, Mila, DI LONARDO, Sara, EGOZI, Roey, MIHALJEVIČ, Zlatko, PAVLIN URBANIČ, Maja, et al. Riparian zones-from policy neglected to policy integrated. *Frontiers in environmental science*. 28 Apr. 2022, vol. 10, str. 1-8, ilustr.

KNEHTL, Miha, PODGORNIK, Samo, URBANIČ, Gorazd. Scale-dependent effects of hydromorphology and riparian land-use on benthic invertebrates and fish : implications for large river management. *Hydrobiologia*. Apr. 2021, vol. 848, str. 3447-3467, ilustr. ISSN 1573-5117.

URBANIČ, Gorazd. Ecological status assessment of the rivers in Slovenia - an overview = Vrednotenje ekološkega stanja rek v Sloveniji - pregled. *Natura Sloveniae : revija za terensko biologijo*. [Tiskana izd.]. 2011, letn. 13, št. 2, str. 5-16, ilustr. ISSN 1580-0814

URBANIČ, Gorazd, MIHALJEVIČ, Zlatko, PETKOVSKA, Vesna, PAVLIN URBANIČ, Maja. Disentangling the effects of multiple stressors on large rivers using benthic invertebrates : a study of Southeastern European large rivers with implications for management. *Water*. 2020, vol. 12, iss. 3, str. 1-25. ISSN 2073-4441. <https://www.mdpi.com/2073-4441/12/3/621>, DOI: [10.3390/w12030621](https://doi.org/10.3390/w12030621).

POIKĀNE, Sandra, REMEC-REKAR, Špela, URBANIČ, Gorazd, et al. Defining chlorophyll-a reference conditions in European lakes. *Environmental management*. 2010, vol. 45, no. 6, str. 1286-1298. ISSN 0364-152X. [COBISS.SI-ID [2243407](https://cobiss.si/2243407)]

URBANIČ, Gorazd, PETKOVSKA, Vesna, ŠILING, Rebeka, KNEHTL, Miha. Poznavanje vplivov in sprejemanje rešitev lahko privede do boljšega stanja voda. V: CERKVENIK, Stanka (ur.), ROJNIK, Enisa (ur.). *Zbornik referatov : simpozij z mednarodno udeležbo*. Ljubljana: Slovensko društvo za zaščito voda, 2018. Str. 45-54, ilustr. ISBN 978-961-6631-12-9. [COBISS.SI-ID [8617057](https://cobiss.si/8617057)]

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	UVOD V OKOLJSKO INŽENIRSTVO
Course title:	
	INTRODUCTION TO ENVIRONMENTAL ENGINEERING

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni	Ni členitve (študijski program)	1. letnik	Zimski

Univerzitetna koda predmeta/University course code:	1578
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Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
45	15	30	0	0	90	6

Nosilec predmeta/Lecturer:	Dušan Žagar, Nataša Atanasova, Simon Rusjan
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Vrsta predmeta/Course type:	Obvezni strokovni /Obligatory professional
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Jeziki/Languages:	Predavanja/Lectures:	Slovenščina
	Vaje/Tutorial:	Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:

Vsebina:	Content (Syllabus outline):
Okoljsko inženirstvo združuje številne discipline, ki so potrebne, da gospodarno in dolgoročno zagotavljamo zdravo bivalno in naravno okolje za ljudi in vsa živa bitja na planetu, izkoriščamo obnovljiva naravna bogastva in energijo, skrbimo za zmanjševanje negativnega človeškega vpliva na okolje in povečevanje pozitivnih vplivov, zagotavljanje javnega zdravja itd. Predmet Uvod v okoljsko inženirstvo podaja uvid v to kompleksno povezanost disciplin in na primerih pojasnjuje inženirske metode, s katerimi analiziramo in predvidimo delovanje okoljskih procesov.	Environmental Engineering brings together many disciplines in order to: ensure healthy living and natural conditions for people and all living creatures on our planet, use renewable natural resources in efficient and sustainable way, minimize negative and maximize positive human environmental impacts, ensure public health... Introduction to Environmental Engineering gives an overview to this complex interconnection of disciplines and uses practical examples to explain engineering methods for analyzing and predicting environmental processes. Lectures are composed from the

Predavanja so sestavljena iz naslednjih osnovnih poglavij: predstavitev predmeta, poslanstvo, zgodovina, povezava na trenutne probleme; postavitev masnih bilanc; postavitev energetskih bilanc; osnove bio-geo-kemije: kroženja ključnih elementov; osnove kemijske kinetike; populacijska dinamika; voda, zemlja, zrak, biota; modeli transporta in usode onesnažil; analiza tveganja; analiza življenjskega cikla; presoja vplivov na okolje. Pridobljena znanja bodo študentu pomagala premostiti pot od teoretičnih k praktičnim predmetom. Praktični primeri pri vajah bodo zasnovani tako, da bo študent lahko predvidel in razumel možne rezultate in tako lažje razumel teoretično ozadje.	following main topics: introduction, mission, history, connection to present day environmental problems; mass balances; energy balances; basics of bio-geo-chemistry: basic elements' cycles; basics of chemistry kinetics; population dynamics; water, soil, air, biota; transport models and fate of pollutants; risk analysis; life cycle analysis; environmental impact assessment. Acquired knowledge will help students to overcome the gap between theoretical and practical subjects. Practical exercises will be designed in a way that students can predict and understand possible outcomes and facilitate the understanding of theoretical background.
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Temeljna literatura in viri/Readings:

Gaur, R.C 2009. Basic Environmental Engineering. New Age International Publishers Limited, 203 str.

Berthouex P.M. & Brown L.C. 2013. Pollution Prevention and Control, 1st edition, 243 str.

Kumar De, A. 2009. Environmental Engineering. New Age International Publishers Limited, 191 str.

Joergensen, S.E., Bendoricchio, G. 2001. Fundamentals of Ecological Modelling, 3rd ed. Developments in Environmental Modelling 21. Elsevier, 530 str.

Učno gradivo v spletni učilnici UL FGG.

Cilji in kompetence:

Cilji	Objectives and competences:
• Spoznanje področja delovanja okoljskega inženirja in metodologij dela, • evidenca in analiza okoljskih problemov, • izbira možnih inženirskih ukrepov, • snovna, energetska in ekonomska analiza, • presoja vplivov na okolje, • analiza življenjskega cikla, • izdelava predloga optimalne rešitve. Pridobljene kompetence • Prepoznati okoljske problem, • definirati nabor možnih inženirskih rešitev, • izdelati potrebne analize in presoje ukrepov, • predlagati / zagovarjati optimalno rešitev.	Objectives • Introducing the field of environmental engineering as well as working methods, • analysis of environmental problems, • list of engineering measures, • material, energy and economic analysis, • environmental impact assessment, • life cycle analysis, • elaboration of optimal environmental solution. Gained competences • Recognizing environmental problems, • defining a list of viable engineering solutions, • elaborating analysis and assessing measures, • suggesting / arguing optimal solutions.

Predvideni študijski rezultati:

Predvideni študijski rezultati:	Intended learning outcomes:
• Pridobiti osnovna znanja in spretnosti za prepoznavanje in reševanje okoljskih problemov.	• To gain basic knowledge and skills for recognising and solving environmental problems.

- Pridobljeno znanje bo študent uporabil, oz. nadgradil pri nadaljevalnih predmetih.

- to upgrade this knowledge in subsequent courses of the study programme.

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

Predavanja, seminarske vaje in samostojno delo (seminarska naloga).

Lectures, tutorials-seminar exercises, individual work (seminar work).

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

samostojno delo (seminarska naloga)	30,00 %	seminar work (individual work)
pisni izpit (Pogoj za pristop k izpitu so opravljene vse ostale obveznosti)	50,00 %	written exam (Conditions to approach the exam are successfully elaborated other duties).
seminarske vaje	20,00 %	Tutorials-seminar exercises

Reference nosilca/Lecturer's references:

RUSJAN, Simon, MIKOŠ, Matjaž. Seasonal variability of diurnal in-stream nitrate concentration oscillations under hydrologically stable conditions. *Biogeochemistry*, ISSN 0168-2563, 2010, vol. 97, no. 2-3, str. 123-140.

RUSJAN, Simon, BRILLY, Mitja, MIKOŠ, Matjaž. Flushing of nitrate from a forested watershed : an insight into hydrological nitrate mobilization mechanisms through seasonal high-frequency stream nitrate dynamics. *Journal of Hydrology*, ISSN 0022-1694. [Print ed.], 2008, vol. 354, no. 1-4, str. 187-202.

BRILLY, Mitja, RUSJAN, Simon, VIDMAR, Andrej. Monitoring the impact of urbanisation on the Glinscica stream. V: FOHRER, N. (ur.). Assessing water quality on catchment scale, (*Journal of the European ceramic society*, ISSN 1474-7065, vol. 31, no. 17, 2006). Kidlington: Elsevier, 2006, issue 17, str. 1089-1096.

ŠIVIC, Ana, ATANASOVA, Nataša, PUIG, Sebastià, GRIESSLER BULC, Tjaša. Ammonium removal in landfill leachate using SBR technology - dispersed versus attached biomass. *Water science and technology*, ISSN 0273-1223, 2017, vol. 77, iss. 1, str. 27-38.

ATANASOVA, Nataša, DALMAU, Montserrat, COMAS, Joaquim, POCH ESPALLARGAS, Manel, RODRIGUEZ-RODA, Ignasi, BUTTIGLIERI, Gianluigi. Optimized MBR for greywater reuse systems in hotel facilities. *Journal of environmental management*, ISSN 0301-4797, 2017, letn. 193, št. maj, str. 503-511.

VOLF, Goran, ATANASOVA, Nataša, KOMPARE, Boris, OŽANIĆ, Nevenka. Modeling nutrient loads to the northern Adriatic. *The chemical engineering journal*, ISSN 1385-8947. [Print ed.], nov. 2013, letn. 504, str. 182-193.

SOCZKA-MANDAC, Rok, ŽAGAR, Dušan. Spatial distribution of suspended solids during short-term high river discharge in the Bay of Koper, northern Adriatic Sea. *Mediterranean Marine Science*, ISSN 1108-393X, 2018, letn. 19, št. 1, str. 1-13.

ŽAGAR, Dušan, SIRNIK, Nataša, ČETINA, Matjaž, HORVAT, Milena, KOTNIK, Jože, OGRINC, Nives, HEDGECK, Ian M., CINNIRELLA, Sergio, DE SIMONE, Francesco, GENCARELLI, Christian N., PIRRONE, Nicola. Mercury in the Mediterranean. Part 2, Processes and mass balance. V: *16th International Conference on Heavy Metals in the Environment, 23-27 September, 2012, Rome, Italy*, (Environmental science and pollution research international, ISSN 0944-1344, vol. 21, no. 6, 2014). Heidelberg: Springer. 2014, letn. 21, št. 6, str. 4081-4094.

OSTANEK JURINA, Tadej, ŠOŠKO, Helena, ŽAGAR, Dušan. Primerjava modelov širjenja nafte na morju po metodah trajektorij in koncentracij = Comparison of trajectory and concentration methods in oil spill modelling at sea. *Acta hydrotechnica*, ISSN 0352-3551. [Tiskana izd.], 2014, 27, [št.] 46, str. 43-56.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	MATEMATIKA II
Course title:	
	MATHEMATICS II

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni	Ni členitve (študijski program)	1. letnik	Letni

Univerzitetna koda predmeta/University course code:

1583

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
60	0	60	0	0	120	8

Nosilec predmeta/Lecturer:

Marjeta Kramar Fijavž, Nik Stopar

Vrsta predmeta/Course type:

Obvezni splošni /Obligatory general

Jeziki/Languages:

Predavanja/Lectures:

Slovenščina

Vaje/Tutorial:

Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

Prerequisites:

Opravljen izpit iz Matematike I oz. drugega predmeta s primerljivo vsebino.

Passed exam in Mathematics I or other courses with comparable content.

Vsebina:

Content (Syllabus outline):

Skalarne funkcije več realnih spremenljivk: metrika prostora R^n , definicijsko območje, graf, nivojnice, limita in zveznost funkcije več realnih spremenljivk, odvod v dani smeri, parcialni odvodi, gradient, stacionarne točke, vezani ekstremi, globalni ekstremi, višji parcialni odvodi, Taylorjeva formula, Jacobijeva matrika za vektorsko funkcijo vektorskega argumenta, verižno pravilo. Dvojni in trojni integral: Riemannova integralska vsota, integrabilnost, lastnosti, prevedba dvojnega (trojnega) integrala na dvakratni (trikratni) integral, uvedba novih

Scalar functions of several real variables: metrics of the space R^n , domain, graph, isohipses, limit and continuity of a multivariate real function, directional derivative, partial derivative, gradient, stationary points, constrained extrema, global extrema, higher partial derivatives, Taylor formula, Jacobi matrix for vector function of a vector argument, chain rule. Double and triple integral: Riemannian sum, integrability, properties, transformation of double (triple) integral to twice (three times) univariate integral, substitution (polar, cylindric, spheric

spremenljivk (polarne, cilindrske, sferne koordinate). Integrali s parametrom: integriranje, odvajanje, funkciji gama in beta. Diferencialna geometrija: pot, krivulja, parametrizacija, dolžina krivulje, naravni parameter, osnovni trieder, fleksija, torzija, krivinski polmer, Frenet-Serrejeve formule, gladka elementarna ploskev, parametrizacija, tangentna ravnina, površina. Krivuljni integral: krivuljni integral 1. vrste skalarne polja po krivulji, orientacija krivulje, krivuljni integral 2. vrste vektorskega polja po orientirani krivulji, Greenova formula. Ploskovni integral: ploskovni integral 1. vrste skalarne polja po ploskvi, orientacija ploskve, ploskovni integrala 2. vrste vektorskega polja po orientirani ploskvi. Integralski izreki: diferencialni operatorji: grad, div, rot, Gaussov in Stokesov izrek, gradientnost (potencialnost, konzervativnost) vektorskega polja. Navadne diferencialne enačbe: rešitev, DE prvega reda (ločljive spremenljivke, homogena, linearna), začetni problem, linearna DE n-tega reda s konstantnimi koeficienti.	coordinates). Integrals with parameter: integration, derivation, functions gamma and beta. Differential geometry: path, curve, parameterization, curve length, natural parameter, basic trihedron, inflection, torsion, curvature radius, Frenet-Serre formulae, smooth elementary surface, parameterization, tangent plane, area. Line integral: line integral of a scalar field along a curve, curve orientation, line integral of a vector field along an oriented curve, Green formula. Surface integral: surface integral of a scalar field on a surface, surface orientation, surface integral of order 2. of a vector field on an oriented surface. Integral theorems: differential operators: grad, div, rot, theorems of Gauss and Stokes, gradient (potential, conservative) vector fields. Ordinary differential equations: solution, ODE of first order (separate variables, homogenous, linear), initial problem, linear ODE of order n with constant coefficients.
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Temeljna literatura in viri/Readings:

Foerster, G. O. 1984. Analysis 2, 3 Vieweg Studium.

Lipschutz, M. 1969. Differential Geometry, Schaum's outline series. McGraw-Hill Book Company.

Mizori-Oblak, P. 1987. Matematika za študente tehnike in naravoslovja II, III. Ljubljana, UL FS.

Thomas B., Weir M. D. 1996. Calculus and Analytic Geometry, 9th ed. Addison-Wesley.

Vidav I. 1975. Višja matematika II, III. Ljubljana, DMFA Slovenije.

Zorich, V. A.. 2004. Mathematical Analysis I, II. Springer Verlag, Universitext.

Cilji in kompetence:

Cilji

- Omogočiti razumevanje matematičnega aparata, ki ga uporabljajo strokovni predmeti,
- usposobiti za kritične presoje podatkov in dobljenih računskih rezultatov.

Pridobljene kompetence

- Sposobnost abstraktne formulacije konkretnih problemov,
- zna uporabiti matematiko pri inženirskih problemih,
- razvijanje matematičnega mišljenja - sklepanje od splošnega k posebnemu in obratno.

Objectives and competences:

Objectives

- To enable understanding of mathematical tools used by engineering courses,
- to train for critical judgement of data and obtained numerical results.

Gained competences

- To be able to formulate practical problems abstractly,
- to be able to use mathematics in engineering problems,
- to develop of mathematical thinking - reasoning from general to special and vice versa.

Predvideni študijski rezultati:

- Imeti osnovna znanja iz matematične analize, diferencialne geometrije in vektorske analize,
- imeti osnovne računske spretnosti,
- doseženo matematično znanje uporabljajo strokovni predmeti in omogoča nadaljevanje poglobljenega študija tiste matematike, ki jo uporablja tehnika,
- matematika se izkaže kot uporabna, celo kot nujna osnovna znanost pri študiju tehnike,
- spoznanje, da je matematika prisotna v vseh porah človekovega delovanja,
- sposobnost abstraktne formulacije konkretnih problemov,
- sposobnost kritične presoje podatkov in dobljenih računskih rezultatov
- sposobnost sklepanja od splošnega k posebnemu in obratno,
- spretnost uporabe literature.

Intended learning outcomes:

- To possess basic knowledge in mathematical analysis, differential geometry and vector analysis,
- to handle basic computational skills,
- the achieved mathematical knowledge is used by the engineering courses and enables the study of mathematics for technology,
- mathematical science is essential in the study of technology,
- mathematics is present in all pores of human activity,
- ability of abstract formulation of practical problems,
- capability of critical judgement of data and obtained numerical results,
- ability of reasoning from general to special and vice versa,
- ability to use relevant literature.

Metode poučevanja in učenja:

predavanja, seminarske vaje, konzultacije, internet

Learning and teaching methods:

lectures, tutorials, consultations, internet

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

Naloge in sprotno delo	70,00 %	Exercises and homework
Izpit (teoretični del)	30,00 %	Exam (theoretical part)

Reference nosilca/Lecturer's references:

ENGEL, Klaus, KRAMAR FIJAVŽ, Marjeta, KLÖSS, Bernd, NAGEL, Rainer, SIKOLYA, Eszter. Maximal controllability for boundary control problems. Appl. math. optim., 2010, vol. 62, no. 2, str. 205-227.

KRAMAR FIJAVŽ, Marjeta, MUGNOLO, Delio, SIKOLYA, Eszter. Variational and semigroup methods for waves and diffusion in networks. Appl. math. optim., 2007, vol. 55, no. 2, str. 219-240.

KRAMAR FIJAVŽ, Marjeta. The structure of irreducible matrix groups with submultiplicative spectrum. Linear multilinear algebra, 2005, vol. 53, no. 1, str. 13-25.

OMLADIČ, Matjaž, STOPAR, Nik, Multivariate imprecise Sklar type theorems. Fuzzy sets and systems: international journal of soft computing and intelligence, 428 (2022), 80-101.

ĐURIĆ, Alen, JEVDENIĆ, Sara, STOPAR, Nik. Compressed zero-divisor graphs of matrix rings over finite fields, Linear and Multilinear Algebra, 69 (2021), 2012-2039.

OMLADIČ, Matjaž, STOPAR, Nik, Final solution to the problem of relating a true copula to an imprecise copula. Fuzzy sets and systems: international journal of soft computing and intelligence, 393 (2020), 96-112.

STOPAR, Nik, Rank of elements of general rings in connection with unit-regularity, Journal of Pure and Applied Algebra, 224 (2020), 106211 (11 str.).

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	OSNOVE KEMIJE
Course title:	
	BASIC CHEMISTRY

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni	Ni členitve (študijski program)	1. letnik	Letni

Univerzitetna koda predmeta/University course code:	1582
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Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	0	30	0	0	60	4

Nosilec predmeta/Lecturer:	Romana Cerc Korošec
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Vrsta predmeta/Course type:	Obvezni splošni /Obligatory general
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Jeziki/Languages:	Predavanja/Lectures:	Slovenščina
	Vaje/Tutorial:	Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:

Vsebina:	Content (Syllabus outline):
Zgradba snovi; sestava atomov; elementi in spojine; masni in energijski odnosi pri kemijskih reakcijah; periodni zakon in elektronska zgradba atomov; kemijska vez; idealni in realni plini; voda in raztopine; kristali; kemijska kinetika in ravnotežje; kemija površin; elektroliti in neelektroliti; osnove elektrokemije; pregled kemije elementov glavnih skupin in pregled kemije elementov stranskih skupin; ekologija: zrak, voda, energija.	Structure of matter; atomic structure; elements and compounds; mass and energy in chemical reactions; the periodic table and the electronic structure of atoms; chemical bonds; ideal and real gases; water and solutions; crystals; chemical kinetics and chemical equilibrium; surface chemistry; electrolytes and nonelectrolytes; electrochemistry; the chemistry of the main group elements and transition elements; ecology: air, water, energy.

Temeljna literatura in viri/Readings:

Čeh, B. 2022. Splošna kemija. Ljubljana, UL FKKT.

Lazarini, F., Brenčič, J.V. 2004/2011. Splošna in anorganska kemija. Ljubljana, UL FKKT.

Čeh, B. 2015. Splošna in anorganska kemija: zbirka pojmov, vprašanj in nalog z odgovori in rešitvami, Ljubljana, UL FKKT.

Čeh, B. 2015. Kemijsko računanje in osnove kemijskega ravnotežja, Ljubljana, UL FKKT.

Turel, I. 2002. Kemija. Ljubljana, UL FS.

Cilji in kompetence:**Cilji**

- Seznaniti z osnovnimi zakonitostmi kemije ter s sistematiko elementov in njihovih spojin,
- pridobiti občutek za snov in snovne spremembe,
- podajanje naravoslovnih znanj za boljše razumevanje strokovnih predmetov.

Pridobljene kompetence

- Zna opazovati in razume procese v vodah in vplive na okolje z znanjem o lastnostih snovi in kemijskih reakcijah,
- razvit občutek za laboratorijsko eksperimentalno delo ter natančnost meritev.

Objectives and competences:**Objectives**

- To get the knowledge of the basic principles of chemistry, the properties of the elements and their compounds and chemical reactions,
- to use the knowledge of chemistry as a basis for understanding specialized water management courses.

Gained competences

- To observe and understand the processes in water and the impacts on environment with the knowledge about properties of substances and chemical reactions,
- to get the sense for laboratory experimental work and measurements.

Predvideni študijski rezultati:

- Študent dobi znanje in razumevanje o strukturi atomov, periodnem sistemu, vezeh med atomi in molekulami, lastnostih snovi v plinu, tekočinah in trdnem stanju, raztopinah, kemijskih reakcijah, lastnostih spojin in elementov posameznih skupin.
- Zna opazovati in razumeti pojave, procese in razvoj tudi skozi kemijske spremembe, ki so udeležene.

Intended learning outcomes:

- Students gain knowledge and understanding of the structure of atoms, periodic table, atomic and molecular bonds, the properties of substances in gas, liquids and in solid state, solutions, chemical reactions, properties of compounds and the elements of the periodic table.
- Students are able to observe and understand the phenomena and processes by understanding the chemical changes that are involved.

Metode poučevanja in učenja:

Predavanja z eksperimenti, navezovanje tematike na reševanje problemov, ki so študentom blizu, povezovanje predelane snovi na odprta vprašanja o okolju in družbi, laboratorijsko delo pri vajah.

Learning and teaching methods:

Lectures with experiments, solving problems, chemical examples connected with interesting topics in environment and society, laboratory work.

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

Pisni izpit ali pisni izpit s testi

50,00 %

Written exam, written exam done by tests

Kolokvij iz laboratorijskih vaj	30,00 %	Test – chemical calculations
Laboratorijske vaje	20,00 %	Laboratory work

Reference nosilca/Lecturer's references:

CERC KOROŠEC, Romana, MILJEVIĆ, Bojan, UMEK, Polona, BERGH, John Milan van der, VUČETIĆ, Snezana, RANOGAJEC, Jonjaua. Photocatalytic self-cleaning properties of Mo:TiO₂ loaded Zn-Al layered double hydroxide synthesised at optimised pH value for the application on mineral substrates. *Ceramics international*, 2020, vol. 46, str. 6756-6766.

MATOH, Lev, ŽENER, Boštjan, CERC KOROŠEC, Romana, LAVRENČIČ ŠTANGAR, Urška. Photocatalytic water treatment. V: PACHECO TORRAL, Fernando (ur.). *Nanotechnology in eco-efficient construction: materials, processes and applications*, 2nd ed. Duxford: Elsevier: Woodhead Publishing, 2019, str. 675-702.

ŽENER, Boštjan, MATOH, Lev, CARRARO, Giorgio, MILJEVIĆ, Bojan, CERC KOROŠEC, Romana. Sulfur-, nitrogen- and platinum-doped titania thin films with high catalytic efficiency under visible-light illumination. *Beilstein journal of nanotechnology*, 2018, vol. 9, str. 1629-1640.

GALER, Petra, CERC KOROŠEC, Romana, VIDMAR, Maja, ŠKET, Boris. Crystal structures and emission properties of the BF₂ complex 1-phenyl-3-(3,5-dimethoxyphenyl)-propane-1,3-dione : multiple chromisms, aggregation- or crystallization-induced emission, and the self-assembly effect. *Journal of the American Chemical Society*, 2014, vol. 136, no. 20, str. 7383-7394.

BUKOVEC, Nataša, CERC KOROŠEC, Romana, GOLOBIČ, Amalija, LAH, Nina, TRATAR-PIRC, Elizabeta. *Osnove kemijskega računanja: zbirka nalog*. 1. izd. Ljubljana: Fakulteta za kemijo in kemijsko tehnologijo, 2022.

BUKOVEC, Nataša, CERC KOROŠEC, Romana, TRATAR-PIRC, Elizabeta. *Praktikum iz splošne in anorganske kemije*. 3. dopolnjena izd. Ljubljana: Fakulteta za kemijo in kemijsko tehnologijo, 2020.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	GEODEZIJA
Course title:	
	GEODETIC ENGINEERING

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni	Ni členitve (študijski program)	1. letnik	Letni

Univerzitetna koda predmeta/University course code:	1024
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Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	0	30	0	0	60	4

Nosilec predmeta/Lecturer:	Dušan Kogoj
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Vrsta predmeta/Course type:	Obvezni strokovni /Obligatory professional
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Jeziki/Languages:	Predavanja/Lectures:	Slovenščina
	Vaje/Tutorial:	Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:

Vsebina:	Content (Syllabus outline):
Definicija geodezije, področja geodezije, naloge geodezije. Oblika in dimenzije Zemlje. Koordinatni sistemi, koordinate, kartografske projekcije. Geodetske mreže. Teorija geodetskih meritev (mere, osnovni pojmi teorije pogreškov in izravnave). Geodetske terestrične meritve (geodetsko orodje, merjenje kotov, merjenje dolžin, merjenje višinskih razlik, relativne merske metode). Sodobne merske tehnike in metode (TPS sistemi, 3D skenerji, GPS meritve). Osnovni principi določanja koordinat točk (merski in koordinatni prostor - izračun). Detajlna izmera (zajem prostorskih podatkov). Načrti in karte	Definition of geodesy, fields of geodesy (geodetic engineering), tasks of geodetic engineering. Shape and dimensions of the Earth. Coordinate systems, coordinates, cartographic projections. Geodetic networks. Theory of geodetic surveying (measuring, basic principles of theory of errors and adjustment). Terrestrial surveying (tools, angle measurements, distance measurements, height difference measurements, relative measurement techniques). Modern measurement systems and methods (TPS systems, 3D scanners, GNSS measurements). Basic principles of point coordinate determination

(značilnosti, načini izdelave, vrste, uporabnost). Geodetske evidence (zemljiški kataster, kataster stavb, DMR, GIS). Splošno o geodeziji pri gradnji objektov in drugih posegih v prostor (raba prostora, pridobivanje dovoljenj za posege, izvedba posega). Osnovne metode zakoličevanja. Geodetska dela pri visokih gradnjah (zakoličba, spremljanje gradnje, ugotavljanje stabilnosti objekta – primeri iz prakse). Geodetska dela pri nizkih gradnjah (geodetske podlage, zakoličba, spremljanje gradnje, merjenja ob obremenitvah preizkušnja, ugotavljanje stabilnosti in deformacij objekta – primeri iz prakse). Hidrografska merjenja.	(observation and coordinate space - calculation). Detail surveying (spatial data acquisition). Plans and maps (characteristics, manufacturing methods, types, usability). Geodetic records (land cadastre, building cadastre, DTM, GIS). General about surveying in building construction and other spatial planning methods (land use, obtaining land use permits, implementation of intervention). Basic stakeout methods. Geodetic works for infrastructural engineering (stakeout, construction monitoring, determination of the stability of the building – practical examples). Geodetic work for infrastructural engineering (geodetic layers, stakeout, construction monitoring, measuring the load tests, determination of stability and deformation of a structure - practical examples). Hydrographic measurements.
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Temeljna literatura in viri/Readings:

Juvančič, I. 2000. Geodezija za gozdarje in krajinske arhitekte. Ljubljana, UL BF.

Witte, B., Schmidt, H. 2006. Vermessungskunde und Grundlagen der Statistik für das Bauwesen. Heidelberg, Herbert Wichmann Verlag.

Kogoj, D. 2013. Geodezija za gradbenike in vodarje, Ljubljana, UL FGG.

Učna gradiva v spletni učilnici.

Cilji in kompetence:

Cilji	Objectives
- Študenti se seznajajo z osnovnimi geodetskimi metodami izmere in geodetskimi proizvodi s poudarkom na praktičnih primerih uporabe geodezije v gradbeništvu in možnostmi sodelovanja z geodeti, za naročanje in prevzemanje geodetskih produktov. Pridobljene kompetence - Poznavanje in razumevanje osnovnega izrazoslovja s področja geodezije, poznavanje nalog in družbene pomembnosti geodezije, obvladovanje praktičnih primerov uporabe geodezije v gradbeništvu.	- Students are acquainted with basic geodetic surveying methods and geodetic products with the main stress on the practical examples on application in geodetic engineering – planning, design, construction and the possibilities of cooperation with geodetic experts, to order and to accept geodetic products. Gained competences - Skills and understanding of basic geodetic terminology, knowledge about social importance of geodesy in society, to master practical use of geodetic services in civil engineering.

Predvideni študijski rezultati:

Predvideni študijski rezultati:	Intended learning outcomes:
- Poznavanje geodezije kot vede in stroke, njenih področij, nalog in družbene pomembnosti. - Razumevanje osnovnih geodetskih postopkov meritev in obdelave merskih vrednosti s poudarkom na razumevanju rezultatov	- Skills on geodesy and surveying as science and profession, its field of work, geodetic tasks and importance for modern society. - Understanding of basic geodetic measurements and computations with the main stress on

geodetskih meritev in načini interpretacije le teh. Seznanitev s celotnim spektrom geodetskih proizvodov in razumevanje njihove uporabnosti v vodarstvu in okoljskem inženirstvu. Pridobljeno znanje je uporabno v smislu racionalne uporabe geodezije tako s stališča investitorja kot s stališča izvajalca, predvsem v smislu zagotavljanja visoke kvalitete opravljenih del. Razumevanje geodetskih postopkov in izdelkov omogoča kritično presojo kvalitete ter objektivno ovrednotenje skladnosti teoretičnih načel in praktičnega ravnanja.	understanding the results of geodetic measurements and their interpretation. Getting acquainted with the whole spectrum of geodetic products and understanding of their applicability in water management and environmental engineering. Acquired knowledge is useful for rational use of geodetic products from the investors' points of view and in the process of project realization. Special stress is on the understanding of geodetic products which give an opportunity for critical view (judgment) of their quality and objective valuation of accordance between theoretical principles and practical proceedings.
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Metode poučevanja in učenja:**Learning and teaching methods:**

Predavanja: prosojnice, grafične prezentacije, demonstracije, praktični primeri. Laboratorijske vaje: računalniška učilnica, uporaba terestričnih geodetskih instrumentov pri terenski izmeri. Konzultacije, spletna učilnica, internet.	Lectures: slides, graphical presentations, demonstrations, practical examples. Practical exercises: computer classroom, use of terrestrial geodetic instruments (total stations, GPS, levels) in field use. Consultations, E-classroom, internet.
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Načini ocenjevanja:**Delež/Weight****Assessment:**

Vaje	50,00 %	Tutorial
Izpit	50,00 %	Examination

Reference nosilca/Lecturer's references:

MARJETIČ, Aleš, KREGAR, Klemen, AMBROŽIČ, Tomaž, KOGOJ, Dušan. An Alternative Approach to Control Measurements of Crane Rails. *Sensors*, 2012, letn. 12, št. 5, str. 5906-5918.

KREGAR, Klemen, TURK, Goran, KOGOJ, Dušan. Statistical testing of directions observations independence. *Surv. rev. - Dir. Overseas Surv.*, 2013, letn. 45, št. 329, str. 117-125.

MARJETIČ, Aleš, KREGAR, Klemen, KOGOJ, Dušan. Geodetsko merjenje dolžin v atletiki = Geodetic measurement of distances in athletics. *Geodetski vestnik*, 2014, letn. 58, št. 2, str. 243-253.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	HIDROLOGIJA
Course title:	
	HYDROLOGY

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni	Ni členitve (študijski program)	1. letnik	Letni

Univerzitetna koda predmeta/University course code:

1023

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	25	30	0	5	90	6

Nosilec predmeta/Lecturer:

Mojca Šraj

Vrsta predmeta/Course type:

Obvezni splošni /Obligatory general

Jeziki/Languages:

Predavanja/Lectures:

Slovenščina

Vaje/Tutorial:

Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

Prerequisites:

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Vsebina:

Content (Syllabus outline):

Predavanja Pregled razvoja hidrologije kot znanosti doma in v svetu; Fizikalne in kemijske lastnosti vode; Kroženje vode, energije in snovi v naravi; Uporaba teorije verjetnosti in statistike v hidrologiji (osnove verjetnostnega računa, teoretične in empirične porazdelitve, faktor frekvence in verjetnostne mreže, povratna doba, regresija in korelacija); Lastnosti atmosfere in njihova meritev; Padavine (meritve, napake pri meritvah padavin, obdelava padavinskih podatkov, prestrežene padavine, sneg); Daljinsko zaznavanje v hidrologiji; Evapotranspiracija	Lectures The overview of the development of the hydrological science in Slovenia and in the world; Physical and chemical characteristics of the water; Water and energy cycle; The use of probability theory and statistics in hydrology (basics of the probability, theoretical and empirical distributions, frequency factor and probability papers, return period, regression and correlation); Characteristics of the atmosphere and their measurement; Precipitation (measurements, errors, analyses, intercepted precipitation, snow); Remote sensing in hydrology;
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(merjenje, metode izračuna, Penman-Monteithova enačba); Odtok površinskih voda (krivulja trajanja); Lastnosti tal; Različne oblike vode v tleh (vlaga v tleh, izviri, podtalnica, infiltracija, Darcy); Vodna bilanca; Podnebne spremembe in podnebna spremenljivost; Hidrometrija (meritve globlin, gladin in hitrosti vode, meritve pretokov, pretočna krivulja); Negotovost hidrometričnih meritev in analiz (teorija pogreška); Osnove rečne hidravlike. Vaje Kroženje energije in vode na Zemlji, izračun vodne bilance. Hidrološki in meteorološki podatki. Verjetnostni račun v hidrologiji. Teoretične porazdelitve in njihova praktična uporaba v hidrologiji, povratna doba. Verjetnostne mreže. Testiranje hidroloških vzorcev. Empirične porazdelitve, krivulja trajanja. Uporaba korelacije v hidrologiji. Padavine, popravek padavin, ITP krivulje. Porečje, razvodnica, površinski odtok, racionalna enačba. Obdelava hidrometričnih podatkov, pretočna krivulja. Model podzemnega toka (GWF). Obisk klimatološke postaje in Agencije za okolje RS. Meritve hitrosti na naravnem vodotoku in izračun pretoka. Seminar Celostna analiza manjšega vodotoka s poudarkom na terenskem delu.	Evapotranspiration (measurements, calculation methods, Penman- Monteith equation); Runoff (flow duration curve); Soil characteristics; Different types of water in the soil (soil moisture, springs, groundwater, infiltration, Darcy's law); Water balance; Climate change and climate variability; Hydrometry (measurements of water depth, water level and velocity, measurement of discharge, stage – discharge relationship; Uncertainty of hydrometric measurements and analyses (theory of error); Basics of river hydraulics. Tutorial Energy and water cycle of the Earth, water balance calculation. Hydrological and meteorological data; Probability in hydrology; Theoretical distributions and their practical implementation in hydrology, return period. Probability papers. Testing of hydrological samples. Empirical distributions, flow duration curve. The use of correlation in hydrology. Precipitation, precipitation correction, IDF curves. Catchment, delineation, runoff, rational equation. Analysis of hydrometric data, rating curve. Groundwater flow model (GWF). Visit of the climatological station of the Slovenian Environmental Agency. Measurements of the velocity of the natural stream and discharge calculation. Seminar Detailed study of individual hydrological theme or comprehensive analysis of a small watercourse.
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Temeljna literatura in viri/Readings:

Brilly, M., Šraj, M. 2005. Osnove hidrologije, univerzitetni učbenik. 1. izd. Ljubljana, UL FGG, 309 str.

Šraj, M. 2010. Model podzemnega toka = Ground water flow model. Ljubljana, UL FGG, 22 str.

Mikoš, M., Kranjc, A., Matičič, B., Muller, J., Rakovec, J., Roš, M., Veselič, M., Brilly, M. 2002. Hidrološko izrazje = Terminology in hydrology. Acta hydrotechnica, vol. 20, št. 32, str. 3-324.

Učna gradiva v spletni učilnici.

Cilji in kompetence:**Cilji**

- Seznanitev z osnovami hidrologije, hidrometrije in uporabo analitičnih metod v hidrologiji,
- pridobitev poglobljenega znanja o posameznih komponentah hidrološkega kroga in njihovim merjenjem s poudarkom na hidrometriji.

Objectives and competences:**Objectives**

- To learn about the basics of hydrology, hydrometry and the use of the analytical methods in hydrology,

Pridobljene kompetence • Pridobitev spretnosti zbiranja, interpretacije in obdelave podatkov ter osnovne spretnosti terenskega dela in ravnanja z merilnimi instrumenti, • z znanjem o kakovosti merjenih podatkov in njihovi interpretaciji zna uporabljati hidrološke podatke pri inženirskem odločanju in dimenzioniranju objektov.	• to get a thorough knowledge about the components of the hydrological cycle and their measurement with a focus on hydrometry. Gained competences • To get skills of collecting, interpreting and analyzing the data and the basic skills of the field work and handling with measuring instruments, • with the knowledge of the quality of the measured data and their interpretation student uses hydrological data for engineering decision-making and designing the structures.
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Predvideni študijski rezultati:**Intended learning outcomes:**

• Študent pridobi znanje o zakonitostih gibanja vode v hidrološkem krogu, • študent spozna pomembnost hidroloških podatkov in njihovo uporabo pri analizi in vodarskem odločanju, • razumevanje pomena podatkov pri izvajanju analiz ter spoznanje celovitosti in kompleksnosti procesov v okolju, • spretnosti zbiranja, interpretiranja in obdelave podatkov, • uporaba računalniških orodij za izdelavo tabel, grafov ter osnovnih statističnih izračunov (npr. Excel), uporaba IKT, • spretnost uporabe domače in tuje literature ter drugih virov, poznavanje strokovnih izrazov, • uporaba različnih statističnih metod, identifikacija in reševanje problemov, kritična analiza, sinteza, • poročanje (ustno in pisno).	• Student gains knowledge about principles of the water movement in the hydrological cycle, • student learns about the importance of the hydrological data and their application in analysis and decision-making in water management, • understanding the importance of the data in analyses and getting the knowledge of the integrity and complexity of processes in the environment, • skills of collecting, interpreting and processing of the data, • the use of software for creating tables, graphs and basic statistical calculations (e.g. Excel), use of ICT, • skills in using national and world literature and other sources, knowledge of professional terms, • the use of different statistical methods, identification and problem solving, critical analysis, synthesis, • reporting (oral and written).
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Metode poučevanja in učenja:**Learning and teaching methods:**

Predavanja, seminar, laboratorijske vaje, terenske meritve, uporaba IKT, skupinsko in problemsko zasnovano delo, interaktivno delo preko spletne učilnice oz. e-učenje (forumi, klepetalnice, kvizi, lekcije, dnevniki, individualno reševanje nalog, Wiki).	Lectures, seminar, lab exercises, field measurements, use of ICT, group and problem-based work, interactive work through e-classroom. e-learning (forums, chats, quizzes, lessons, blogs, individual exercises, Wiki).
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Načini ocenjevanja:**Delež/Weight****Assessment:**

Računski del izpita ali dva kolokvija	30,00 %	Practical part of final exam or two mid-term exams
Teoretični del izpita ali dva kolokvija	20,00 %	Theoretical part of final exam or two mid-term exams
Oddane vaje	30,00 %	Coursework/lab exercises

Seminarska naloga s predstavitvijo in sovrstniškim ocenjevanjem	20,00 %	Seminar with the oral presentation and peer assessment
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Reference nosilca/Lecturer's references:

BEZAK, Nejc, BRILLY, Mitja, ŠRAJ, Mojca. Comparison between the peaks over threshold method and the annual maximum method for flood frequency analyses. Hydrological sciences journal, ISSN 0262-6667. [Print ed.], 2014, letn. 59, št. 5, str. 959-977.

ŠRAJ, Mojca, MIKOŠ, Matjaž, BRILLY, Mitja. Rainfall interception by deciduous mediterranean forests in Slovenia, Europe. V: DANIELS, Justin A. (ur.). Advances in environmental research, (Advances in Environmental Research, 14). New York: Nova Science Publishers, cop. 2011, str. 153-182.

ŠRAJ, Mojca, RUSJAN, Simon, PETAN, Sašo, VIDMAR, Andrej, MIKOŠ, Matjaž, GLOBEVNIK, Lidija, BRILLY, Mitja. The experimental watersheds in Slovenia. V: BRILLY, Mitja (ur.). XXIVth Conference of the Danubian Countries on the Hydrological Forecasting and Hydrological Bases of Water Management, IOP Conference Series, vol. 4. London: Institute of Physics, 2008, str. 1- 13.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	GRADIVA
Course title:	
	CONSTRUCTION AND BUILDING MATERIALS

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni	Ni členitve (študijski program)	1. letnik	Letni

Univerzitetna koda predmeta/University course code:	1018
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Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	0	30	0	0	60	4

Nosilec predmeta/Lecturer:	Violeta Bokan-Bosiljkov, Vlatko Bosiljkov
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Vrsta predmeta/Course type:	Obvezni strokovni /Obligatory professional
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Jeziki/Languages:	Predavanja/Lectures:	Slovenščina
	Vaje/Tutorial:	Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:

Vsebina:	Content (Syllabus outline):
Sistematični pregled gradiv in njihovih značilnosti (klasifikacija po kemični zgradbi, uporabi in izvoru). Osnove standardizacije in obravnava gradiv v standardih in predpisih za načrtovanje in gradnjo objektov (Uredba o gradbenih proizvodih, harmonizirani standardi, Evrokodi). Osnove kemičnih, fizikalnih in mehanskih lastnosti gradiv in njihovo opredeljevanje in kvantificiranje s pomočjo eksperimentalnih preiskav. Keramična gradiva: kamen; gradbena keramika in steklo; mineralna veziva, malte in ometi; betoni. Kovinska gradiva: železove kovine in neželezove kovine ter zlitine.	Systematic review of construction and building materials and their characteristics (classification according to chemical structure, application and origin). Basics of standardization, construction and building materials in standards and regulations for the design and construction of buildings and civil engineering structures (Construction Products Regulation, harmonized standards, Eurocodes). Fundamentals of chemical, physical and mechanical properties of construction and building materials and their identification and quantification by means of testing. Ceramics: stone; building ceramics and

Polimerna gradiva: umetne mase; ogljikovodikova gradiva. Kompozitna gradiva: umetna gradiva (z delci in vlaknasto armirane plastike, lastnosti, področja uporabe); naravna gradiva (les, papir in ostala naravna vlaknasta gradiva). Ponovna uporaba in recikliranje gradiv in gradbenih proizvodov. Vključevanje sekundarnih surovin v gradiva. Izbrane metode preskušanja gradiv.

glass; mineral binders, mortars and renders and plasters; concretes. Metals: ferrous and non-ferrous metals and metal alloys. Polymer materials: plastics; bitumen and asphalt. Composite materials: plastic composites (particle- and fibre-reinforced plastic, properties, application); natural building materials (wood, paper and other natural fibre materials). Re-use and recycling of materials and construction products. Incorporation of secondary raw materials in the construction products. Selected methods of materials testing.

Temeljna literatura in viri/Readings:

Žarnić, R. 2005. Osnove gradiv. Ljubljana, UL FGG.

Žarnić, R., Bokan-Bosiljkov, V., Bosiljkov, V. 2016. Gradiva – vaje. Ljubljana, UL FGG.

Taylor, G.D. 2000. Materials in Construction: An Introduction, 3rd edition. Pearson Education Limited.

Cilji in kompetence:

- Obvladanje znanja o tehničnih lastnostih gradiv in njihovi ekonomični uporabi ter ponovni uporabi ali recikliranju,
- spoznavanje metod projektiranja gradiv (beton, malte, kompoziti),
- usposobitev za preverjanje lastnosti gradiv in klasifikacije kakovosti s pomočjo standardnih metod laboratorijskih in terenskih preiskav.

Objectives and competences:

- To manage knowledge about the technical properties of construction and building materials and their economical use and about re-use or recycling of the materials,
- to know methods to design mortar, concrete or composite materials,
- to be trained to check the properties of construction and building materials and for their classification by using laboratory and in-situ test methods.

Predvideni študijski rezultati:

- Klasifikacija gradiv; osnove standardizacije in zakonodaje; surovinska sestava gradiv; tehnološki postopki proizvodnje gradiv; vrste izdelkov pri posameznem gradivu; mehanske, fizikalne in tehnološke lastnosti; uporabnost gradiv, vzroki in posledice propadanja gradiv; osnove standardnih metod preiskav gradiv.
- Razumevanje relacij med posameznimi lastnostmi gradiv (na primer: trdnost – poroznost; trdnost – način obremenitve (tlak, nateg, strig); prostorninska masa – poroznost; vpijanje vode – obstojnost); razumevanje vpliva osnovnih komponent kompozitnih materialov, velikosti njihovih delcev ter prostorninskih deležev na mehanske, fizikalne in tehnološke lastnosti kompozita; razumevanje postopkov projektiranja posameznih gradiv in načinov analiziranja doseženih lastnosti določenih z eksperimentalnim preskušanjem.

Intended learning outcomes:

- Classification of materials; the basics of standardization and legislation; composition of materials; technological processes for the production of materials; products made of particular material; mechanical, physical and technological characteristics; application of construction and building materials, causes and consequences of decay of materials; the basics of standard test methods of construction and building materials.
- Understanding of relationships between the individual properties of construction and building materials (for example: strength - porosity, strength – direction of load (pressure, tension, shear); density - porosity, water absorption - durability); understanding the influence of the basic components of composite materials, the size of the particles and the volume fractions on the mechanical, physical and technological properties of the composite;

- Pridobljeno znanje omogoča reševanje manj zahtevnih problemov v praksi in je ustrezno izhodišče za poglobljeno spoznavanje posameznih gradbenih materialov s pomočjo obsežne literature in primerov iz prakse. Študentje so sposobni izvesti preproste preiskave gradbenih materialov in rezultate ovrednotiti. - Predmet pokriva nabor osnovnih znanj na področju gradbeništva, ki so izhodišče za razumevanje in obvladovanje učne snovi v nadaljnjem študiju. Študentje pridobijo spretnost uporabe standardov s področja gradbenih materialov. V okviru laboratorijskih vaj se spoznajo s timskim delom, analiziranjem lastnosti gradbenih materialov ter njihovim klasificiranjem.	understanding of the design processes of specific materials and methods for the evaluation of selected characteristics obtained by testing. - Acquired knowledge enables solving of less complex problems in practice and is an appropriate starting point for an in-depth understanding of individual construction and building material, with the help of extensive literature and case studies. Students are able to carry out simple tests of construction and building materials and evaluate obtained results. - The subject covers a range of basic skills in the construction sector, which are platform for understanding and mastering the knowledge provided by courses in continuation of the study process. Students acquire skills in using the standards in the field of construction and building materials. In the framework of laboratory tutorials the students are acquainted with teamwork and analysis of the properties of construction and building materials and their classification.
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Metode poučevanja in učenja:**Learning and teaching methods:**

Osnovni del snovi se podaja v obliki predavanj na osnovi izbranih vsebin iz učbenika nosilca predmeta. Predavanjem sledijo laboratorijske vaje v skupinah po 15 študentov v laboratoriju FGG. Pri tem se uporablja posebej pripravljena literatura v obliki delovnega zvezka. V okviru vaj se podajo tudi preprostejši računski zgledi in naloge s področja vrednotenja lastnosti gradiv in njihovega projektiranja.	The main part of the course is provided in the form of lectures based on the selected content of textbook, prepared by the lecturer. Lectures are followed by laboratory exercises/tutorial, in groups of 15 students in the UL FGG laboratory. Students use log book specially prepared for the laboratory work. Within tutorial also simple calculations are carried out, along with exercises about evaluation of properties of materials and their design.
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Načini ocenjevanja:**Delež/Weight Assessment:**

2 kolokvija ali pisni izpit	80,00 %	Two mid-term exams or exam
Delovni zvezek	20,00 %	Log book

Reference nosilca/Lecturer's references:

PRINČIČ, Tina, ŠTUKOVNIK, Petra, PEJOVNIK, Stane, SCHUTTER, Geert De, BOKAN-BOSILJKOV, Violeta. Observations on dedolomization of carbonate concrete aggregates, implications for ACR and expansion. Cem. concr. res. [Print ed.], 2013, letn. 54, str. 151-160.

URANJEK, Mojmir, BOSILJKOV, Vlatko, ŽARNIČ, Roko, BOKAN-BOSILJKOV, Violeta. In situ tests and seismic assessment of a stone-masonry building. Mat. struct., 2012, letn. 45, št. 6, str. 861-879.

BOKAN-BOSILJKOV, Violeta, ŽARNIČ, Roko, BOSILJKOV, Vlatko, ČEPON, Franci. Optimizacija načina sanacije voziščnih plošč viaduktov na avtocestah : razvojno raziskovalna naloga - končno poročilo. Ljubljana: Univerza v Ljubljani, Fakulteta za gradbeništvo in geodezijo, 2008. 88 f.

ŠTUKOVNIK, Petra, ŽARNIČ, Roko, BOKAN-BOSILJKOV, Violeta. Portable 3D optical microscope as a tool for identification of climate change influence on heritage assets. V: ŽARNIČ, Roko (ur.), RAJČIČ, Vlatka (ur.), VODOPIVEC, Barbara (ur.). Heritage protection from documentation to interventions : proceedings of the EU-CHIC International conference on Cultural heritage preservation, 29 May - 1 June 2012, Split, Croatia. Zagreb: University of Zagreb, Faculty of Civil Engineering, 2012, str. 215-218.

BOKAN-BOSILJKOV, Violeta, DUH, David, BOSILJKOV, Vlatko, ŽARNIČ, Roko. Time evolution of properties of SCC mixtures produced using crushed limestone aggregate and high content of limestone filler. V: KHAYAT, Kamal (ur.), FEYS, Dimitri (ur.). Design, production and placement of self-consolidating concrete : proceedings of SCC2010, Montreal, Canada, September 26-29, 2010, (RILEM Bookseries, vol. 1). Dordrecht: Springer, cop. 2010, str. 317-327.

COTIČ, Patricia, JAGLIČIČ, Zvonko, NIEDERLEITHINGER, Ernst, EFFNER, Ute, KRUSCHWITZ, Sabine, TRELA, Christiane, BOSILJKOV, Vlatko. Effect of moisture on the reliability of void detection in brickwork masonry using radar, ultrasonic and complex resistivity tomography. Materials and structures, ISSN 1359-5997, 2013, letn. 46, št. 10, str. 1723-1735.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	DIGITALNO NAČRTOVANJE IN PROGRAMIRANJE
Course title:	
	DIGITAL DESIGN AND PROGRAMMING

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni	Ni členitve (študijski program)	1. letnik	Letni

Univerzitetna koda predmeta/University course code:	1579
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Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
15	0	60	0	0	75	5

Nosilec predmeta/Lecturer:	Tomo Cerovšek
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Vrsta predmeta/Course type:	Obvezni strokovni /Obligatory professional
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Jeziki/Languages:	Predavanja/Lectures:	Slovenščina
	Vaje/Tutorial:	Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:

Vsebina:	Content (Syllabus outline):
Osnove računalniške grafike: - Klasifikacija: programi za delo z računalniško grafiko in obvladovanje geometrijskih oblik. - Osnove CAD: okolje, natančnost, merilo, plasti, črte, šrafure, dimenzioniranje, tiskanje, formati in način izmenjave geometrijskih podatkov - Geometrijsko pogojeno reševanje problemov (uporaba geometrije v gradbeništvu, v računskih modelih, pristopi glede na kompleksnost). Podatkovne strukture: - vrste podatkovnih tipov (osnovni in izpeljani);	The basics of computer graphics: - Classification: software package for computer graphics and management of geometrical shapes. - CAD Basics: CAD environment, precision, scale, layers, lines, hatches, dimensioning, printing – model spaces and paper space, formats and exchange of geometrical data structures. - Geometrically defined problem solving procedures (the use of geometry in civil engineering, in computational models, methods depending on complexity).

- organizacija in računalniški zapis geometrijskih in ne-geometrijskih inženirskih podatkov; - zasnova relacijskih zbirk inženirskih podatkov (modeliranje, prva in druga relacijska norma); - osnove SQL za inženirje (sintaksa in uporaba) - izdelava tabel, poizvedb, obrazcev in poročil. Avtomatska obdelava in programiranje: - Računalniška obdelava podatkov glede na problem (pred in po-procesiranje – parsanje); - osnove determinističnih regularnih izrazov in uporaba za avtomatsko obdelavo podatkov; - OLAP - pivot tabele in vizualizacija podatkov. Programiranje za inženirje: - Algoritmi in procedure ter klasifikacija funkcij; - Programiranje (osnove dela z matlab in/ali Mathematica – prikaz na praktičnih zgledih); podajanje 2D in 3D grafike z Mathematico.	Data Structures: - types of data structures (basic and derived data structures); - organization and computer representation of geometrical and non-geometrical engineering data; - design of relational databases (modelling, database normalization, first and second normal form); - SQL basics for engineers (syntax and practical use of SQL); the design of database tables, - queries, forms and reports. Automatic processing and programming: - computer assisted processing of data by problem type (pre- and post-processing and parsing); - basics of deterministic regular expressions and its use of automatic data processing; - OLAP – On-line analytical process, pivot tables and data visualization. Programming for engineers: - Algorithms, procedures and classification of functions; - Programming (basics of Matlab and/or Mathematica – practical examples of real-world scenarios); 2D and 3D graphics using built-in Mathematica functions.
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Temeljna literatura in viri/Readings:

Raphael, B., Smith, I. 2003. Fundamentals of Computer Aided Engineering. John Wiley and Sons, 297 str.

Friedl, J. 2006. Mastering Regular Expression. O'Reilly, 313 str.

Hagen, K. 2008. Introduction to Engineering Analysis. Prentice Hall, 366 str.

Cerovšek T. 2013. Računalniško integrirana graditev. Študijsko gradivo, 380 str.

Učno gradivo v spletni učilnici UL FGG.

Cilji in kompetence:**Cilji**

- Naučiti študenta podati in uporabljati CAD inženirske geometrijske podatke v 2D in 3D,
 - naučiti študenta avtomatizirati obdelavo,
 - naučiti študenta osnov programiranja.
- Pridobljene kompetence
- Samostojna uporaba in razumevanje delovanja programov za računalniško grafiko (2D in 3D),
 - izvajati osnovne matematične operacije s pomočjo računalniških programov,
 - sposobnost reševanja problemov in ponovljivih operacij z računalniškimi algoritmi.

Objectives and competences:**Goals**

- To learn how to describe and use CAD related engineering geometry in 2D and 3D,
 - to be able to automate processing of large data sets,
 - to learn the basics of programming.
- Gained competences

- To independently use and understand software packages for computer graphics (2D and 3D),
- to execute basic mathematical procedures and processing using self-created computer programs,

	to be able to solve computer based problems and reproducible operation with computer algorithms.
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Predvideni študijski rezultati:**Intended learning outcomes:**

- Pridobi znanje in razumevanje dela in delovanja programov za grafično reševanje problemov, - sposobnost urejanja grafičnih podlog v programih CAD, - sposobnost ocene kompleksnosti problema in na osnovi ocene izbrati ustrezno orodje, - sposobnost zaznavanja priložnosti in smiselnosti za avtomatizacijo ponavljajočih opravil pri obdelavi empiričnih podatkov, - samostojno izdelani regularni izrazi za avtomatsko obdelavo podatkov konkretnih problemov, - sposobnost samostojne izdelave programa v okolju Matlab/Mathematica.	- To gain knowledge and understanding of software packages for graphics based problem solving, - to understand and be able to use CAD software. - to be able to assess the complexity of a problem and use appropriate tool for problem solving. - to be able to identify, justify and execute automation of repeating tasks in the case of processing of empirical data. - to be able to independently form basic regular expression to solve given parsing problems. - to be able to independently develop procedures in Matlab/Mathematica.
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Metode poučevanja in učenja:**Learning and teaching methods:**

Predavanja, praktične vaje v računalniški učilnici. Učenje deloma poteka z uporabo elektronskih gradiv, tudi deloma doma.	Lectures, lab work in computer classroom. The learning is partly executed using digital tutorials which can be used at students' convenience.
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Načini ocenjevanja:**Delež/Weight****Assessment:**

Domače naloge	20,00 %	Homework
1. in 2. kolokvij (teorija + vaje) 40 + 40 ali Izpit (teorija + vaje)	80,00 %	2 midterm examinations (40 each) or Final exam (theory & work)

Reference nosilca/Lecturer's references:

CEROVŠEK, Tomo. A review and outlook for a 'Building Information Model' (BIM) : a multi-standpoint framework for technological development. Advanced engineering informatics, 2011, letn. 25, št. 2, str. 224-244.

CEROVŠEK, Tomo. IMREC: A reference collection for information management and retrieval in engineering (IMRE). V: CIB W78 W102 2011, Joint Conference, 28th CIB W78 2011 International Conference, 6th CIB W102 2011 International Conference, 26-28 October, Sophia Antipolis, France. Program and proceedings : Computer Knowledge Building. Sophia Antipolis: CIB, 2011, str. 1-9.

CEROVŠEK, Tomo. On AEC query formulation techniques. V: ZARLI, Alain (ur.), SCHERER, Raimar J. (ur.). 7th European Conference on Product and Process Modelling in the Building and Construction Industry - ECPPM 2008, Sophia Antipolis, France, 10-12 September. eWork and eBusiness in Architecture, Engineering and Construction : proceedings of the 7th European Conference on Product and Process Modelling in the Building and Construction Industry - ECPPM 2008, Sophia Antipolis, France, 10-12 September. Boca Raton [etc]: CRC Press: Taylor & Francis Group, cop. 2009, str. 269-277.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	HIDROMEHANIKA
Course title:	
	HYDROMECHANICS

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni	Ni členitve (študijski program)	2. letnik	Zimski

Univerzitetna koda predmeta/University course code:

1166

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
45	0	30	0	0	75	5

Nosilec predmeta/Lecturer:

Gorazd Novak

Vrsta predmeta/Course type:

Obvezni strokovni /Obligatory professional

Jeziki/Languages:

Predavanja/Lectures:

Slovenščina

Vaje/Tutorial:

Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

Prerequisites:

Opravljeni izpiti iz predmetov Fizika, Matematika I in II.

Passed exams in Physics, Mathematics I and II.

Vsebina:

Content (Syllabus outline):

Predavanja

Lastnosti tekočin, razlike med hidromehaniko in mehaniko trdnih teles. Osnovne enačbe: kontinuitetna, dinamična, enačba stanja. Princip reševanja hidrodinamičnih problemov. Hidrostatika: tlaki in sile na ravne in krive ploskve, vzgon, stabilnost plavanja. Kinematika idealne nestisljive tekočine: tokovna funkcija in potencial toka. Rotor hitrosti, primeri vrtničnega toka, potencialni tok in primeri iz gradbene prakse. Dinamika idealne nestisljive tekočine: energijska, Bernoullijeva, Cauchyjeva enačba. Teorem o gibalni tekočini. Tok

Lectures

Fluid properties, differences between hydromechanics and solid mechanics. Basic equations: continuity, momentum, equation of state. Principles of solving hydrodynamic problems. Hydrostatics: pressures and forces on flat and curved planes, buoyancy, stability of floating bodies. Kinematics of ideal incompressible fluid: stream function and potential function. Velocity curl, examples of rotational flow, irrotational (potential) flow and examples from civil engineering practice. Dynamics of ideal incompressible fluid: energy,

podtalnice, Darcyjev zakon. Tok realne tekočine: turbulenca, laminarni in turbulentni tok, mejna plast, upor teles. Konvekcijsko difuzijska enačba za transport snovi v vodi. Modelna podobnost, fizični in numerični hidravlični modeli.

Vaje

Izračun velikosti in prijemališč sil hidrostatičnega tlaka na ravne in ukrivljene ploskve. Stabilnost pregrade. Stabilnost plavanja in kot nagiba splavov in pontonskih mostov. Določitev tokovnic pri obtekanju različnih kotov; superpozicija izvora in paralelnega toka. Uporaba energijske enačbe za tok v cevovodih, tudi primeri s črpalko. Uporaba Darcyjevega zakona za račun podtalnice: tok v vodonosniku, filtracija pod pregrado, vodnjaki. Uporaba impulznega stavka za račun sil na kolena in razcepe cevovodov. Realna tekočina: določitev sile upora pri obtekanju mostnega opornika. Eksperimentalne vaje na fizičnih modelih (model hidrostatičnega tlaka v tekočinah, model stabilnosti plavanja, model podtalnice, model toka v cevovodih).

Bernoulli, Cauchy equations. Momentum theorem. Groundwater flow, Darcy's law. Flow of real fluid: turbulence, laminar and turbulent flow, boundary layer, fluid drag. Convective-diffusion equation for mass turbulent transport in water. Model similarity, physical and numerical models.

Tutorials

Computation of forces and their points of application on flat and curved planes. Stability of a dam. Stability and angles of inclination of floating bodies and pontoon bridges. Determination of streamlines in various bends; superposition of source and parallel flow. The use of energy equation for flow in pipelines, including cases with pumps. The use of Darcy law for the calculation of groundwater flow. The use of momentum theorem for the computation of forces in pipeline bends and junctions. Real fluid: drag force in case of a flow past a bridge pier. Experimental exercises using physical models (model of hydrostatic pressure in liquids, buoyancy stability model, groundwater model, pipeline flow model). measurements with computational results.

Temeljna literatura in viri/Readings:

Novak, G. 2024. Hidromehanika – vaje. Učno gradivo za predmet Hidromehanika. Ljubljana, UL FGG, 87. str.
Rajar, R. 1997. Hidromehanika, učbenik. Ljubljana, UL FGG, 236 str.
Četina, M. 1997. Zbirka rešenih nalog iz hidromehanike, študijsko gradivo. Ljubljana, UL FGG, 245 str.

Cilji in kompetence:

Cilji

- Študent dobi osnovno znanje mehanike tekočin, ki mu omogoča reševanje številnih problemov gradbene prakse.
- Študent se nauči splošnega načina reševanja inženirskih problemov - od zbiranja podatkov, izbire ustreznih enačb, presoje njihove točnosti, izračuna, do verifikacije rezultatov.
- S pomočjo računskih in laboratorijskih vaj študentje utrdijo pridobljeno teoretično znanje in spoznajo njegovo uporabnost za reševanje praktičnih problemov.

Pridobljene kompetence

- Študent zna uporabljati poenostavljene enačbe, ki izhajajo iz splošnih enačb mehanike tekočin.
- Študent zna uporabljati osnovne enačbe hidrostatične za določanje tlakov, sil in njihovih prijemališč na ravne in ukrivljene ploskve ter za račun stabilnosti pregrad.
- Študent zna uporabiti Bernoullijevo oz. energijsko enačbo za določanje značilnosti toka idealne nestisljive tekočine v cevovodih.

Objectives and competences:

Objectives

- Student gets basic knowledge of fluid mechanics that allows him to solve numerous problems from civil engineering practice.
- Student learns the general way of solving engineering problems – from data acquisition, selection of the relevant equations, assessment of their accuracy, calculation, to verification of results.
- With the help of calculation and laboratory tutorials, students consolidate the acquired theoretical knowledge and recognize its applicability.

Gained competences

- Student knows how to use simplified equations derived from general equations of fluid mechanics.
- Student knows how to use basic equations of hydrostatics to determine pressures, forces and their points of application on flat and curved planes, and how to determine stability of dams.

• Študent razume teorijo potencialnega toka za določanje toka podtalnice in rešuje enostavne probleme. • Študent zna uporabiti teorem o gibalni količini za stalni tok za račun reakcijskih sil in sile curka. • Študent razume principe laminarnega in turbulentnega toka realnih tekočin ter pozna osnove modelne podobnosti; zna praktično uporabiti enačbo za račun upora teles v toku	• Student knows how to use Bernoulli or energy equation to determine characteristics of ideal incompressible fluid flow in pipes. • Student understands the theory of potential flow to determine groundwater flow and can solve simple problems. • Student knows how to use the momentum theorem. • Student understands the principles of laminar and turbulent flow of real fluids, as well as of model similarity; he is able to use the equation of fluid drag for practical purposes.
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Predvideni študijski rezultati:

• Študent razume lastnosti in razvrstitev tekočin ter njihove posebnosti v primerjavi s trdnimi snovmi. • Študent pozna osnovne principe izpeljave osnovnih enačb: kontinuitetne (princip ohranitve mase), dinamične (princip ravnovesja sil) in enačbe stanja. • Poenostavljene enačbe študent zna uporabiti za praktične probleme določanja sil in prijemališč zaradi hidrostatskega tlaka na zapornice, pregrade in nasipe. • Študent zna uporabiti energijsko enačbo za račun toka v kratkih cevovodih, kjer je možna predpostavka o idealni tekočini. • S pomočjo teorije potencialnega toka študent zna preračunati tok podtalnice v primerih toka pod pregrado in toka proti vodnjaku. • Študent razume razlike med modelnimi podobnostmi in zna uporabiti modelna merila za pretvorbo veličin v naravi in na modelu. • Študent zna izračunati silo upora v primerih obtekanja teles. • Študent se navaja na uporabo literature in kritično presojo spletnih virov ter se z oddajo pisnih izdelkov navaja na pisno poročanje.	• Student understands properties and classification of fluids and their specifics in comparison with solids. • Student knows the basic principles of the derivation of equations: continuity (the principle of mass conservation), dynamic (the principle of forces equilibrium) and equation of state. • Student is able to use simplified equations for practical problems of determining forces and their points of application on gates, dams and dykes. • Student knows how to use energy equation for flow in short pipelines where the supposition of ideal fluid is possible. • With the use of potential flow theory, the student knows how to compute groundwater flow below dams and in cases of wells. • Student understands various model similarities and knows how to apply model scales to transform quantities from a model to the nature. • Student knows how to calculate drag force in various cases of flow past an object. • Student becomes familiar with the use of literature and critical evaluation of internet sources; the submission of written course works helps developing reporting skills.
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Metode poučevanja in učenja:

Predavanja so podana kot digitalne predstavitve, ki vključujejo tudi video posnetke in interaktivne teste, s katerimi se lahko sproti preveri razumevanje snovi, oz. poudari bistvene točke. Vsi koraki glavnih izpeljav so podani na tablo, skupaj s komentarji. Zaradi lažje predstave dinamike obravnavanih pojavov imajo študentje laboratorijske vaje podkrepljene s prikazi v okviru demonstracijskega centra na modelih v laboratoriju, ki jih izvajajo v manjših skupinah. Ob koncu semestra se izvede strokovno vodeni ogled Inštituta za hidravlične raziskave, kjer	Lectures are given as digital presentations that also include videos and interactive tests to check if the lecture was clear, and to point out the important highlights. All the steps of the main derivations are written on a blackboard, together with the comments. To allow better perception of the dynamics of the considered phenomena, the students have laboratory tutorials supported in the scope of demonstration center with experiments on models in smaller groups.
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študentje lahko vidijo fizične modele aktualnih raziskav različnih hidrotehničnih objektov.	At the end of the semester, a guided tour of the Institute for hydraulic research is organized, so that students can see current physical hydraulic models of various hydrotechnical structures.
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Načini ocenjevanja:**Delež/Weight****Assessment:**

Računski del izpita (naloge, pisni)	50,00 %	Computational part of the exam exercises, written)
Teoretični del izpita (pisni)	40,00 %	Theoretical part of the exam (written)
Domače naloge	10,00 %	Homework

Reference nosilca/Lecturer's references:

NOVAK, Gorazd, PENGAL, Polona, SILVA T., Ana, DOMÍNGUEZ, José Manuel, TAFUNI, Angelo, ČETINA, Matjaž, ŽAGAR, Dušan. Interdisciplinary design of a fish ramp using migration routes analysis. *Ecological modelling*. jan. 2023, letn. 475, [article no.] 110109, str. 1-12. DOI: [10.1016/j.ecolmodel.2022.110189](https://doi.org/10.1016/j.ecolmodel.2022.110189)

NOVAK, Gorazd, DOMÍNGUEZ, José M., TAFUNI, Angel, SILVA T., Ana, PENGAL, Polona, ČETINA, Matjaž, ŽAGAR, Dušan. 3-D numerical study of a bottom ramp fish passage using smoothed particle hydrodynamics. *Water*. 1 Jun. 2021, vol. 13, iss. 11, [article no.] 1595, str. 1-19. DOI: [10.3390/w13111595](https://doi.org/10.3390/w13111595).

NOVAK, Gorazd, DOMÍNGUEZ, José M., TAFUNI, Angel, ČETINA, Matjaž, ŽAGAR, Dušan. Določitev koeficienta upora potopljenega telesa z uporabo metode SPH = Evaluation of the drag coefficient of a fully submerged body using SPH. *Acta hydrotechnica*. [Spletna izd.]. 2019, letn. 32, št. 57, str. 107-119. DOI: [10.15292/acta.hydro.2019.08](https://doi.org/10.15292/acta.hydro.2019.08).

BOMBAČ, Martin, ČETINA, Matjaž, NOVAK, Gorazd. Study on flow characteristics in vertical slot fishways regarding slot layout optimization. *Ecological engineering*. [Print ed.]. okt. 2017, letn. 107, str. 126-136. DOI: [10.1016/j.ecoleng.2017.07.008](https://doi.org/10.1016/j.ecoleng.2017.07.008).

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	OSNOVE MEHANIKE
Course title:	
	INTRODUCTION TO STRUCTURAL MECHANICS

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni	Ni členitve (študijski program)	2. letnik	Zimski

Univerzitetna koda predmeta/University course code:

1167

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
75	0	45	0	0	120	8

Nosilec predmeta/Lecturer:

Dejan Zupan

Vrsta predmeta/Course type:

Obvezni strokovni /Obligatory professional

Jeziki/Languages:

Predavanja/Lectures:

Slovenščina

Vaje/Tutorial:

Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

Prerequisites:

Opravljeni izpiti iz predmetov: Matematika I, Matematika II, Fizika.

Passed exams from the courses: Mathematics I, Mathematics II, Physics.

Vsebina:

Content (Syllabus outline):

1.del

Uvod in osnovni koncepti modeliranja gradbenih konstrukcij: modeliranje konstrukcij, podpor in vezi; linijske, ploskovne in 3D konstrukcije; obtežbe gradbenih konstrukcij. Statično določena ravninska paličja: koncepti in definicije; lokalna in globalna ravnotežna enačba; metode reševanja. Statično določeni ravninski okvirji: koncepti in definicije; ravnotežne enačbe; taktike reševanja statično

Part 1

Engineering description of various types of structures and their supports and connections. Basic concepts of structural modelling by using trusses, beams, plates and shells. Models of structural loads. Statically determined planar trusses: concepts and definitions; principles of equilibrium; analytical solution methods. Statically determined planar frames: concepts and definitions; equilibrium

določenih ravninskih okvirjev. Pomiki, zasuki in upogibnica linijskega nosilca: koncepti; diferencialna enačba ravninskega upogiba; robni pogoji; integracija diferencialne enačbe za klasične primere s preprosto obtežbo; interpretacija rezultatov, upogibnica, notranje sile in reakcije. Statično nedoločeni ravninski okvirji: stopnja statične nedoločnosti; metode reševanja preprostih okvirjev. Geometrijske karakteristike prereza nosilca: ploščina; statični moment; vztrajnostni moment; sestavljeni prerezi. 2.del Koncept zvezne snovi. Geometrijski opis telesa. Deformacije. Polje pomikov. Tenzor deformacij. Fizikalni pomen majhnih deformacij. Napetosti. Vektor napetosti. Tenzor napetosti. Normalne in strižne komponente. Notranja sila in notranji moment kot rezultanti napetosti v prereza. Ravnotežni pogoji za delec v notranjosti in na površini telesa. Zveze med napetostmi in deformacijami. Enoosni natezni preskus. Linearno elastična snov, Hookov zakon. Posplošitev na prostorsko napetostno-deformacijsko stanje. Strižni preskus. Vplivi temperature, krčenja in tečenja materiala.	equations; methods and methodology. Displacements, rotations and deformed shape in planar beams: concepts; differential equations for displacements; boundary conditions; integration of boundary-value problem for continuous tractions; engineering interpretation of results; deformed shape, internal forces and reactions. Simple statically indeterminate frames: degree of static indeterminacy; basic concepts of displacement-based method of analysis. Geometrical characteristics of planar cross-sections: area; static moment; inertial moment; composite cross-sections. Part 2 Concept of continuum: body and its position in mathematical space. Strains: displacements, strain tensor, engineering meaning of small strains. Stresses: stress vector; stress tensor; normal and shear components; stress resultants; equilibrium equations and boundary conditions. Material equations (or constitutive equations): linearly elastic material as a material model for steel, concrete and soil; uniaxial, shear and triaxial tests; experimental determination of material parameters; effects of temperature; effects of shrinkage and creep in concrete.
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Temeljna literatura in viri/Readings:

Stanek, M., Turk, G. 2005. Statika I, učbenik. Ljubljana, UL FGG.
 Srpcič, S. 2003. Mehanika trdnih teles, učbenik. Ljubljana, UL FGG.
 Stanek, M., Turk, G. 1998. Osnove mehanike trdnih teles, učbenik. Ljubljana, UL FGG.
 SRPČIČ, Stane. 2015. Trdnost I. Ljubljana, Univerza v Ljubljani, Fakulteta za gradbeništvo in geodezijo, 420 str.
 SRPČIČ, Stane. 2015. Trdnost II. Ljubljana, Univerza v Ljubljani, Fakulteta za gradbeništvo in geodezijo, 387 str.
 ZUPAN, Dejan. 2013. Trdnost : gradivo za vaje na študiju 1. stopnje Operativno gradbeništvo. Ljubljana, Fakulteta za gradbeništvo in geodezijo, 1 optični disk (CD-ROM).

Cilji in kompetence:

Cilji

- Spoznati osnovne koncepte statike in modeliranja različnih gradbenih konstrukcij,
- spoznati tipičen računalniški program za statično analizo ravninskih linijskih konstrukcij,
- spoznati osnovne koncepte matematičnega modeliranja mehanskega obnašanja 3D teles in razumeti fizikalni/inženirski pomen količin, ki nastopajo v modelih,
- razumeti, interpretirati in presojati podatke in dobljene rezultate.

Objectives and competences:

Objectives

- To know concepts of statics and modeling of structural systems,
- to know a typical computer program for static analysis of planar frames,
- to become acquainted with basic concepts of mathematical modeling of mechanical behavior of deformable solids and being able to understand how the concepts and theories are applied in the analysis of structures,

Pridobljene kompetence • Sposobnost povezovanja raznih znanj med seboj, • sposobnost abstraktnega razmišljanja, • sposobnost brez računalniškega programa izračunati statiko preprostih ravninskih linijskih konstrukcij, • sposobnost uporabljati računalniški program za analizo manj zahtevnih konstrukcij.	• to be able to understand, interpret and judge data and results of the structural analysis. Gained competences • To be able to combine various disciplines like mathematics, physics, structural mechanics, computers and constructional engineering, • to be able of abstract thinking, • to be able to perform static analysis of simple planar frames by hand, • to be able to use computer tools to perform static analysis of simple planar frames.
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Predvideni študijski rezultati:**Intended learning outcomes:**

• Študent zna brez računalniškega programa določiti sile in pomike v preprostih ravninskih linijskih konstrukcijah. Zna uporabljati tudi računalniški program. • Študent se nauči določenih konkretnih algoritmov in procedur, ki jih potrebuje pri računu napetostno-deformacijskega stanja v konstrukciji (račun deformacij iz znanih pomikov, račun napetosti iz znanih deformacij, račun ekstremnih vrednosti deformacij in napetosti in njihovih smeri). • Zna na izvedbeni ravni reševati preproste naloge in razume teoretično ozadje (koncepti, principi), kar dokaže z opisnim znanjem.	• Students should be able to determine forces and displacements in simple planar frames by hand and by computer. • They should be able to explain theoretical background and to determine strains from a given displacement field, stresses from strains, strains and stresses in a chosen direction as well as calculate principal strains and stresses. • Students should well understand concepts, principles and how the equations have been set; applications are limited to simple problems, mainly to illustrate the theory and how it can be applied in practice.
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Metode poučevanja in učenja:**Learning and teaching methods:**

Ker je predmet temeljni, predavanja in vaje potekajo klasično. Del vaj študenti rešujejo pred tablo, del doma. Predstavitve konstrukcij in računalniške simulacije njihovega odziva na obtežbe so prikazane računalniško. Za boljše spremljanje snovi in sprotno učenje dobijo študenti individualne domače naloge.	Teaching is performed traditionally. Lectures are followed by exercises whenever it is convenient. In the statics unit, problems are mostly being solved by students. This is not the case in the strength of material unit. Students must regularly work and learn at home to complete their individual home assignments.
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Načini ocenjevanja:**Delež/Weight****Assessment:**

Dva pisna preizkusa znanja	50,00 %	Two written tests
Pisni izpit	50,00 %	Written examination

Reference nosilca/Lecturer's references:

RODMAN, Urban, ZUPAN, Dejan, ŠUŠTAR, Tomaž, KORELC, Jože. Geometrically nonlinear analysis of layered beams using symbolic approach. *Composite structures*. 2025, vol. 351, DOI: 10.1016/j.compstruct.2024.118583.

KUSUMA CHANDRASHEKHARA, Sudhanva, ZUPAN, Dejan. Analyzing material softening and strain localisation through embedded strong discontinuity approach within velocity-based beam formulation. *Computers & Structures*. 2024, vol. 301, <https://doi.org/10.1016/j.compstruc.2024.107464>.

MOČNIK, Robert, KOLER, Božo, ZUPAN, Dejan, AMBROŽIČ, Tomaž. The influence of pillar displacements on geodetic measurements. *Applied sciences*. 2020, vol 10, DOI: [10.3390/app10238319](https://doi.org/10.3390/app10238319).
ZUPAN, Eva, ZUPAN, Dejan. Velocity-based approach in non-linear dynamics of three-dimensional beams with enforced kinematic compatibility. *Computer methods in applied mechanics and engineering*. 2016, vol. 310, DOI: [10.1016/j.cma.2016.07.024](https://doi.org/10.1016/j.cma.2016.07.024).

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	MATEMATIKA III
Course title:	
	MATHEMATICS III

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni	Ni členitve (študijski program)	2. letnik	Zimski

Univerzitetna koda predmeta/University course code:

1642

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
60	0	45	0	0	105	7

Nosilec predmeta/Lecturer:

Marjeta Kramar Fijavž

Vrsta predmeta/Course type:

Obvezni splošni /Obligatory general

Jeziki/Languages:

Predavanja/Lectures:

Slovenščina

Vaje/Tutorial:

Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

Prerequisites:

Opravljen izpiti iz Matematike I in Matematike II.

Passed exams in Mathematics I and Mathematics II.

Vsebina:

Content (Syllabus outline):

Navadne diferencialne enačbe: linearna diferencialna enačba n -tega reda s konstantnimi koeficienti, linearni sistemi diferencialnih enačb 1. reda, karakteristični polinom, neodvisnost rešitev, matrična rešitev začetnega problema, fazni diagrami v dveh dimenzijah, robni problem.

Parcialne diferencialne enačbe: klasifikacija, enačbe matematične fizike, linearne enačbe 1. reda, metoda karakteristik, nihanje neskončne in končne strune, d'Alembertova rešitev, toplotna enačba, Fourierove vrste, začetni in robni problem.

Ordinary differential equations: linear differential equations of order n with constant coefficients, linear systems of differential equations of first order, characteristic polynomial, independence of solutions, matrix solution of initial problem, phase diagrams in two dimensions, boundary value problem.

Partial differential equations: classification, equations of mathematical physics, linear equations of first order, method of characteristics, vibrating infinite and finite string, d'Alembert solutions, heat

Osnove teorije grafov: vozlišča, povezave, izomorfnost, pot, cikel, sprehod, drevo, Hamiltonov in Eulerjev cikel, problem najkrajše pot, usmerjeni grafi, uteženi grafi, povezanost, vpeta drevesa, ravninski grafi. Primeri matematičnega modeliranja.	equation, Fourier series, initial and boundary value problem. Basics on graph theory: vertices, edges, isomorphism, adjacency and incidence, matrix presentation, path, cycle, walk, tree, Hamiltonian and Eulerian cycle, the shortest path problem, directed graph, weighted graph, connectedness, spanning trees, planar graphs. Examples of mathematical modelling.
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Temeljna literatura in viri/Readings:

Gerald, C.F., Wheatley, P.O. 1993. Applied Numerical Analysis, Addison-Wesley Publishing Company.

Logan, J. D. 2011, A first course in differential equations, Springer.

Mizori-Oblak, P. 1987. Matematika za študente tehnike in naravoslovja II, III. Ljubljana, UL, Fakulteta za strojništvo.

Pinchover, Y., Rubinstein, J. , 2005, An Introduction to Partial Differential Equations, Cambridge University Press.

Vidav, I. 1976. Višja matematika III. Ljubljana, DMFA.

Wilson, R.J., Watkins, J.J. 1997. Uvod v teorijo grafov. Ljubljana, DMFA.

Cilji in kompetence:**Cilji**

- Nadgraditi pridobljeno matematično znanje,
- omogočiti razumevanje matematičnega aparata, ki ga uporabljajo strokovni predmeti,
- usposobiti za pravilno postavitev in numerično reševanje konkretnih problemov.

Pridobljene kompetence

- Sposobnost kritične presoje podatkov in dobljenih računskih rezultatov,
- sposobnost uporabe matematičnega znanja v inženirski praksi.

Objectives and competences:**Objectives**

- To upgrade acquired mathematical knowledge,
- to enable understanding of mathematical tools used by engineering courses,
- to train for correct posing and numerical solving of given practical problems.

Gained competences

- Capability of a critical judgement of data and obtained numerical results,
- to be able to use mathematical knowledge in engineering problems.

Predvideni študijski rezultati:

- Reševanje navadnih in parcialnih diferencialnih enačb,
- pridobiti osnovna znanja o slučajnih procesih in teoriji grafov,
- formulacija konkretnih problemov v matematičnem jeziku,
- identifikacija ustreznega matematičnega modela,
- poznavanje teoretičnih osnov za praktično iskanje rešitev,
- spretnost uporabe literature in modernih tehnologij.

Intended learning outcomes:

- Solving ordinary and partial differential equations,
- basic knowledge on stochastic processes and graph theory,
- formulation of practical problems in mathematical language,
- identification of the appropriate mathematical model,
- basic theoretical knowledge for using in practical problems,
- skills in using literature and modern technologies.

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

Predavanja, seminarske vaje, domače naloge, konzultacije.

Lectures, tutorials, home exercises, consultations.

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

Računske naloge in sprotno delo

70,00 %

Exercises and homework

Izpit (teoretični del)

30,00 %

Exam (theoretical part)

Reference nosilca/Lecturer's references:

ENGEL, Klaus, KRAMAR FIJAVŽ, Marjeta, KLÖSS, Bernd, NAGEL, Rainer, SIKOLYA, Eszter. Maximal controllability for boundary control problems. Appl. math. optim., 2010, vol. 62, no. 2, str. 205-227.

KRAMAR FIJAVŽ, Marjeta, MUGNOLO, Delio, SIKOLYA, Eszter. Variational and semigroup methods for waves and diffusion in networks. Appl. math. optim., 2007, vol. 55, no. 2, str. 219-240.

KRAMAR FIJAVŽ, Marjeta, SIKOLYA, Eszter. Spectral properties and asymptotic periodicity of flows and networks. Math. Z., 2005, vol. 249, no. 1, str. 139-162.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	GOSPODARJENJE S SEKUNDARNIMI IN ODPADNIMI SNOVMI
Course title:	
	SECONDARY AND WASTE MATERIALS MANAGEMENT

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni	Ni členitve (študijski program)	2. letnik	Zimski

Univerzitetna koda predmeta/University course code:	1643
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Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
45	0	45	0	0	90	6

Nosilec predmeta/Lecturer:	Violeta Bokan-Bosiljkov
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Vrsta predmeta/Course type:	Obvezni strokovni /Obligatory professional
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Jeziki/Languages:	Predavanja/Lectures:	Slovenščina
	Vaje/Tutorial:	Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Opravljeni izpiti iz predmetov: Uvod v okoljsko inženirstvo, Osnove kemije, Gradiva.	Passed exams in the following subjects: Introduction to Environmental Engineering, Basic Chemistry, and Construction and Building Materials

Vsebina:	Content (Syllabus outline):
Predavanja Zgodovinski pregled gospodarjenja z odpadnimi snovmi; okoljske politike; mednarodni sporazumi in zakonodaja; lastnosti in značilnosti sekundarnih surovin in odpadkov in klasifikacija odpadkov; predelava in obdelava sekundarnih surovin: fizikalno-kemijska predelava; biokemična obdelava; toplotna obdelava; MBO mešanih komunalnih odpadkov; odlaganje odpadkov na odlagališča; ponovna uporaba nenevarnih odpadkov v gradbenih	Lectures Historical overview of waste material management; environmental policies; international agreements and legislation; properties and characteristics of secondary raw materials and waste and classification of waste; processing and treatment of secondary raw materials: physical-chemical processing; biochemical treatment; heat treatment; MBO of mixed municipal waste; disposal of waste to landfills; re-use of non-hazardous waste in construction

proizvodih; krožno gospodarstvo in vloga inženirja; zahteve za inženirske pregrade v odlagališču visokoradioaktivnih odpadkov ter v odlagališču nizko in srednje radioaktivnih odpadkov Seminar Priprava programskih izhodišč in izdelava idejne zasnove in koncepta gospodarjenja s sekundarnimi surovinami ali analiza različnih nacionalnih praks gospodarjenja s sekundarnimi surovinami. Izhodišča za seminarsko nalogo so štirje usmerjeni sklopi ekskurzij, ki praktično predstavijo krožno gospodarstvo ter predelavo, obdelavo in odlaganje sekundarnih surovin.	products; circular economy and role of engineer; requirements for engineering barriers in repositories of high level or low and intermediate level radioactive waste Seminar Preparation of programme starting points and conceptual design of secondary raw material management concept or analysis of various national approaches to the secondary raw material management. Platform for the project work is four directed sets of excursions that virtually present circular economy as well as the processing, treatment and disposal of secondary raw materials.
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Temeljna literatura in viri/Readings:

Williams, P.T. 2005. Waste treatment and disposal, 2nd edition. Wiley-Blackwell, 392 p.

Letcher, T., Vallero, D. (Editors). 2011. Waste: A Handbook for Management. Academic Press, 604 p.

OECD Environmental Performance Reviews: Slovenia 2012, OECD Publishing, 2012, 186 p.

Kranert, M., Cord-Landwehr, K. (Editors). 2010. Einführung in die Abfallwirtschaft, 4. edition, 665 p.

Spletna stran Ministrstva za kmetisjstvo in okolje – delovno področje odpadki. Dostopno na: http://www.mko.gov.si/si/delovna_podrocja/odpadki/.

Cilji in kompetence:**Cilji**

- Spoznati problematiko preprečevanja, nastajanja in gospodarjenja s sekundarnimi surovinami,
 - spoznati procesno integrirano varstvo okolja v izbranih gospodarskih panogah in storitvah,
 - spoznati fizikalno-kemične in biokemične lastnosti sekundarnih surovin, relevantnih za njihovo ponovno uporabo, predelavo ali odlaganje,
 - spoznati najnovejše tehnologije ločevanja, zbiranja, ponovne uporabe, predelave in odlaganja komunalnih odpadkov,
 - pridobiti znanja za načrtovanje objektov za ponovno uporabo, predelavo in odstranjevanje sekundarnih in odpadnih snovi,
 - pridobiti znanja za načrtovanje inženirskih pregrad v odlagališčih,
 - spoznati politike, zakonodajo in mednarodne sporazume na tem področju.
- Pridobljene kompetence
- Zna načrtovati dolgoročne pristope, postopke in naprave za stalno zmanjševanje nastajanja odpadkov,

Objectives and competences:**Objectives**

- To learn about the problems of prevention, generation and management of secondary raw materials,
- to learn about production-integrated environmental protection in selected industries and services,
- to learn about physical-chemical and biochemical properties of secondary raw materials relevant to re-use, recycling or disposal,
- to learn about the latest technologies of separation, collection, re-use, recycling and disposal of municipal waste,
- to acquire knowledge for the design of facilities for re-use, recycling and disposal of secondary and waste materials,
- to acquire knowledge for the design of engineering barriers in repositories,
- to learn about policies, legislation and international agreements in this field.

Gained competences

• samostojno zna postaviti programska izhodišča in izdelati idejno zasnovo za koncept gospodarjenja s komunalnimi odpadki, • samostojno zna izdelati idejno zasnovo inženirskih pregrad v odlagališčih odpadkov.	• To be able to plan long-term approaches, procedures and facilities for continuous reduction of waste, • to be able to set up programme platform and prepare a conceptual design for the management of municipal waste, • to be able to prepare a conceptual design of engineering barriers in waste repositories.
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Predvideni študijski rezultati:

• Sistematičen vpogled v mesta in vzroke nastajanja surovinsko-energetske entropije družbe v njenih glavnih pojavnih oblikah in pristopi za njihovo obvladovanje. • Koncepti trajnostnega ravnanja s surovinami in emisijami. • Koncepti načrtovanja inženirskih pregrad v odlagališčih odpadkov. • Percepcija zahtev moderne družbe, zagotavljanje dobrin in organizirano gospodarjenje s sekundarnimi in odpadnimi snovmi. Prehod od linearnega k cikličnemu procesu, razvoj od »neomejenih virov« do učinkovite rabe virov, sodelovanje povzročiteljev, 3R principi, strategija vzpostavljanja družbe brez odpadkov. • Pridobljena znanja omogočajo sistematično načrtovanje dolgoročnih pristopov, postopkov in naprav za stalno zmanjševanje nastajanja odpadkov ter za gospodarno in okoljsko sprejemljivo ravnanje s sekundarnimi in odpadnimi snovmi. • Teoretična znanja in praktične izkušnje ter ozaveščenost glede pomembnosti vloge inženirja na področju gospodarjenja s sekundarnimi in odpadnimi snovmi omogoča diplomantu kreativno in inovativno reševanje tovrstnih družbenih problemov. • Vsebina predmeta s svojim interdisciplinarnim pristopom omogoča sooblikovati kritično misleče vrhunske strokovnjake, ki so usposobljeni za vzpostavljanje trajnostne družbe.	Intended learning outcomes: • Systematic insight into the places and causes of the society entropy connected with raw materials and energy in its main forms and approaches to their management. • Concepts of sustainable management of raw materials and emissions. • Concepts of planning of engineering barriers in waste repositories. • Perception of the requirements of modern society, the provision of goods and management of secondary and waste materials. Transition from linear to cyclical process, development from "unlimited resources" to efficient use of resources, cooperation of waste producers, 3R principles, strategy of establishing zero-waste society. • The acquired knowledge enables systematic planning of long-term approaches, procedures and facilities for continuous reduction of waste as well as economically and environmentally sound management of secondary and waste materials. • Theoretical knowledge and practical experience and awareness of the importance of the role of engineer in the field of management of secondary and waste materials allows the graduate creative and innovative solving of such social problems. • The content of the course with its interdisciplinary approach allows educating of top professionals with critical thinking who are trained to re-establish sustainable society.
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Metode poučevanja in učenja:

Snov se podaja v obliki predavanj in usmerjenih sklopov štirih ekskurzij, ki vključujejo predavanja strokovnjakov iz prakse in sledijo glavnim ciljem predmeta. Predavanjem in ekskurzijam sledijo seminarske vaje, v okviru katerih študentje pripravijo programska izhodišča in samostojno izdelajo idejno zasnovo in koncept gospodarjenja z izbranimi sekundarnimi surovinami ali kritično analizirajo	Knowledge is provided in the form of lectures and four directed sets of excursions that include lectures given by experts from practice who follow the main objective of the course. The lectures and excursions are followed by seminar tutorial, during which students prepare programme platform and conceptual design and management of selected secondary raw material concept or critically analyse
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različne nacionalne prakse gospodarjenja s sekundarnimi surovinami.	various national practices of secondary raw material management.
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Načini ocenjevanja:**Delež/Weight****Assessment:**

Kolokvij ali izpit	50,00 %	Mid-term exam or exam
Vaje (opravljene in zagovor)	50,00 %	Seminar exercises and its defence

Reference nosilca/Lecturer's references:

ŽARNIČ, Roko, BOKAN-BOSILJKOV, Violeta, GIACOMELLI, Marko. Safety evaluation methodology of engineering barriers at repository for low and intermediate level radioactive waste. V: JENČIČ, Igor (ur.), LENOŠEK, Melita (ur.). International Conference Nuclear Energy for New Europe 2007, Portorož, Slovenia, September 10-13. Conference proceedings. Ljubljana: Nuclear Society of Slovenia, 2007, str. 710.1-710.8.

PRINČIČ, Tina, ŠTUKOVNIK, Petra, PEJOVNIK, Stane, SCHUTTER, Geert De, BOKAN-BOSILJKOV, Violeta. Observations on dedolomization of carbonate concrete aggregates, implications for ACR and expansion. Cem. concr. res.. [Print ed.], dec. 2013, letn. 54, str. 151-160.

BOKAN-BOSILJKOV, Violeta, ŽARNIČ, Roko. Izdelava metodologije za presojo varnosti inženirskih pregrad odlagališča nizko in srednje radioaktivnih odpadkov : izdelek 3. faze projektne naloge : končno poročilo. Ljubljana: Univerza v Ljubljani, Fakulteta za gradbeništvo in geodezijo, Katedra za preskušanje materialov in konstrukcij, 2006. 129 str.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	OSNOVE ZDRAVSTVENE HIDROTEHNIKE
Course title:	
	INTRODUCTION TO SANITARY ENGINEERING

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni	Ni členitve (študijski program)	2. letnik	Letni

Univerzitetna koda predmeta/University course code:	1556
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Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	0	30	0	0	60	4

Nosilec predmeta/Lecturer:	Mario Krzyk, Nataša Atanasova
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Vrsta predmeta/Course type:	Obvezni strokovni /Obligatory professional
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Jeziki/Languages:	Predavanja/Lectures:	Slovenščina
	Vaje/Tutorial:	Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:

Vsebina:	Content (Syllabus outline):
Kaj obsega zdravstvena hidrotehnika. Zgodovinski razvoj zdravstvene hidrotehnike. Izhodišča za vodooskrbo in čiščenje pitnih voda: karakteristike virov pitne vode, poraba in kakovost vode, vodovodni sistemi in objekti, priprava, tehnološke metode in tehnike priprave čiščenja pitnih voda. Izhodišča za odvod in čiščenje onesnaženih voda iz naselij: vrste in količine onesnaženih voda, zasnove sistemov za odvodnjo v urbanih naseljih in avtocestah in njihovo dimenzioniranje, osnovne tehnološke metode in tehnike čiščenja odpadnih	Scope of sanitary engineering. Historical development of sanitary engineering. Basics of water supply and water treatment: characteristics of water sources, water consumption and water quality requirements, water supply systems and facilities, water treatment technologies. Wastewater: types and quantities of wastewater, urban drainage and sewerage, types of sewage systems. Design of drainage systems in urban areas and highways. Wastewater characterisation and treatment, wastewater treatment plants.

voda, objekti na kanalizacijskih sistemih in komunalnih čistilnih napravah.

Temeljna literatura in viri/Readings:

Panjan, J. 2005. Osnove zdravstveno hidrotehnične infrastrukture. Ljubljana, UL FGG, 289 str.

Izbrana poglavja iz;

Malcolm J. Brandt; K. Michael Johnson; Andrew J. Elphinston; Don D. Ratnayaka (2016) Twort's Water Supply, Seventh Edition. Butterworth-Heinemann, 2016.

Metcalf & Eddy, Inc. Wastewater Engineering : Treatment and Reuse. Boston :McGraw-Hill, 2003. Print.

Degremont, I. 1991. Water Treatment Handbook. Paris, Lavoisier Publishing, 1459 str.

Imhoff, K., Klaus, K. 1999. Taschenbuch der Stadtentwässerung, 29 Auflage. Oldenbourg, 472 str.

Hosang, W., Bischof, W. 1998. Abwassertechnik. Leipzig, B.G. Teubner Stuttgart, 724 str.

Cilji in kompetence:

Objectives and competences:

Cilji	Objectives
- Osvojiti osnovna znanja, ki so potrebna za zasnovu, projektiranje, gradnjo in vzdrževanje objektov in naprav na sistemih za oskrbo z zdravim pitno vodo in čiščenje pitnih voda ter odvodu in čiščenju onesnaženih voda. Pridobljene kompetence - Razumeti pomen oskrbe z vodo in odvoda voda, - pozna ekološki vidik varstva voda, - pozna osnove tehnologije in tehniko izvedbe objektov za čiščenje pitnih in odpadnih voda.	- To master the basic knowledge that is necessary for the design, planning, construction and maintenance of facilities and equipment for the water supply and wastewater systems and treatment of drinking water and draining of sewage water. Gained competences - understanding the importance of water supply and wastewater management/treatment, - understanding ecological aspects of water protection, - basic design of water supply, urban drainage and wastewater systems.

Predvideni študijski rezultati:

Intended learning outcomes:

- Zdravstveno hidrotehnične osnove oskrbe z zdravim pitno vodo, odvodom in čiščenjem onesnaženih voda in zaščito voda. - Študent bo spoznal in razumel: pomen oskrbe in odvoda voda za javno zdravje, ekološki vidik varstva voda, osnove tehnologije za pripravo pitnih in za čiščenje odpadnih voda, tehniko izvedbe objektov za oskrbo in odvod onesnaženih voda. - Spoznal bo postopke zdravstvene hidrotehnike pri naravnih in drugih nesrečah.	- Basics of sanitary engineering providing drinking water, drainage and treatment of polluted waters and water protection. - Student will learn and understand: the importance of water supply and drainage for public health, ecological aspects of water protection, basic water treatment technologies and wastewater treatment, design of water supply and wastewater systems. - Student will learn procedures of sanitary engineering for water protection.
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Metode poučevanja in učenja:

Learning and teaching methods:

Predavanja, prezentacije, filmi, vaje, klinične (laboratorijske) vaje.	Lectures (Power Point), video, tutorials, laboratory work.
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Načini ocenjevanja:**Delež/Weight****Assessment:**

Pisni izpit	60,00 %	Written exam
Seminarske vaje	40,00 %	Tutorials

Reference nosilca/Lecturer's references:

RADINJA, Matej, BANOVEC, Primož, COMAS, Joaquim, ATANASOVA, Nataša. Modeliranje in ocena vplivov razpršenih ukrepov zadrževanja in ponikanja padavinske vode na odtok iz urbanega povodja = Modelling and evaluating impacts of distributed retention and infiltration measures on urban runoff. *Acta hydrotechnica*, ISSN 1581-0267. [Spletna izd.], 2017, vol. 30, no. 52, str. 51-64, ilustr. <ftp://ksh.fgg.uni-lj.si/acta/a30mr.pdf>. [COBISS.SI-ID 8228193].

ŠIVIC, Ana, ATANASOVA, Nataša, PUIG, Sebastià, GRIESSLER BULC, Tjaša. Ammonium removal in landfill leachate using SBR technology - dispersed versus attached biomass. *Water science and technology*, ISSN 0273-1223, 2017, vol. 77, iss. 1, str. 27-38, ilustr., doi: 10.2166/wst.2017.519. [COBISS.SI-ID 8181089].

ATANASOVA, Nataša, DALMAU, Montserrat, COMAS, Joaquim, POCH ESPALLARGAS, Manel, RODRIGUEZ-RODA, Ignasi, BUTTIGLIERI, Gianluigi. Optimized MBR for greywater reuse systems in hotel facilities. *Journal of environmental management*, ISSN 0301-4797, 2017, letn. 193, št. maj, str. 503-511, ilustr., doi: 10.1016/j.jenvman.2017.02.041. [COBISS.SI-ID 8125793].

KRZYK, Mario, DREV, Darko, KOLBL, Sabina, PANJAN, Jože. Self-purification processes of Lake Cerknica as a combination of wetland and SBR reactor. *Environmental science and pollution research international*, ISSN 0944-1344., 2015, str. 1-9, ilustr., doi: [10.1007/s11356-015-5088-0](https://doi.org/10.1007/s11356-015-5088-0). [COBISS.SI-ID [7133793](#)].

KRZYK, Mario, MALUS, Davor, PANJAN, Jože. Meritve kakovostnih parametrov za modeliranje prvega vala onesnaženih voda s cestnih površin = Measurements of quality parameters for the modeling of the first flush of polluted water from roads. *Gradbeni vestnik*, ISSN 0017-2774, jul. 2013, letn. 62, str. 159-164, ilustr. [COBISS.SI-ID [6310497](#)]

KRZYK, Mario, PANJAN, Jože. Občutljivostna analiza parametrov modeliranja prvega vala onesnaženih voda s cestnih površin = A sensitivity analysis modeling parameters of the first wave of polluted water from road surface. *Gradbeni vestnik*, ISSN 0017-2774, dec. 2012, letn. 61, str. 275-283, ilustr. [COBISS.SI-ID [6129505](#)].

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	HIDRAVLIKA
Course title:	
	HYDRAULICS

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni	Ni členitve (študijski program)	2. letnik	Letni

Univerzitetna koda predmeta/University course code:	1675
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Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	15	30	0	0	75	5

Nosilec predmeta/Lecturer:	Gašper Rak
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Vrsta predmeta/Course type:	Obvezni strokovni /Obligatory professional
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Jeziki/Languages:	Predavanja/Lectures:	Slovenščina
	Vaje/Tutorial:	Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Opravljen izpiti iz predmetov Matematika I in Fizika.	Passed exams from the courses Mathematics I and Physics.

Vsebina:	Content (Syllabus outline):
Predavanja Uporaba enačb realne tekočine za razumevanje hidravličnih sistemov in robnih pogojev za hidravlično analizo običajnih objektov. Hidravlično dimenzioniranje objektov, ureditev in naprav, ki jih študentje spoznava po tehnološki in izvedbeni plati pri drugih predmetih z vodnogospodarskega področja. Značilnosti in dinamika realne tekočine (režimi toka). Tok v cevovodih (linijske in lokalne izgube, enostavni cevovodi, črpalke, sistemi cevovodov, programska oprema). Iztok iz odprtih in	Lectures Use of real fluid equations for the understanding of hydraulic systems and hydraulic boundary conditions for the analysis of conventional hydraulic structures. Hydraulic design of structures, watercourses and facilities that students learn about from the technological and operational aspects in other subjects within the water management area. Characteristics and dynamics of real fluids (flow regimes). Flow in conduits (local and linear losses, simple pipe problems, pumps, pipe systems,

izenačevanje gladin (stalni in nestalni tok). Odtok čez prelive, pragove in jezove. Tok v odprtih vodotokih (normalni tok, sestavljeni prerezi, hidravlično najugodnejši prerez, lokalne motnje). Stabilni odseki vodotokov (obložena in neobložena korita). Stalni neenakomerni tok (gladinske krivulje, račun gladin, programska oprema). Laboratorijske vaje Inženirska zasnova računskih primerov, računski postopki, inženirske poenostavitve z osnovami presoje računske negotovosti, primeri izračunov za cevovode, tok s prosto gladino, odprtine in preliivi. Prikaz tokovnih razmer v hidravličnem laboratoriju. Seminar Izdelava samostojne seminarske naloge za določen primer toka. Uporaba prosto dostopne programske opreme za hidravlične izračune. Izdelava poročila z interpretacijo rezultatov izračunov.	simulation software). Orifice flow and water level balancing in two vessels (steady and unsteady flow). Flow over weirs, sills and dams. Flow in open channels (normal flow, combined profiles, hydraulically efficient channel section, and local disturbances). Stable river sections (coated and uncoated water courses). Steady non-uniform flow (gradually varied flow profiles, calculation of water levels, simulation software). Laboratory exercises Engineering design of hydraulic calculations, calculation procedures. Engineering simplifications with basics of uncertainty assessment. Examples of calculations for pipe flow, flow in open channels, flow through orifices and over weirs. Visit of the hydraulic laboratory. Seminar Elaboration of individual seminar papers for a selected flow type. The use of freely available software for hydraulic calculations. Elaboration of reports with interpretation of the results of hydraulic calculations.
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Temeljna literatura in viri/Readings:

Steinman, F. 2010. Hidravlika. učbenik, 2. ponatis. Ljubljana, UL FGG, 310 str.

Rossert R. 2000. Hydraulik im Wasserbau. Oldenbourg, 184 str.

Alluri C., Featherstone, R. E., 2001. Civil engineering hydraulics: essential theory with worked examples. Blackwell, 80 str. od 430 str.

US Army Corps of Engineers: HEC-RAS 4.0 . Dostopno na: <http://www.hec.usace.army.mil/software/hec-ras> .

US Environmental Protection Agency: EPANET 2.0. Dostopno na: <http://www.epa.gov/nrmrl/wswrd/dw/epanet.html> .

Cilji in kompetence:**Cilji**

- Spoznati osnovne fizikalne zakonitosti energijskih pretvorb in specifičnosti ter hidrodinamske pojave pri različnih vrstah toka vode,
- predstaviti področja uporabe hidravličnih izračunov ter povezanost inženirske zasnove primerov vodnega toka z okoljem preko hidravličnih robnih pogojev.
- spoznati način hidravličnega dimenzioniranja elementov in enostavnih sistemov.

Objectives and competences:**Objectives**

- To understand of the basic physical principles of energy conversion, flow specificity and hydrodynamic phenomena in various types of water flow,
- to present the scope of the hydraulic calculations and integration of engineering design cases of water flow in the environment through the use of hydraulic boundary conditions,
- to understand the hydraulic design of components and simple systems.

Pridobljene kompetence	Gained competences
- Sposobnost pravilne definicije tokovnih razmer, njim primerne izbire ustreznih osnovnih enačb in robnih pogojev, - uporaba v stroki običajnih, prosto dostopnih računalniških programov za določanje merodajnih količin pri različnih vrstah tokov.	- To be able to correctly identify specific flow types, appropriate selection of hydraulic equations and boundary conditions, - to use of state-of-the-art and freely available simulation software for flow and energy determination of different types of flows.

Predvideni študijski rezultati:**Intended learning outcomes:**

- Pridobljeno znanje za obravnavo enostavnejših primerov toka v cevovodih in v vodotokih. - Razumevanje in sposobnost analize vejičastih cevovodnih sistemov ter analize črpalke v sistemu. - Razumevanje in sposobnost analize enostavnih hidrotehničnih posegov v vodotoke. - Uporaba hidravličnega dimenzioniranja na primerih, ki se obravnavajo pri drugih predmetih (vodovod, urejanje vodotokov idr.).	- Acquire knowledge to deal with simple cases of flow in pipes and in open channels. - Understanding of and ability to analyze meshed pipe systems and the analysis of pumps in the system. - Understanding of and ability to analyze simple hydro-technical interventions in open channels. - The use of hydraulic design in cases that are treated in other courses (water supply, river regulation, etc.).
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Metode poučevanja in učenja:**Learning and teaching methods:**

Predavanja, seminar in laboratorijske vaje.	Lectures, seminar and laboratory exercises.
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Načini ocenjevanja:**Delež/Weight****Assessment:**

Računski del izpita (pisno)	30,00 %	Calculation assignments (written)
Seminarska naloga	30,00 %	Seminar work
Teoretični del izpita (pisno ali ustno)	40,00 %	Theoretical part of the exam (written or oral)

Reference nosilca/Lecturer's references:

Bajcar, Tom, Gosar, Leon, Širok, Brane, Steinman, Franci, **Rak, Gašper**. 2010. Influence of flow field on sedimentation efficiency in a circular settling tank with peripheral inflow and central effluent. Chemical engineering and processing, 49 (5): 514-522. DOI: 10.1016/j.cep.2010.03.019.

Jašarević, Ajdin, Hočevar, Marko, **Rak, Gašper**. 2021. Turbulent flow height measurement with stereo vision. Defense and security studies, 2: 96-111. DOI: 10.37868/dss.v2.id175.

Müller, Matej, Novak, Gorazd, Steinman, Franci, **Rak, Gašper**, Bajcar, Tom. 2015. Influence of the operating and geometric characteristics of a bottom-hinged flap gate. Strojniški vestnik, 61 (9): 498-506. DOI: 10.5545/sv-jme.2015.2453.

Novak, Gorazd, **Rak, Gašper**, Prešeren, Tanja, Bajcar, Tom. 2017. Non-intrusive measurements of shallow water discharge. Flow measurement and instrumentation, 56: 14-17. DOI: 10.1016/j.flowmeasinst.2017.05.007.

Pavlovčič, Urban, **Rak, Gašper**, Hočevar, Marko, Jezeršek, Matija. 2020. Ranging of turbulent water surfaces using a laser triangulation principle in a laboratory environment. Journal of hydraulic engineering, 146 (8): 1-10. DOI: 10.1061/%28ASCE%29HY.1943-7900.0001777.

Rak, Gašper, Hočevar, Marko, Steinman, Franci. 2017. Measuring water surface topography using laser scanning. Flow measurement and instrumentation, 56: 35-44. DOI: 10.1016/j.flowmeasinst.2017.07.004.

Rak, Gašper, Hočevar, Marko, Steinman, Franci. 2018. Construction of water surface topography using LIDAR data. Strojniški vestnik, 64 (9): 555-565. DOI: 10.5545/sv-jme.2017.4619.

Rak, Gašper, Hočevar, Marko, Steinman, Franci. 2019. Water surface topology of supercritical junction flow. Journal of Hydrology and Hydromechanics, 67, (2): 163-170. DOI: 10.2478/johh-2018-0042.

Rak, Gašper, Hočevar, Marko, Steinman, Franci. 2020. Non-intrusive measurements of free-water-surface profiles and fluctuations of turbulent, two-phase flow using 2-D laser scanner. Measurement science & technology: 1-14. DOI: 10.1088/1361-6501/ab727f.

Rak, Gašper, Steinman, Franci, Hočevar, Marko, Dular, Matevž, Jezeršek, Matija, Pavlovčič, Urban. 2020. Laser ranging measurements of turbulent water surfaces. European journal of mechanics. B, Fluids, 81: 165-172. DOI: 10.1016/j.euromechflu.2020.02.001.

Škerjanec, Mateja, Kregar, Klemen, Štebe, Gašper, **Rak, Gašper**. 2022. Analysis of floating objects based on non-intrusive measuring methods and machine learning. Geomorphology: an international journal of pure and applied geomorphology, 408. DOI: 10.1016/j.geomorph.2022.108254.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	MEHANIKA TAL IN INŽENIRSKA GEOLOGIJA
Course title:	
	SOIL MECHANICS AND ENGINEERING GEOLOGY

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni	Ni členitve (študijski program)	2. letnik	Letni

Univerzitetna koda predmeta/University course code:	1165
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Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
60	0	40	0	5	105	7

Nosilec predmeta/Lecturer:	Boštjan Pulko, Petra Štukovnik
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Vrsta predmeta/Course type:	Obvezni strokovni /Obligatory professional
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Jeziki/Languages:	Predavanja/Lectures:	Slovenščina
	Vaje/Tutorial:	Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Opravljeni izpiti iz predmetov Fizika, Matematika I, Gradiva in sočasni vpis na Osnove mehanike.	Passed exams in Physics, Mathematics I, Construction and Building Materials and simultaneous entry to Introduction to Structural Mechanics.

Vsebina:	Content (Syllabus outline):
Pomen geologije v gradbeništvu. Zgradba Zemlje, tektonika plošč, endogeni in eksogeni procesi, osnove geološke karte in geoloških profilov. Kamnine: razdelitev kamnin po nastanku, mineralna sestava kamnin, klasifikacija kamnin v gradbeništvu, kamnine na slovenskem ozemlju. Geološka starost, tektonska dogajanja, geološka okolja, pomembna za gradbeništvo. Osnove hidrogeologije. Pobočni procesi. IG lastnosti kamnin in načini določanja.	The role of geology in civil engineering. Earth structure, plate tectonics, endogenous and exogenous. Classification of rocks based on origin and minerals. Rocks of the Slovenian territory. Geological time scale, tectonic events, geological environments that are important for civil engineering. The basics of hydrogeology. Slope processes. Rock properties and their determination. Geological survey. Basic physical and mechanical

Geološke raziskave za potrebe gradbeništva. Osnovne fizikalne in mehanske lastnosti zemljin in kamnin, osnove obnašanja zemljin, laboratorijske preiskave zemljin. Klasifikacija zemljin. Standardi v geotehnikih. Prvotne in dodatne napetosti v tleh. Deformacije/posedki tal. Voda v tleh, pojem pornege tlaka, efektivnih in totalnih napetosti, strujanje vode. Konsolidacija tal. Osnove stabilnosti tal in pobočij.	properties of soils and rocks. Laboratory soil tests. Classification of soils. Standards in geotechnical engineering. Stress in soil. Ground deformations and settlements. Water in the soil, the concept of pore pressure, effective and total stress, water seepage. Consolidation. Soil shear strength and basics of soil slope stability.
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Temeljna literatura in viri/Readings:

Petkovšek, A. 2006. Skripta za predmet Inženirska geologija, Ljubljana, UL FGG.

Majes, B. 2006. Skripta za predmet Mehanika tal, Ljubljana, UL FGG.

Ribičič, M. 2002. Inženirska geologija I in II, skripta, Ljubljana, UL FNT.

Šuklje, L. 1984. Mehanika tal. Ljubljana, Univerza v Ljubljani, Fakulteta za arhitekturo, gradbeništvo in geodezijo.

Nonveiller, E. 1990. Mehanika tla i temeljenje građevina. Školska knjiga, Zagreb, str. 13-309 in 401- 455.

Cilji in kompetence:**Cilji**

- Cilj predmeta je spoznati osnove geologije z namenom razumevanja sestave tal in procesov na površini, spoznati osnovne mineralogije in petrologije, bistvene fizikalne lastnosti kamnin in postopke njihovega preiskovanja, osnove tektonike in inženirske geologije s hidrogeologijo ter usvojiti osnove mehanike tal in razumeti bistvene posebnosti v primerjavi z ostalimi področji gradbeništva (odvisnost od preiskav tal, večfaznost in nelinearnost zemljin, 3D prostor).

Pridobljene kompetence

- Sposobnost komunikacije med gradbenikom in geologom,
- razumevanje geološke karte in geoloških elaboratov
- izvedba preprostih laboratorijskih preiskav,
- razumevanje preprostih geotehničnih poročil o preiskavah tal,
- računi napetosti, posedkov in stabilnosti tal pod preprostimi objekti in nasipi,
- sposobnost razumevanja in kritične presoje rezultatov.

Objectives and competences:**Objectives**

- To understand the basics of geology in order to understand the ground structure and processes on the surface, to learn the basics of mineralogy and petrology, fundamental physical properties of rocks, basics of tectonics and geology engineering, hydrogeology, to assimilate the basics of soil mechanics and to understand the essential peculiarities of geotechnical engineering in comparison to other areas of civil engineering (dependence on ground investigations, multi-phase and non-linearity of soils, 3D space).

Gained competences

- To be able to communicate with geologist,
- to understand geological maps and reports,
- to conduct simple rock and soil laboratory tests,
- to understand simple geotechnical reports based on ground investigations,
- to calculate of stresses, settlements and the stability of the ground under engineering structures and embankments,
- to understand and critically assess the results.

Predvideni študijski rezultati:

- Prepoznavanje zemljin in kamnin, pomembnih za slovenski prostor in opisovanje njihovih osnovnih lastnosti, terminologija, osnovni pojmi

Intended learning outcomes:

- Identification/recognition of soils and rocks important for the Slovenian territory, and their basic engineering properties, terminology, basic

geologije, postopki preskušanja vzorcev zemljin v laboratoriju in na terenu. - Razumevanje nastanka zemeljskega površja, destruktivnih procesov na površju, odnosa med starostjo kamnin, tektoniko, mineralogijo ter lastnostmi geo- materialov, razumevanje bistvenih osnovnih pojmov mehanike tal (napetosti v tleh – totalne, efektivne, porni tlaki; konsolidacija, togost, trdnost, stabilnost), razumevanje pomena preiskav tal v gradbeništvu. - Komunikacija med gradbeniki in geologi, osnovno klasificiranje zemljin in kamnin, prepoznavanje erozijskih pojavov, izvedba osnovnih laboratorijskih preiskav tal, sposobnost razumevanja geološko- geotehniške dokumentacije, uporaba enačb in postopkov za računske analize napetosti v tleh, posedkov, trajanja konsolidacije.	concepts of geology, laboratory and field/in-situ testing of soil and rocks. - The formation of the earth's surface, erosion processes, the relationship between the age of rocks, tectonics, mineralogy and properties of geo-materials, basic concepts of soil mechanics (stresses in soil, total and effective stress, pore pressure, consolidation, stiffness, shear strength, slope stability), the importance of ground investigations in civil engineering. - Communication between civil engineer and geologists, basic classification of soils and rocks, identification of erosional phenomena, conducting basic laboratory tests in/on soils, ability to understand geotechnical documentation, use of equations and computational procedures for the analysis of stresses in soil, ground settlements and time of consolidation.
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Metode poučevanja in učenja:**Learning and teaching methods:**

Predavanja, laboratorijske, terenske in računske vaje na praktičnih primerih, motivacija za raziskovalno/projektno delo v skupinah ali individualno, simulacije na računalniških ali fizičnih modelih, ekskurzija.	Lectures, laboratory, field and numerical exercises on practical cases, the motivation for the research/project work in groups or individually, computer or physical model simulation, fieldwork.
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Načini ocenjevanja:**Delež/Weight****Assessment:**

Izdelava računskih vaj in nalog - do 10% k pozitivni oceni vaj iz Mehanike tal	10,00 %	Laboratory work and practical examples - up to 10% bonus to positive grade in Soil Mechanics (tutorials only)
Pisni izpit (ali kolokvij) – inženirska geologija	35,00 %	Written exam (or midterm exam)
Pisni izpit (ali kolokvij) – mehanika tal	65,00 %	Written exam (or midterm exam)

Reference nosilca/Lecturer's references:

PULKO, Boštjan, MAJES, Bojan, MIKOŠ, Matjaž. Reinforced concrete shafts for the structural mitigation of large deep-seated landslides : an experience from the Macesnik and the Slano blato landslides (Slovenia). Landslides. [Print ed.], [v tisku] 2012.

PULKO, Boštjan, MAJES, Bojan, LOGAR, Janko. Geosynthetic-encased stone columns - analytical calculation model. Geotext. geomembr. [Print ed.], feb. 2011, letn. 29, št. 1, str. 29-39.

PULKO, Boštjan, MAJES, Bojan. Analytical Method for the Analysis of Stone-Columns According to the Rowe Dilatancy Theory = Analitična metoda za analizo gruščnatih kolov z upoštevanjem Rowove teorije razmikanja. Acta geotech. Slov., 2006, letn. 3, št. 1, str. 36-45.

PULKO, Boštjan, LOGAR, Janko. Fully coupled solution for the consolidation of poroelastic soil around elastoplastic stone column. *Acta geotechnica*, ISSN 1861-1125, 2017, letn. 12, št. 4, str. 869-882

ŠTUKOVNIK, Petra, BOKAN-BOSILJKOV, Violeta, MARINŠEK, Marjan. ACR progress in concretes with dolomite aggregate and blast furnace slag CEM III binder. *Ceramics*. 2024, vol. 68, iss. 1, str. 67-79.

ŠTUKOVNIK, Petra, GROM, Janez Peter, MARINŠEK, Marjan, BOKAN-BOSILJKOV, Violeta. Mineralogical Characterization of Historical Cement-based Mortars from the Rupnik Military Fortification Line.

International journal of architectural heritage : conservation, analysis and restoration. [Print ed.]. 2020, letn. 14, št. 7, str. 1030-1041.

ŠTUKOVNIK, Petra, MARINŠEK, Marjan, MIRTič, Breda, BOKAN-BOSILJKOV, Violeta. Influence of alkali carbonate reaction on compressive strength of mortars with air lime binder. Construction & building materials. [Print ed.]. Jan. 2015, vol. 75, str. 247-254.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	KOMUNALNE NAPRAVE
Course title:	
	COMMUNAL TECHNICAL INFRASTRUCTURE

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni	Ni členitve (študijski program)	2. letnik	Letni

Univerzitetna koda predmeta/University course code:	1681
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Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	0	30	0	0	60	4

Nosilec predmeta/Lecturer:	Daniel Kozelj, Mario Krzyk
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Vrsta predmeta/Course type:	Obvezni strokovni /Obligatory professional
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Jeziki/Languages:	Predavanja/Lectures:	Slovenščina
	Vaje/Tutorial:	Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:

Vsebina:	Content (Syllabus outline):
Temeljne pojmovne opredelitve; pomen in vloga komunalnih dejavnosti; stroškovni vidiki izvajanja komunalnih dejavnosti; komunalna infrastruktura v prostorskih aktih; gradbeno dovoljenje in gradnja komunalne infrastrukture; pridobivanje in opremljanje zemljišč za gradnjo; tehnično-tehnološke značilnosti komunalnih omrežij, objektov in naprav; dimenzioniranje in lokacijski pogoji; tehnični pogoji opremljanja zemljišč za gradnjo. Funkcija, razvoj in struktura komunalnih sistemov, izhodišča za razumevanje in organizacijo gospodarske javne infrastrukture, značilnosti elementi in naprave komunalne, prometne,	Basic conceptual definitions; concept and role of municipal activities; cost aspects of municipal activity implementation; technical infrastructure within spatial planning document; building permit and construction of technical infrastructure; acquisition and development of building land ; technical – technological characteristics of municipal networks, structures and devices; design and location conditions of technical infrastructure; technical conditions of building land development. Function, development and structure of municipal systems, basics for the understanding and organization of economic public infrastructures,

energetske vodne in ostale infrastrukture, medsebojni odnosi med posamezno gospodarsko infrastrukturo.	characteristics, elements and facilities of municipal, transport, energy, water and other infrastructures as well as the relationships between individual economic infrastructures.
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Temeljna literatura in viri/Readings:

Rakar, A. 2011. Komunalne naprave in seminar: študijsko gradivo. Ljubljana, UL FGG, 155 strani.
 Ciuha, A. 1997. Komunalne naprave-daljinsko ogrevanje: študijsko gradivo. Ljubljana, UL FGG.
 Panjan, J. 2002. Osnove zdravstveno-hidrotehnične infrastrukture. Ljubljana, UL FGG.
 Krzyk, M. 2022: Komunalne naprave, 2. del, Študijsko gradivo za študente študija VOI, FGG.
 Platiše, G. 1999. Električna omrežja in naprave za javno razsvetljavo: študijsko gradivo. Ljubljana, UL FGG.
 Žegarac, Z., Arsić, V. 1999. Programi unapređivanja javne infrastrukture, Urbanistički zavod Beograda Jp, 161 strani, izbrana poglavja.
 Učno gradivo v spletni učilnici UL FGG.

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

Cilji - Seznanitev s tehnično-tehnološkimi značilnostmi komunalnih omrežij, objektov in naprav ter s tehničnimi pogoji opremljanja zemljišč za gradnjo, - v samostojnem projektu združiti in sintetizirati teoretična znanja o različnih infrastrukturnih sistemih v urbanem okolju. Pridobljene kompetence - Razumevanje delovanja komunalne infrastrukture kot pogoja za življenje in delo v urbanem okolju, - zna sintetizirati različne infrastrukturne sisteme v delujočo celoto.	Objectives - To familiarize students with technical / technological characteristics of municipal networks, structures and devices and technical conditions of building land development - to combine (within individually done project) theoretical knowledge about various infrastructure systems in urban environment. Gained competences - Understanding the function of technical infrastructure as one of the conditions for urban living, - skills to synthesize various infrastructure systems into a working whole.
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Predvideni študijski rezultati:**Intended learning outcomes:**

- Študent razume delovanje komunalne infrastrukture kot nenadomestljiv pogoj za zagotavljanje temeljnih materialnih dobrin za življenje in delo v urbani sredini, - pridobljeno znanje študent uporabi pri izdelavi idejnih zasnov in idejnih projektov komunalne in energetske infrastrukture, - sinteza tehnično-tehnološko različnih sistemov v celoto, ki rezultira k skupnemu cilju.	- Understand the role of public service infrastructure (technical infrastructure) as an irreplaceable condition for the provision of basic material goods to live and work in the urban environment, - acquired knowledge can be used when making a design concept in the field of public service infrastructure or energy infrastructure, - synthesis of various technical / technological systems into a whole, aiming towards a common goal.
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Metode poučevanja in učenja:**Learning and teaching methods:**

Predavanja z uporabo vizualnih pripomočkov, izdelava vaje (projekta) pod vodstvom asistenta in zunanjih sodelavcev.	Lectures using visual aids; individual project done under the guidance of assistants and external staff (practitioners in the field of technical infrastructure).
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Načini ocenjevanja:**Delež/Weight****Assessment:**

Pisni izpit	70,00 %	Written exam
Samostojno izdelana vaja (projekt)	30,00 %	Individually done project

Reference nosilca/Lecturer's references:

KRZYK, Mario, DREV, Darko. Economic and ecological assessment of packaging waste in Slovenia = Ekonomska in ekološka upravičenost ravnanja z odpadno embalažo v Sloveniji. *Materiali in tehnologije*, ISSN 1580-2949.

DREV, Darko, KRZYK, Mario. Raziskava pomanjkljivosti Zakona o varstvu okolja in njegovih podzakonskih aktov z vidika načrtovanja in gradnje objektov = Investigation of the deficiencies of the environmental protection act and its regulations in terms of building design and construction. *Gradbeni vestnik : glasilo Zveze društev gradbenih inženirjev in tehnikov Slovenije*, ISSN 0017-2774.

KRZYK, Mario, DREV, Darko. Incompatibility of Slovenian regulations in the field of water management with European regulations and resulting damage. *Lexonomica : revija za pravo in ekonomijo*, ISSN 1855-7147.

KRZYK, Mario, PANJAN, Jože, DREV, Darko. Postupci recikliranja tekstilnog odpada = Procedures of textile waste recycling = Recyclingverfahren von textilen Abfällen. *Tekstil : časopis za tekstilnu tehnologiju i konfekciju*, ISSN 0492-5882.

KRZYK, Mario, MALUS, Davor, PANJAN, Jože. Meritve kakovostnih parametrov za modeliranje prvega vala onesnaženih voda s cestnih površin = Measurements of quality parameters for the modeling of the first flush of polluted water from roads. *Gradbeni vestnik : glasilo Zveze društev gradbenih inženirjev in tehnikov Slovenije*, ISSN 0017-2774.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	OSNOVE JEKLENIH KONSTRUKCIJ
Course title:	
	FUNDAMENTALS STEEL STRUCTURES

Predmet:	Osnove jeklenih konstrukcij
Course title:	Fundamentals of steel structures
Članica nosilka/UL Member:	UL FGG

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni (v postopku)	Ni členitve (študijski program)	2. letnik	2. semester	obvezni

Univerzitetna koda predmeta/University course code:	0643634
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Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
30	0	30	0	0	60	4

Nosilec predmeta/Lecturer:	Jože Korelc, Primož Može
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Vrsta predmeta/Course type:	Obvezni strokovni/Obligatory professional
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Jeziki/Languages:	Predavanja/Lectures:	Slovenščina
	Vaje/Tutorial:	Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Opravljen izpit iz predmeta Osnove mehanike.	Passed exam from the course Introduction to Structural Mechanics.

Vsebina:	Content (Syllabus outline):
Mesto in vloga jekla kot gradbenega materiala v slovenskem in svetovnem merilu. Jeklo kot gradbeni	Place and role of steel as a building material in Slovenia and on a global scale. Steel as a building

material: postopki izdelave jekla, kemijska sestava, spreminjanje mehanskih lastnosti, mehanske lastnosti jekla, standardne kvalitete, označevanje in izbira kvalitete jekla.	material: steelmaking processes, chemical composition of steel and its effect on the mechanical properties, mechanical properties of steel. Grades, labelling and choice of steel grade.
Tehnološki postopki izdelave jeklenih konstrukcij: vrste, načini izdelave in standardni asortiman polizdelkov, tehnološki postopki obdelave jekla, varjenje, zaostale napetosti.	Technological processes of manufacture of steel elements/structures: types and methods of manufacture and the standard assortment of semi-finished steel elements, technological processing of steel elements, welding, residual stress.
Uvod v stabilnost konstrukcij: osnovna načela stabilnosti, uklon tlačnih palic, bočna zvrnitev upogibnih nosilcev, lokalno izbočenje pločevin.	Introduction to structural stability: basic principles of stability, flexural buckling of columns, lateral – torsional buckling of beams. Local buckling of slender plates. Cross-sections of steel elements: cross section classification as a function of plate slenderness, specifics of slender cross-sections, bearing capacity of cross-sections.
Prečni prerezi jeklenih konstrukcij: razvrstitev prečnih prerezov po kompaktnosti, posebnosti vitkih prerezov, nosilnost prečnih prerezov.	Bearing elements of steel structures: compression members, tension members, beams. Members in bending and axial compression.
Nosilni elementi jeklenih konstrukcij: tlačne palice, natezne palice, upogibni nosilci, tlačno in upogibno obremenjene palice.	Fasteners: welds, bolts, rivets, pins. Connections: basis to design of joints – basic principles, conception design of basic moment resistant and pinned joints (lap joints, joints with end plates).
Vezna sredstva: zvari, vijaki, zakovice, čepi.	Fire and corrosion protection of steel structures.
Spoji osnovna načela projektiranja spojev, konceptualna zasnova osnovnih momentnih in členkastih spojev (preklopni spoji, spoji s čelnimi pločevinami).	
Protipožarna in proti korozijska zaščita jeklenih konstrukcij.	

Temeljna literatura in viri/Readings:

Priročnik za projektiranje gradbenih konstrukcij, IZS, 2009 (Deli, ki se nanašajo na SIST EN 1990, SIST EN 1993-1-1).

Kržič, F. 1994. Jeklene konstrukcije I. Ljubljana, UL FGG.

P Može, J Korelc, Študijsko gradivo - izbrane teme, spletna učilnica UL FGG.

NS Trahair, MA Bradford, David Nethercot, L Gardner, The Behaviour and Design of Steel Structures to EC3, Fourth Edition, 2008, 490 p.

Standardi za gradbene konstrukcije Evrokod, Evrokod 3, (SIST EN 1990, SIST EN 1993-1-1).

ESDEP - The European Steel Design Education Programme, spletna učilnica, splet <http://fgg-web.fgg.uni-lj.si/~pmoze/esdep/master/toc.htm>.

Cilji in kompetence:

Cilji predmeta - Pridobiti teoretična in praktična znanja, ki omogočajo projektiranje elementov enostavnih jeklenih konstrukcij in projektiranje običajnih vijačenih in varjenih spojev. Pridobljene kompetence - Zna najti ustrezno konstrukcijsko rešitev v jekleni izvedbi, - zna uporabiti splošna znanja mehanike in konstruiranja pri reševanju specifičnih problemov jeklenih konstrukcij, - zna dimenzionirati elemente enostavnih jeklenih konstrukcij in zna zasnovati osnovne tipe spoje v med jeklenimi elementi.	Objectives - To acquire theoretical and practical knowledge that enables the design of elements of simple steel structures and design of basic bolted and welded joints. Gained competences - To know how to find adequate structural solution in steel, - to know how to use general knowledge of mechanics and design to solve specific problems of steel structures, - to know how to design elements of simple steel structures and to know how to concept basic types of joints between steel members.
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Predvideni študijski rezultati:

- Spozna mehanske lastnosti jekla in razume njihov vpliv na obnašanje konstrukcij v različnih pogojih obratovanja, - spozna osnove tehnoloških postopkov izdelave enostavnih jeklenih konstrukcij, - spozna in razume obnašanje osnovnih konstrukcijskih elementov jeklenih konstrukcij, - spozna praktične postopke in pripomočke za dimenzioniranje jeklenih konstrukcij, - spozna in razume obnašanje veznih sredstev in spojev, - spozna standarde za analizo in dimenzioniranje jeklenih konstrukcij, spozna postopke protipožarne zaščite jeklenih in lesenih konstrukcij ter protikorozijske zaščite jeklenih konstrukcijskih elementov.	Intended learning outcomes: - To learn about mechanical properties of steel and understands their behaviour in a structure in different serviceability conditions, - to learn the basic technological procedures for the construction of simple steel structures, - to learn and understands the behaviour of basic structural elements of steel structures, - to learn about practical procedures and tools for the design of timber and steel structures, - to learn about and understands the behaviour of fasteners and joints, - to learn about standards for the analysis and design of steel structures, to know the procedures of fire protection for steel and timber structures and anti-corrosion protection of steel structural elements.
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Metode poučevanja in učenja:

Predavanja in seminarske vaje v klasični učilnici.	Lectures and seminar tutorials in classical classroom.
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Načini ocenjevanja:**Delež/Weight****Assessment:**

Računski del izpita (možno opraviti s kolokviji)	40,00 %	Computational part of exam (can be completed by mid-term exams)
Vaje	20,00 %	Tutorials
Teoretični del izpita	40,00 %	Theoretical part of exam
Ocene: 6-10 pozitivno, 5 negativno (v skladu s statutom UL).		Grades: 6-10 positive, 5- negative (in accordance with the UL Statute)

Reference nosilca/Lecturer's references:

KRISTANIČ, Niko, KORELC, Jože. Optimization method for the determination of the most unfavorable imperfection of structures. *Computational mechanics*, issue 6, vol. 42, str. 859-872.

MELINK, Teja, KORELC, Jože. Upoštevanje korelacije pri stohastični analizi konstrukcij = Effect of correlation in stochastic structural analysis. V: 32. zborovanje gradbenih konstruktorjev Slovenije, Bled, 7.-8. oktober 2010. LOPATIČ, Jože (ur.), MARKELJ, Viktor (ur.), SAJE, Franc (ur.). [Zbornik]. Ljubljana: Slovensko društvo gradbenih konstruktorjev, 2010, str. 327-334.

KORELC, Jože, STUPKIEWICZ, Stanisław. Closed-form matrix exponential and its application in finite-strain plasticity. *International journal for numerical methods in engineering*, ISSN 0029-5981. [Print ed.], 2014, letn. 98, št. 13, str. 960-987.

MOŽE, Primož, YANG, Fei, VELJKOVIC, Milan. Validation and application of bearing and block tearing resistance - background to prEN1993-1-8:2021. *Journal of constructional steel research*. [Print ed.]. dec. 2021, [no.] 106985, letn. 187, [20] str., ilustr. ISSN 0143-974X., DOI: 10.1016/j.jcsr.2021.106985. [COBISS.SI-ID 79955971]

PICULIN, Sara, MOŽE, Primož. Stability behaviour of stiffened curved plates subjected to pure compression. *Thin-walled structures*. feb. 2021, letn. 159, št. 107313, str. 1-17, ilustr. ISSN 0263-8231. <https://doi.org/10.1016/j.tws.2020.107313>, [COBISS.SI-ID 42017283].

FILIPOVIĆ, Aljoša, DOBRIĆ, Jelena, BADDON, Nancy, MOŽE, Primož. Experimental response of hot-rolled stainless steel angle columns. *Thin-walled structures*. jun. 2021, letn. 163, št. 107659, str. 1-21, ilustr. ISSN 0263-8231, DOI: 10.1016/j.tws.2021.107659. [COBISS.SI-ID 58659587].

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	ORGANIZACIJA GRADBENIH DEL IN POSLOVANJE
Course title:	
	ORGANIZATION OF CONSTRUCTION WORKS AND OPERATION

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni	Ni členitve (študijski program)	2. letnik	Letni

Univerzitetna koda predmeta/University course code:	1314
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Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
45	0	45	0	0	90	6

Nosilec predmeta/Lecturer:	Robert Klinc
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Vrsta predmeta/Course type:	Obvezni strokovni /Obligatory professional
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Jeziki/Languages:	Predavanja/Lectures:	Slovenščina
	Vaje/Tutorial:	Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:

Vsebina:	Content (Syllabus outline):
Temeljni pojmi s področja organizacije, zgodovina in razvoj organizacije; - vloga, pomen in medsebojni odnosi posameznih udeležencev v procesu gradnje; osnovni viri za graditev;; proizvodni faktorji, produktivnost in; ekonomičnost gradnje; oblikovanje tehnološkega procesa osnove normiranja in plačevanja dela;osnove določanja cene gradbenega objekta (gradbene kalkulacije) in obračuna; študije dela in časa; osnove zagotavljanja kakovosti v gradbeni proizvodnji, industrializacija gradbeništva; projekt organizacije gradnje; predhodna preučevanja, pripravljala dela, ureditev gradbišča;;	Fundamental concepts from the field of organisation; role, importance and relationships among construction project stakeholders; resources for construction process; production factors, productivity, economics of construction; design of technology process; fundamentals of work productivity and payment of work; fundamentals of building/structure price determination and payment options; time and motion studies. Fundamentals of quality assurance in construction industry, industrialisation of construction. Organisation of construction project; preliminary investigation,

organizacija vzdrževanja in prenove gradbenih objektov; proces graditve objekta od zasnove do konca življenjske dobe, spremljajoča zakonodaja; načela planiranja in vodenja, predstavitev metod planiranja; metoda mrežnega planiranja; izdelava spremljajočih planov virov in stroškov.	preparation works, construction site organisation building/structure maintenance and refurbishment management life cycle of building/structure; relevant legislature fundamentals of planning and management, scheduling and planning techniques; critical Path Method resource and cost planning.
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Temeljna literatura in viri/Readings:

Rodošek, E. (1998). Osnove organizacije v gradbeništvu (1. natis). Fakulteta za gradbeništvo in geodezijo.

Rodošek, E. (1985). *Operativno planiranje*. Fakulteta za arhitekturo, gradbeništvo in geodezijo.

Pšunder, M. (2011). *Operativno planiranje* (2. dopolnjena izd.). Fakulteta za gradbeništvo.

Gradbeni zakon GZ-1, Uradni list RS

Pravilnik o gradbiščih, Uradni list RS

Cilji in kompetence:**Cilji**

- Seznaniti študente z osnovami organizacijske vede kot izhodišče za uspešno delovanje gradbenega podjetja.
- Študentje se seznajajo s posebnostmi gradbene proizvodnje ter s procesnim pogledom na proizvodnjo, spoznajo povezavo in razmejitev tehnoloških in organizacijskih ukrepov, pomen organizacije v procesu graditve objektov.
- Nadalje je cilj predmeta, da študentje spoznajo metode za oblikovanje in spremljanje dela (osnove študija časa in dela, normiranja in plačevanja dela) ter osnove določanja cene gradbenih objektov. Študentje osvojijo osnove planiranja in vodenja projektov.

Pridobljene kompetence

- Je sposoben povezovati znanja s področja organizacije in tehnologije,
- zna uporabiti osvojeno znanje pri vodenju del od zasnove do uporabe objekta,
- zna praktično uporabiti osnovna znanja o planiranju in vodenju gradbenega projekta ter ta znanja ustrezno nadgraditi.

Objectives and competences:**Objectives**

- To familiarize students with fundamentals of organisation theory, as the starting point for successful operation of a construction enterprise.
- Students get acquainted with specific features of construction production and process considering production, get to know links and divisions of technological and organisational actions, and the importance of organisation within construction process.
- Further goal of the course is to make students familiar with methods for the design and monitoring of work (fundamentals of motion and time studies, norms and payment of work), and basics of the determination of price for structure as a whole. Fundamental knowledge from the field of project planning and management needs to be acquired.

Gained competences

- To be able to link the knowledge from the field of organisation and technology,
- to be able to use the acquired knowledge in management of works, from the conception stage to the use of the structure;
- to be able to use the fundamental knowledge from the field of project management in practice, and is able to upgrade this knowledge in an appropriate manner.

Predvideni študijski rezultati:

- Potrebno deklarativno znanje zajema poznavanje organizacije gradbenega podjetja,

Intended learning outcomes:

- The necessary declarative knowledge includes knowledge of a construction company

faz gradbenega projekta, poznavanje metod študija dela in časa, poznavanje osnov normiranja in plačevanja del ter določanja cene gradbenega objekta, osnovnih tehnik terminskega in finančnega planiranja projektov v gradbeništvu ter metod nadzora in spremljanja njihove realizacije. Razumevanje teh pojmov zagotavlja osnovo za uspešno uporabo in nadgradnjo. • Sposobnost povezovanja pridobljenega znanja z gradbeno prakso • Uporaba pridobljenega znanja v nadaljevanju - študija na 2.stopnji. • Refleksija o razmerju med organizacijo in tehnologijo gradbenih del. • Refleksija o razmerju med pridobljenim znanjem in prakso. • Študent se pri predmetu nauči povezovati vsebine iz različnih področij v celoto (sinteza znanja).	organisation; knowledge of motion and time studies, work norms and payment options; and determination of price of a total building/structure; fundamentals of project scheduling and financial planning in construction, and surveying and following-up the execution of a project. Understanding of these concepts ensures that student can successfully use and upgrade them as required by practice. • Ability to combine the acquired knowledge with practice in construction field; • Use of acquired knowledge on the graduate (2nd cycle) studies level. • On the relationship between organisation and technology of construction works; • On the relationship between acquired knowledge and practical experience • Student learns to link and combine contents/acquired knowledge from various scientific disciplines into a whole (knowledge synthesis).
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Metode poučevanja in učenja:**Learning and teaching methods:**

Predavanja in seminarske vaje.	Lectures and seminar tutorial.
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Načini ocenjevanja:**Delež/Weight****Assessment:**

Računski del izpita	50,00 %	Computational part of exam
Teoretični del izpita	50,00 %	Theoretical part of exam

Reference nosilca/Lecturer's references:

TURK, Žiga, KLINC, Robert. A social-product-process framework for construction. Building research and information. 2020, letn. 48, št. 7, str. 747-762, ilustr. ISSN 0961-3218.
<https://www.tandfonline.com/doi/full/10.1080/09613218.2019.1691487>, <https://repozitorij.uni-lj.si/lzpisGradiva.php?id=114374&lang=slv>, DOI: 10.1080/09613218.2019.1691487. [COBISS.SI-ID 8961121]

KLINC, Robert, TURK, Žiga. Construction 4.0 - digital transformation of one of the oldest industries. Economic and business review. 2019, vol. 21, no. 3, str. 393-410, ilustr. ISSN 1580-0466.
http://ojs.ebrjournal.net/ojs/index.php/eb/article/view/786/pdf_163, <https://repozitorij.uni-lj.si/lzpisGradiva.php?id=114085&lang=slv>, DOI: 10.15458/eb.92. [COBISS.SI-ID 9010017]

KLINC, Robert, TURK, Žiga, DOLENC, Matevž. Raziskava o rabi informacijsko - komunikacijskih tehnologij v slovenski gradbeni industriji = Survey of the information and communication technologies usage in Slovenian AEC industry. Gradbeni vestnik : glasilo Zveze društev gradbenih inženirjev in tehnikov Slovenije. [Tiskana izd.]. nov. 2010, letn. 59, str. 269-276, ilustr. ISSN 0017-2774. [COBISS.SI-ID 5201761]

GERMOVNIK, Neža, SNEDIC, Anka, FORTUNA, Barbara, KLINC, Robert. Stanje na področju elektronskih vlog za izdajo gradbenega dovoljenja v Sloveniji = Current situation on the field of electronic applications for the issuing of building permits in Slovenia. Gradbeni vestnik : glasilo Zveze društev gradbenih inženirjev in tehnikov Slovenije. [Tiskana izd.]. avg. 2014, letn. 63, str. 188-192, ilustr. ISSN 0017-2774. [COBISS.SI-ID [6717025](#)]

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	CESTE IN PROMET
Course title:	
	ROADS AND TRAFFIC

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni	Ni členitve (študijski program)	3. letnik	Zimski

Univerzitetna koda predmeta/University course code:	1313
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Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
45	0	45	0	0	90	6

Nosilec predmeta/Lecturer:	Peter Lipar
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Vrsta predmeta/Course type:	Obvezni strokovni /Obligatory professional
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Jeziki/Languages:	Predavanja/Lectures:	Slovenščina
	Vaje/Tutorial:	Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:

Vsebina:	Content (Syllabus outline):
Prometna politika; planiranje in okolje; razdelitev cest; projektna dokumentacija; določitev prečnega prereza; horizontalni potek osi; vertikalni potek osi; prostorsko vodenje; preglednost; trenje; razširitve; odvodnjevanje; dimenzioniranje zgornjega ustroja; objekti; vrste križišč; kolesarski površine; peš površine; umirjanje prometa; mirujoči promet; prometna signalizacija.	Transport policy; planning and environment; Road distribution; project documentation; Cross-section of the road; horizontal leading of road axis; vertical leading of road axis; space interaction of the road; sight field; friction; widening of the road; water management; surfacing; road objects; intersections; bicycle infrastructure; pedestrian infrastructure; traffic calming; parking facilities; traffic signalization.

Temeljna literatura in viri/Readings:

Juvanc A. 2004. Temeljni pogoji za določanje cestnih elementov. Ljubljana, UL FGG, PTI.

Juvanc A. 2004. Geometrijski elementi ceste in vozišča. Ljubljana, UL FGG, PTI.

Tehnični predpisi za projektiranje cest (domači in tuji).

Cilji in kompetence:**Cilji**

- Seznaniti s transportnimi sistemi ter s stvarnimi in predpisanimi pogoji za načrtovanje cest in spremljajočih ureditev ter tehničnimi rešitvami.
- Pridobljene kompetence
- Sposobnost za samostojno izdelavo enostavnega projekta za cesto,
 - pridobitev sposobnosti za sodelovanje pri gospodarjenju s cestami in za skupinsko delo,
 - razumevanje metod in postopkov pri načrtovanju, projektiranju in gradnji.

Objectives and competences:**Objectives**

- To be aware of the transport systems and prescribed conditions for road design and related arrangements and technical solutions.
- Gained competences

- Ability to independently produce a simple project of the road,
- gaining the ability to participate in the management of roads and teamwork,
- understanding the methods and procedures for planning, designing and construction of roads.

Predvideni študijski rezultati:

- Poznavanje prometnih sistemov,
- poznavanje voznodinamičnih zakonitosti in sistema VOZNIK-VOZILO-OKOLJE in elementov ceste in način njihovega usklajevanja,
- razumevanje metod in postopkov pri načrtovanju, projektiranju in gradnji cest,
- študent pridobi sposobnost samostojnega sprejemanja odločitev, kritične presoje variantnih rešitev in sodelovanja v delovnem teamu.

Intended learning outcomes:

- Knowledge and understanding of traffic systems,
- knowledge of driving dynamic legality and system DRIVER-VEHICLE ENVIRONMENT and road elements and how they co-ordinate,
- understanding of the methods and procedures for planning, designing and construction of roads,
- student acquires the ability of independent decision-making, critical assessment of alternative solutions and participation in a team work.

Metode poučevanja in učenja:

Predavanja in uporaba pridobljenih znanj pri vajah in projektnem izdelku.

Learning and teaching methods:

Lectures and application of acquired knowledge to adapt and project product.

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

Pisni in/ali ustni izpit

50,00 %

Written and / or oral examination

Vaje/projektne izdelke

50,00 %

Practical work - design

Reference nosilca/Lecturer's references:

KOSTANJŠEK, Jure, LIPAR, Peter. Pedestrian Crossing Priority for Pedestrian Safety. V: 3rd Urban Street Symposium : uptown, downtown or small town : designing urban streets that work : Seattle, Washington, June 24-27, 2007.

LIPAR, Peter, KOSTANJŠEK, Jure, ŽURA, Marijan. Uporaba prostorske statistike za določevanje zgostitev prometnih nesreč = Identification of road accident hot spots using spatial statistics. Geod. vestn., 2010, letn. 54, št. 1, str. 61-69.

LIPAR, Peter, LAKNER, Mitja, MAHER, Tomaž, ŽURA, Marijan. Estimation of road centerline curvature from raw GPS data. The Balt. j. road bridge eng., 2011, letn. 6, št. 3, str. 163-168.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	GEOTEHNIKA
Course title:	
	GEOTECHNICAL ENGINEERING

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni	Ni členitve (študijski program)	3. letnik	Zimski

Univerzitetna koda predmeta/University course code:	1173
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Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
45	10	30	0	5	90	6

Nosilec predmeta/Lecturer:	Janko Logar
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Vrsta predmeta/Course type:	Obvezni strokovni /Obligatory professional
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Jeziki/Languages:	Predavanja/Lectures:	Slovenščina
	Vaje/Tutorial:	Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Opravljeni izpiti iz predmetov Osnove mehanike, Mehanika tal in inženirska geologija.	Passed exams Introduction of Structural Mechanics, Soil mechanics and engineering geology.

Vsebina:	Content (Syllabus outline):
Zemeljski pritiski; Mejna napetostna stanja v tleh – nosilnost tal; plitvo temeljenje objektov (potrebne raziskave, načrtovanje, tehnologije); osnove globokega temeljenja objektov (tehnologije, nosilnost in posedki pilotov); kdaj temeljimo objekte plitvo, kdaj globoko; težnostne podporne konstrukcije; priprava temeljnih tal; načrtovanje in gradnja nasipov; načrtovanje in gradnja vkopov; masna bilanca zemeljskih del; osnove uporabe geosintetikov; osnove načrtovanja in gradnje	Earth pressures; Limit stress states in the ground – bearing capacity; shallow foundations (ground investigations, design and technologies); fundamentals of deep foundations (technologies, bearing capacity, settlements); criteria for the choice of foundation type; retaining structures ; ground treatment and fundamentals of soil improvement; design and construction of embankments; design and construction of cuts ; balance of soil masses in earthworks; basic concepts of the use of

zemeljskih; pregrad in visokovodnih nasipov; tok vode v tleh; osnove metod izboljšanja tal.

geosynthetics; groundwater flow; fundamentals of design and construction of dams and dykes.

Temeljna literatura in viri/Readings:

Majes, B., J. Logar. 2012. Skripta za predmet Geotehnika. Ljubljana.

Šuklje, L. 1984. Mehanika tal. Ljubljana, Univerza v Ljubljani, Fakulteta za arhitekturo, gradbeništvo in geodezijo, str. 212-235 in 268-312.

Nonveiller, E. 1990. Mehanika tla i temeljenje građevina. Školska knjiga, Zagreb, str. 309-400 in 495-768.

SIST EN 1997-1, Geotehnično projektiranje – 1. del: Splošna pravila (2006)

SIST EN 1997-2, Geotehnično projektiranje – 2. del: Geotehnično preiskovanje in preskušanje (2007)

Tomlinson, M.J. 2001. Foundation design and construction, Prentice Hall, 569 str.

Učno gradivo v spletni učilnici UL FGG.

Cilji in kompetence:

Objectives and competences:

Cilji

- Nadgraditi osnove mehanike tal in jih uporabiti za aplikacije pri načrtovanju in izvedbi temeljev, zemeljskih del ter geotehničnih gradenj.

Pridobljene kompetence

- Zna izračunati nosilnost in posedek temelja v homogenih tleh pod preprostimi objekti, geotehnično načrtovati manj zahtevne nasipe, vkope, podporne konstrukcije, zemeljske pregrade in rutinske temelje konstrukcij.

Objectives

- The theoretical knowledge on soil mechanics will be upgraded and used in engineering applications for the design of foundations of structures, earthworks and geotechnical works.

Gained competences

- To be able to calculate of bearing capacity and settlement in homogeneous ground under simple structures, geotechnical design of embankments, cuts, dams, dykes, retaining structures and routine foundations.

Predvideni študijski rezultati:

Intended learning outcomes:

- Poznavanje načel projektiranja in gradnje nasipov, vkopov, zemeljskih pregrad, priprave temeljnih tal in uporabe geosintetikov; tehnologije gradnje plitvih in globokih temeljev, podpornih konstrukcij.
- Razumevanje toka vode v tleh, nosilnosti tal, zemeljskih pritiskov, procesa geotehničnega projektiranja od raziskav preko načrtovanja, izvedbe in opazovanja izvedenih del.
- Razumevanje varnosti pri različnih geotehničnih delih, razločevanje bistvenih pogojev, ko je mogoče plitvo temeljenje oziroma je potrebno globoko temeljenje objektov. Razumevanje potrebe po izboljšanju tal v zahtevnih pogojih.
- Sposobnost razumevanja geotehniške dokumentacije, uporaba enačb in postopkov za računske analize vkopov, nasipov, temeljenja, podpornih konstrukcij, uporaba računalniških programov za analize posedkov in globalne stabilnosti tal.

- Principles of the design and construction of embankments, cuts, dams, dykes, retaining structures, ground treatment and use of geosynthetics. Construction technology of shallow and deep foundations and retaining structures.
- Understanding of groundwater flow, bearing capacity, earth pressures, process of geotechnical design from ground investigation, calculations, execution of geotechnical works to monitoring.
- Understanding of safety concept in geotechnical design. Distinguishing of the main reasons for the choice of deep or shallow foundations. Understanding that ground improvement is possible.
- Ability to understand geotechnical reports, to use equations and procedures for the analyses of cuts, embankments, foundations and retaining structures. Ability to use software for

	the calculation of settlements and slope stability.
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Metode poučevanja in učenja:**Learning and teaching methods:**

Predavanja, seminar, terenski dan, računske vaje, domače delo preko spletne učilnice.

Lectures, seminar, field work, tutorials, homework using e-classroom.

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

računski (pisni) izpit (ali 2 kolokvija)	45,00 %	practical (written) exam (or two mid-term exams)
teoretični (ustni) izpit (ali 2 kolokvija)	45,00 %	theoretical (oral) exam (or two mid-term exams)
Domače naloge	10,00 %	Homework

Reference nosilca/Lecturer's references:

PULKO, Boštjan, MAJES, Bojan, LOGAR, Janko. Geosynthetic-encased stone columns - analytical calculation model. Geotext. geomembr.. [Print ed.], feb. 2011, letn. 29, št. 1, str. 29-39.

KUDER, Sebastjan, LOGAR, Janko. Numerični model za analizo obnašanja tlačno obremenjenih, vtisnjenih jeklenih pilotov v Luki Koper = Numerical model for the prediction of behaviour of driven steel piles under axial compression loading in the Port of Koper. Gradb. vestn., avgust 2008, letn. 57, št. 8, str. 207-214.

LOGAR, Janko, FIFER BIZJAK, Karmen, KOČEVAR, Marko, MIKOŠ, Matjaž, RIBIČIČ, Mihael, MAJES, Bojan. History and present state of the Slano Blato landslide. Nat. hazards earth syst. sci. (Print), 2005, 5, str. 447-457.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	TEMELJI PROSTORSKEGA NAČRTOVANJA
Course title:	FUNDAMENTALS OF SPATIAL PLANNING

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni	Ni členitve (študijski program)	3. letnik	Zimski

Univerzitetna koda predmeta/University course code:	1640
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Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
45	0	60	0	0	105	7

Nosilec predmeta/Lecturer:	Alma Zavodnik Lamovšek
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Vrsta predmeta/Course type:	Obvezni strokovni /Obligatory professional
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Jeziki/Languages:	Predavanja/Lectures:	Slovenščina
	Vaje/Tutorial:	Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:

Vsebina:	Content (Syllabus outline):
Predavanja Osnovni pojmi s področja prostorskega načrtovanja, iskanje literature in virov s pomočjo svetovnega spleta in v knjižnicah, spoznavanje kartografskih podlag in načrtov, podatkovne zbirke in njihova dostopnost, zakonodajni okvir prostorskega načrtovanja in vključevanje javnosti v prostorsko načrtovanje, prostor kot razvojni potencial, omejitve v prostoru, spoznavanje osnovnih načrtovalskih orodij. V drugem delu sledi obravnavanje razvoja in razmeščanja dejavnosti v prostoru s poudarkom na ustvarjenih danostih prostora, obravnavi	Lectures Fundamentals of spatial planning, basic terminology in spatial planning, searching for literature and resources on the World Wide Web and in libraries, mapping (surveying) groundwork and designs, databases and their accessibility, legislative framework of spatial planning and inclusion of the public in spatial planning, space as development potential spatial restrictions, basic planning tools, e.g. the map overlay method. In second part is following elaboration of spatial analyses, population (demography), settlement

prebivalstva (demografije), sistema poselitve, prometa in ostale javne gospodarske infrastrukture, krajine (zelenih sistemov). V zaključku sledi še sinteza v prostorskem načrtovanju. Seminar Seminarske naloge za poglobljanje vsebin predavanj z vsebinsko navezavo na vaje. Vaje Opredelitev pojmov prostor in prostorsko načrtovanje, spoznavanje geodetskih podlag in različnih podatkovnih evidenc, spoznavanje različnih vrst rabe prostora (dejanska, planska, namenska, katastrska, GERK), spoznavanje Zakona o načrtovanju prostora (sistem planiranja, OPN, UN), pravilnika o pripravi OPN, uporaba barv v prostorskem načrtovanju, spoznavanje sprejetih prostorskih dokumentov na vseh ravneh prostorskega načrtovanja ter sektorskih omejitve v prostoru (varovalni pasovi in varstveni režimi), prostorske analize na izbranem naselju (promet, zelene površine, grajene, strukture, morfološka, vizualna analiza, analiza omejitev v prostoru, analiza dejanske in planske rabe prostora ipd.) ter sinteza in predlog ureditve izbranega naselja. Terensko delo Terenski ogled obravnavanega območja za namen izdelave prostorskih analiz in predloga razvoja poselitve.	system, transport and other public infraworks, landscape (green systems). In conclusion succeed synthesis in spatial planning. Seminar Seminar coursework to reinforce the topics covered in lectures, and in the associated tutorials. Tutorials Definitions of space and spatial planning, learning about surveying groundwork and various data records, learning about different land uses (actual, planned, intended cadastral, -GERK – Graphical Agricultural Unit of a Farm Holding), Spatial Planning Act and its regulations (planning system, municipal spatial plan, master plan), rules on the content, format and drawing-up of the municipal spatial plan, use of colours in spatial planning, learning about adopted spatial planning documents at all levels of spatial planning (strategy, municipal spatial plan, municipal detailed spatial plan), sectoral restrictions (buffer zones and protection regimes), spatial analysis on a selected settlement (transport, green spaces, urban fabric, morphological, visual analysis, analysis of spatial restrictions, analysis of actual and planned land uses etc.) and synthesis and development scheme proposal for a selected settlement. Field work Site visits of the area in question to prepare spatial analyses and a proposal of settlement development.
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Temeljna literatura in viri/Readings:

Simoneti, M., Zavodnik Lamovšek, A. 2010. Prostor za vsakdanjo rabo. Ljubljana, MOP.

Pogačnik, A. 1999. Urbanistično planiranje. Ljubljana, UL FGG.

Zavodnik Lamovšek, A., Fikfak, A., Barbič, A. (ur.) 2010. Podeželje na preizkušnji, Ljubljana, UL FGG.

Štravs, L. (ur.) 2011. Urejanje prostora na občinski ravni. Uradni list RS, Ljubljana.

Klosterman, R.E. 2001. Urban Planning: Methods and Technologies, Elsevier Science Ltd.

Cilji in kompetence:

Cilji - Podati celovito informacijo o pomenu in vsebini prostorskega načrtovanja na vseh ravneh, - spoznati in razumeti vsebino, metodološke pristope in načine prostorskega načrtovanja tako za podeželski kot urbani prostor,	Objectives and competences: Objectives Ability to give comprehensive information about the meaning and contents of spatial planning at all levels,
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• spoznati nujnost usklajevanja med različnimi sektorskimi programi in izhodišči, • spoznavanje interdisciplinarnega in integralnega pristopa prostorskega načrtovanja, • usposobiti študente za izbor ustreznih podatkov za obravnavani prostorski problem in njihovo pridobitev z različnih institucij, • spoznati različnost pridobljenih podatkov ter njivo ustrezno uporabo na različnih ravneh, • pokazati pomen in vlogo prostorskega načrtovanja s pomočjo dela na terenu, • navajati študente na samostojno delo. Pridobljene kompetence • pozna in razume sistem prostorskega načrtovanja predvsem na lokalni in državni ravni, • pozna in razume metodološke pristope prostorskega načrtovanja, • pozna in razume nujnost usklajevanja med sektorskimi programi in podatki, • pozna in razume različne vsebine prostorskega načrtovanja (načrtovanje prometa, poselitve, turizma, rekreacije, industrije, itd), • pozna in razume interdisciplinarni in integralni pristop prostorskega načrtovanja, • je sposoben izbrati in pridobiti ustrezne podatke za obravnavani prostorski problem z različnih institucij, • pozna in razume pomen terenskega dela ter terensko vedenje o prostoru prenesti v delavni proces.	• to know and understand the contents, methodological approaches and ways of spatial planning for rural and urban areas, • to recognise the necessity of coordination of different sectoral programmes and positions, • to know interdisciplinary and integrated approaches of spatial planning, • to train the students to select appropriate data for a given spatial problem and to acquire the data from different institutions, • to recognise the differences among the acquired data and their proper use at different levels, • to show the significance and role of spatial planning during field work, • to get the students accustomed to work independently. Gained competences • To know and understand the spatial planning system, in particular at the local and national levels, • to know and understand methodological spatial planning approaches, • to know and understand the necessity of coordination of different sectoral programmes and data, • to know and understand various topics of spatial planning (development of transport, settlement, tourism, recreation, industry etc.), • to know and understand interdisciplinary and integrated spatial planning approaches, • the ability to select appropriate data for the given spatial problem and to acquire the data from different institutions, • to know and understand the significance of field work and to transfer the information from the field to the work process.
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Predvideni študijski rezultati:

- Seznanitev s strokovno terminologijo in osnove razumevanja prostorskega načrtovanja v povezavi z osnovami geodezije,
- spoznavanje ustreznih grafičnih metod in orodij,
- sposobnost samostojne izdelave analize in oblikovanja prostorske rešitve na praktičnem primeru.
- povezava urejanja prostora z vedo geodezije in enostavna dela pri planiranju,
- sposobnost uporabe znanja iz urejanja prostora in izdelave projektov za urejanje prostora.
- razumevanje prostora kot omejene dobrine in prostora številnih interesov in sposobnost kritičnega odnosa do pomena prostorskih dokumentov na lokalni ravni ter njihovega pomena za lokalno prebivalstvo ter za prostorski razvoj na lokalni ravni,

Intended learning outcomes:

- Knowledge of terminology and fundamental understanding of spatial planning in relation with the basics of geodesy,
- knowledge of appropriate graphical methods and tools,
- ability of independent analysis and design of a spatial solution on a practical example,
- connection of spatial planning and geodesy, and simple tasks in planning,
- ability to use the know-how in spatial planning and elaboration of planning schemes,
- understanding the space as a finite asset, of various interests and ability of a critical attitude to spatial documents at the local level and their significance for the local population and spatial development,

• sposobnost obvladovanja enostavnega prostorskega problema, sposobnost samostojne analize, sinteze in prezentacije praktičnega primera, • sposobnost samostojnega dela ter dela v skupini. • študenti se navajajo na povezovanje izredno širokega spektra s planiranjem povezljivih naravoslovnih, družboslovnih in tehničnih znanosti, ki so potrebne za sintezno razumevanje urejanja prostora. (geoinformatike, kartografije in razvoj zemljišč, sektorskih vsebin, omejitev in režimov v prostoru, itd.).	• ability to solve a simple spatial problem, ability of independent analysis, synthesis, and presentation of a case in point, • ability to work independently and in a team. • The students get accustomed to connecting a wide range of sciences related to planning, i.e. natural sciences, social and technical sciences, necessary for the synthetic understanding of planning (geoinformatics, mapping, land development, sectoral issues, spatial restrictions and regimes, etc.)
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Metode poučevanja in učenja:**Learning and teaching methods:**

Sistematična predavanja, dialog, praktične vaje v računalniški učilnici, seminarske vaje za poglobljanje vsebin predavanj in terensko delo.	Systematic lectures, dialogue, tutorials in the computer classroom, seminar tutorials to reinforce the topics covered in lectures, field work.
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Načini ocenjevanja:**Delež/Weight****Assessment:**

Pisni izpit	50,00 %	Written examination
Kolokvij (vaje)	15,00 %	Midterm test (tutorials)
Terensko delo (udeležba)	5,00 %	Field work (attendance)
Projektna naloga	30,00 %	Project assignment

Reference nosilca/Lecturer's references:

ZAVODNIK LAMOVŠEK, Alma, KERPAN, Nina, FOŠKI, Mojca. Spremembe namenske rabe prostora glede na razvoj slovenske prostorske zakonodaje v obdobju 1984-2007. Urbani izziv, Posebna izdaja, 2012, str. 5-17.

ZAVODNIK LAMOVŠEK, Alma, DROBNE, Samo, ŽAUCER, Tadej. Small and medium-size towns as the basis of polycentric urban development = Majhna in srednje velika mesta kot ogrodje policentričnega urbanega razvoja. Geod. vestn.. [Tiskana izd.], 2008, letn. 52, št. 2, str. 290-312.

ZAVODNIK LAMOVŠEK, Alma. Prostorsko planiranje na poti k sistemski ureditvi = Spatial planning on route to a systems solution. Urbani izziv (Tisk. izd.). [Tiskana izd.], 2003, let. 14, št. 1, str. 15-20, 107-110.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	OSNOVE POTRESNEGA INŽENIRSTVA
Course title:	
	FUNDAMENTALS OF EARTHQUAKE ENGINEERING

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni (v postopku)	Ni členitve (študijski program)	3. letnik	1. semester	obvezni

Univerzitetna koda predmeta/University course code:	0643631
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Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
30	0	30	0	0	60	4

Nosilec predmeta/Lecturer:	Matjaž Dolšek
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Vrsta predmeta/Course type:	Obvezni strokovni/Obligatory professional
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Jeziki/Languages:	Predavanja/Lectures:	Slovenščina
	Vaje/Tutorial:	Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Opravljen izpit iz predmeta: Osnove mehanike ali Mehanika tal in inženirska geologija	Completion of the course Introduction of Structural Mechanics or Soil Mechanics and Engineering Geology

Vsebina:	Content (Syllabus outline):
Razumevanje potresov – od mitov do znanosti. Potresi nekoč in danes. Potresna nevarnost in potresno tveganje v Sloveniji in po svetu. Uvod v dinamiko gradbenih konstrukcij. Dinamični odziv sistemov z eno prostostno stopnjo pri potresni obtežbi (računski model in enačbe gibanja, lastno	Understanding earthquakes - from myths to science. Earthquake consequences in the past and today. Seismic hazard and risk in Slovenia and around the world. Introduction to the dynamics of civil structures. Dynamic response of systems with a single degree of freedom under seismic loading

nihanje, vsiljeno nihanje, spektri odziva). Poenostavljen potresna analiza konstrukcij (metoda z ekvivalentno statično obtežbo). Osnovni pojmi o potresih in potresni obtežbi (spekter pospeškov, značilnosti gibanja tal na lokaciji, princip redukcije potresnih sil, projektni spektri pospeškov). Osnovni pojmi in načela potresnoodpornega projektiranja (splošno, nosilnost in duktilnost, togost, dušenje, zasnova konstrukcij). Obnašanje gradbenih objektov med minulimi potresi (geotehnični objekti, hidrotehnični objekti, mostovi in viadukti, stavbe, industrijski objekti). Individualna seminarska naloga: Potresna analiza enostavnega objekta.	(computational model, equation of motion, free vibration, forced vibration, response spectra). Simplified seismic analysis (i.e. lateral force method). Basic concepts of earthquakes and seismic loading (response spectra, characteristics of ground motion at the given site, principle of earthquake force reduction, design spectra). Basic concepts and principles of earthquake-resistant design (general, load-bearing capacity and ductility, stiffness, damping, conceptual design). Behaviour of construction facilities during past earthquakes (geotechnical facilities, hydro-technical facilities, bridges and viaducts, buildings, industrial facilities). Individual seminar assignment: Seismic analysis of a simple structure.
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Temeljna literatura in viri/Readings:

Fajfar, P. 1984. Dynamics of structures (in Slovenian). FGG UL, str.1-20, 27-88, 109-119, 132-144, 325-338.

Villaverde, R. 2009. Fundamental concepts of earthquake engineering. CRC Press, (in English), izbrana poglavja.

P. Fajfar, M. Fischinger, D. Beg, M. Dolšek, T. Isaković, M. Kreslin, M. Rozman, Z. Vidrih, B. Čermelj. 2009. Eurocode 8: Design of earthquake-resistant structures (in Slovenian). In Manual for design of structures using Eurocode 8, Eds. D. Beg and A. Pogačnik (selected chapters).

EN 1998-1. Evrokod 8: Projektiranje potresnoodpornih konstrukcij, Del 1 : Splošna pravila, potresni vplivi in vplivi na stavbe

Foreign students can use literature in English after consultation with the Lecturer.

Cilji in kompetence:

Cilji:

- spoznati potresno nevarnost in dojeti posledice potresov na okolje in družbo,
- spoznati osnove dinamike gradbenih konstrukcij,
- spoznati osnovne pojme o potresih, potresni obtežbi in potresnoodpornem projektiranju.

Kompetence:

- študent pridobi občutek o potresni nevarnosti, posledicah potresov in se seznani z načini zaščite pred njimi,
- pozna osnovne značilnosti dinamičnega odziva konstrukcij z uporabo poenostavljenih metod potresne analize,

Objectives and competences:

Objectives:

- learn about seismic hazard and understand the consequences of earthquakes on the environment and society,
- learn about the basics of structural dynamics,
- to understand basic earthquake terminology, basic concepts of seismic action and earthquake-resistant design.

Competences

- student acquires a sense of seismic hazard, the consequences of earthquakes and becomes familiar with the methods of earthquake mitigation,

- sposoben je grobo oceniti potresno odpornost enostavnih objektov in identificirati potresno odporne objekte, - zna uporabljati enostavne postopke za račun najenostavnejših potresnoodpornih objektov.	- student can compute the dynamic response of simple structures using simplified methods of seismic analysis, - student can roughly estimate the earthquake resistance of simple structures and identify earthquake-resistant structures, - student can also apply simple procedures for seismic analysis of simple structures.
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Predvideni študijski rezultati:**Intended learning outcomes:**

- Študent se seznani s potresi in njihovimi posledicami ter z ukrepi za preprečevanje oziroma zmanjševanje posledic, - zave se pomembnosti problemov v zvezi s potresi in odgovornosti gradbenikov na vseh področjih njihovega delovanja, - razume osnovne značilnosti dinamičnega odziva konstrukcij in inženirskega modeliranja konstrukcij, - razume potres kot naravni pojav, nihanje tal med potresi in obnašanje raznih tipov gradbenih objektov med potresi. - razume nujnost sodelovanja gradbenika v začetni fazi načrtovanja objektov, - spozna osnovna načela zasnove potresnoodpornih objektov, - študent je sposoben grobo oceniti potresno odpornost enostavnih objektov in identificirati potresno neodporne objekte, - uporablja enostavne postopke za račun najenostavnejših potresnoodpornih objektov, - uporablja poenostavljene metode analize dinamičnih problemov - identifikacija očitno potresno neodpornih objektov.	- Student learns about earthquakes, their consequences on structures, and the measures for preventing seismic losses, - student becomes aware of the problems related to earthquakes and the engineer's responsibility in his work. - understand basics of the dynamic response of structures and engineering modelling of structures, - student becomes aware of earthquakes as a natural phenomenon, understands ground motions due to earthquakes and seismic behaviour of various structures, - student understands the importance of the cooperation of structural engineers in the conceptual design of a structure, - student learns the basic principles of earthquake-resistant design of structures, - student can approximately assess the seismic resistance of simple buildings and identify earthquake-resistant structures, - student can use simple methods for seismic analysis of structures, - student can use simple methods and tools for the analysis of dynamic problems, - student can identify an apparently earthquake-prone structures.
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Metode poučevanja in učenja:**Learning and teaching methods:**

Predavanja (na tablo, Power point, računski primeri), vaje (individualno delo).	Lectures on a blackboard (theory with practical examples. Lectures using PowerPoint. Tutorials in a computer lab with individual data.
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Načini ocenjevanja:**Delež/Weight****Assessment:**

vaje	30,00 %	Tutorials during year
Pisni izpit računskega dela izpita	30,00 %	Written exam: Practical part
Pisni izpit iz teorije z možnostjo ustnega zagovora po pisnem izpitu	40,00 %	Written exam: Theoretical part (with possibility of an oral exam following the written exam)
Ocene: 6-10 pozitivno, 5- negativno (skladno s Statutom UL)		Grades: 6-10 positive, 5- negative (in accordance with the UL Statute)

Reference nosilca/Lecturer's references:

ŽIŽMOND, J, DOLŠEK, M. Formulation of risk-targeted seismic action for the force-based seismic design of structures. Earthquake engineering & structural dynamics. 2019, 48(12):1406-1428.

DOLŠEK, M. Analytic Fragility and Limit States [P(EDP|IM)] - Nonlinear Static Procedures. V: BEER, Michael (ur.). Encyclopedia of Earthquake Engineering. Berlin: Springer, 2014. Str. 1-19, DOI: 10.1007/978-3-642-36197-5_246-1

BABIČ, A, ŽIŽMOND, J, DOLŠEK, M. Potresno tveganje stavbnega fonda v Sloveniji. Gradbeni vestnik : glasilo Zveze društev gradbenih inženirjev in tehnikov Slovenije. 2022, 71:34-47.

LAZAR SINKOVIĆ, N, DOLŠEK, M. Modeliranje števila smrtnih žrtev pri poružitvi stavbe. Gradbeni vestnik : glasilo Zveze društev gradbenih inženirjev in tehnikov Slovenije. 2018, 67:219-226.

CELANO, F, DOLŠEK, M. Fatality risk estimation for industrialized urban areas considering multi-hazard domino effects triggered by earthquakes. Reliability engineering & systems safety. 2021, 107287:206:1-17.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	OSNOVE LESENIH KONSTRUKCIJ
Course title:	
	INTRODUCTION TO TIMBER STRUCTURES

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni (v postopku)	Ni členitve (študijski program)	3. letnik	1. semester, 2. semester	obvezni

Univerzitetna koda predmeta/University course code:	0643632
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Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
30	0	30	0	0	60	4

Nosilec predmeta/Lecturer:	Jože Lopatič
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Vrsta predmeta/Course type:	Obvezni strokovni/Obligatory professional
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Jeziki/Languages:	Predavanja/Lectures:	Slovenščina
	Vaje/Tutorial:	Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:**Prerequisites:**

Opravljeni izpiti iz predmetov: Gradiva in Osnove mehanike	Passed exams from the courses: Construction and building materials and Introduction to structural mechanics
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Vsebina:**Content (Syllabus outline):**

- Prednosti in slabosti lesenih konstrukcij. - Fizikalne, mehanske in reološke lastnosti lesa in gradbenih lesnih proizvodov v odvisnosti od pogojev okolja. - Tehnologija izdelave osnovnih gradbenih lesnih proizvodov.	Advantages and disadvantages of timber structures. - Physical, mechanical and rheological properties of solid timber and engineered wood products for structural purposes depending on the environmental conditions.
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- Razvrščanje masivnega lesa v trdnostne razrede. - Izhodišča za analizo napetostno-deformacijskega stanja in dimenzioniranje elementov lesenih konstrukcij. - Metoda mejnih stanj lesenih konstrukcij. - Mejna nosilnost in dimenzioniranje elementov lesenih konstrukcij iz masivnega lesa pri osni, osno-upogibni in strižni obremenitvi. - Stabilnost vitkih elementov lesenih konstrukcij. - Odpornost in podajnost veznih sredstev in priključkov. - Račun in omejitve pomikov lesenih konstrukcij. - Zagotavljanje lokalne in globalne stabilnosti lesenih konstrukcij z zavarovalnimi konstrukcijami. - Sodobni opažni sistemi. - Leseni mostovi (zasnova, modeliranje, projektna obtežba, osnovni gradniki nosilne konstrukcije mostu, konstruiranje nosilnih elementov) - Zaščita lesenih konstrukcij pred vplivi okolja in požarom. - Temeljna pravila izvedbe priključkov, vozlišč in detajlov lesenih konstrukcij.	- Bases of manufacturing technology of engineered wood products for structural purposes. - Strength classes and strength grading of timber. - Basic assumptions for the analysis of stress-strain state and the design of elements of timber structures. - Limit state design of timber structures. - Ultimate resistance and design of timber structural elements at axial, combined bending-axial and shear loading. - Stability of slender elements of timber structures. - Resistance and stiffness of fasteners and joints. - Calculation and limitations of deflections of timber structures. - Local and global stability of timber structures; bracing systems. - Modern timber formwork systems for concrete. - Timber bridges (conceptual design, modelling, design loads on bridges, basic structural elements of loadbearing structure of a bridge, design of load-bearing elements). - Protection of timber structures against the impacts of environment and fire. - Basic rules for the execution of joints, nodes and details of timber structures.
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Temeljna literatura in viri/Readings:

J. Lopatič, Študijsko gradivo v obsegu 150 strani (Objavljeno v spletni učilnici predmeta).

S. Thelanderson, H. J. Larsen (urednika). 2003. Timber Engineering. John Wiley & Sons, str. 1-22, 81-102, 131-152, 171-177, 301-332, 365-382, 409-428.

F. Colling. 2004. Holzbau-Beispiele. Vieweg, str 1-116.

Ustrezni deli standardov za gradbene konstrukcije Evrokod 0, Evrokod 1, Evrokod 5 (SIST EN 1990, SIST EN 1991-1, SIST EN 1991-1-3, SIST EN 1991-1-4, SIST EN 1995-1-1, SIST EN 1995-1-2).

Cilji in kompetence:

Cilj predmeta je, da študentje podrobneje spoznajo fizikalne, mehanske in reološke lastnosti lesa in lesnih proizvodov ter principe in postopke zagotavljanja varnosti, trajnosti in uporabnosti nosilnih elementov lesenih konstrukcij.

Predmetno specifične kompetence:

Objectives and competences:

The objective of the course is to introduce students into detailed physical, mechanical and rheological properties of timber and engineered wood-based products as well as the principles and procedures of assuring safety, durability and serviceability of timber load-bearing structures.

- študentje so sposobni dimenzionirati elemente lesenih konstrukcij iz masivnega in lepljenega lesa glede na pogoje mejnih stanj nosilnosti in mejnih stanj uporabnosti, - poznajo vezna sredstva in temeljna pravila dimenzioniranja in konstruiranja priključkov; - sposobni so dimenzionirati vezna sredstva oziroma priključke lesenih elementov, - poznajo pogoje in ukrepe za zagotavljanje zaščite lesenih konstrukcij pred vplivi okolja in požarom, - poznajo možne načine zagotavljanja lokalne in globalne stabilnosti lesenih konstrukcij; sposobni so zasnovati in dimenzionirati zavarovalno konstrukcijo, - znajo izdelati projektno dokumentacijo za konstrukcijske elemente in enostavne sklope nosilnih lesenih elementov.	Course-specific competences: - students are capable to design elements of structures made of solid timber and glulam, considering the conditions of ultimate limit states and serviceability limit states, - students learn about fasteners and the basic rules for the design of joints, - students are capable to design fasteners or joints of timber elements, - students know the conditions and measures to assure protection of timber structures against impacts of the environment and fire, - students know the possible methods for assuring local and global stability of timber structures; they are able to design bracing elements, - students are capable to creating technical documentation for timber structural elements and simple assemblies of timber load-bearing elements.
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Predvideni študijski rezultati:

- Poznavanje fizikalnih, mehanskih in reoloških lastnosti lesa in gradbenih lesnih proizvodov. - Poznavanje tehnologij izdelave gradbenih lesnih proizvodov. - Poznavanje tehnične regulative s področja lesenih konstrukcij. - Razumevanje meril za razvrščanje lesa v trdnostne razrede. - Razumevanje vpliva pogojev okolja na ključne lastnosti lesa. - Razumevanje načel in računskih modelov dokazovanja varnosti in uporabnosti lesenih konstrukcij. - Razumevanje vpliva podajnosti veznih sredstev na obnašanje lesenih konstrukcij. - Razumevanje vloge zavarovalnih konstrukcij. - Zmožnost uporabe postopkov in pripomočkov za analizo in dimenzioniranje lesenih konstrukcij.	Intended learning outcomes: - Knowledge of physical, mechanical and rheological properties of solid timber and engineered wood-based products. - Basic knowledge of manufacturing technologies of engineered wood products for structural purposes. - Knowledge of technical regulation from the area of timber structures. - Understanding of the criteria for the grading of timber with respect to mechanical properties. - Understanding of the environmental influence on key properties of timber. - Understanding of the principles and computational methods for the verification of safety and serviceability of timber structures. - Understanding of the influence of fastener stiffness on the behaviour of timber structures. - Understanding of the role of bracing structures. - Capability to use standard procedures and software for the analysis and design of timber structures.
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Metode poučevanja in učenja:**Learning and teaching methods:**

Predavanja in laboratorijske vaje v računalniški učilnici.	Lectures and seminar tutorials in classical lecture room.
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Načini ocenjevanja:**Delež/Weight****Assessment:**

vaje	20,00 %	tutorials
Računski del izpita	40,00 %	Computational part of exam
Teoretični del izpita	40,00 %	Theoretical part of exam
Ocene: 6-10 pozitivno, 5 negativno (v skladu s statutom UL).		Grades: 6-10 positive, 5- negative (in accordance with the UL Statute)

Reference nosilca/Lecturer's references:

LOPATIČ, Jože. Preiskave kompozitnih nosilcev iz lesa in stiropora. Les, ISSN 0024-1067. [Tiskana izd.], oktober 1993, 45, št. 10, str. 281-288. [COBISS.SI-ID 61447680]

SAJE, Franc, LOPATIČ, Jože, WALLNER, E. Behaviour of glued laminated timber structures. V: EMRI, Igor (ur.), KNAUSS, Wolfgang G. (ur.). Proceedings, 1st International Conference on Mechanics of Time Dependent Materials, Ljubljana, 11-13 September 1995. Bethel (Connecticut): Society for Experimental Mechanics; Ljubljana: [Center za eksperimentalno mehaniko]. 1995, str. 213-217, graf. prikazi. [COBISS.SI-ID 115809]

LOPATIČ, Jože, SAJE, Drago, SAJE, Franc. Creep of timber structures. International journal for engineering modelling, ISSN 1330-1365. [Print ed.], 2005, vol.18, no. 1/2, str. 1-10, ilustr. [COBISS.SI-ID 3621985].

PLANINC, Igor, SCHNABL, Simon, SAJE, Miran, LOPATIČ, Jože, ČAS, Bojan. Numerical and experimental analysis of timber composite beams with interlayer slip. Engineering structures, ISSN 0141-0296. [Print ed.], 2008, letn. 30, št. 11, str. 2959-2969, [COBISS.SI-ID 4047457].

ŠUBIC, Barbara, FAJDIGA, Gorazd, LOPATIČ, Jože. Bending stiffness, load-bearing capacity and flexural rigidity of slender hybrid wood-based beams. Forests, ISSN 1999-4907. [Online ed.], 2018, vol. 9, iss. 11, 16 str., ilustr. <https://www.mdpi.com/1999-4907/9/11/703>, doi: 10.3390/f9110703. [COBISS.SI-ID 2967433].

TAVOUSSI, Kamyar, WINTER, Wolfgang, RIOLA-PARADA, Felipe, FADAI, Alireza, LOPATIČ, Jože, PRAŠNJAK, Ivana. Prefabricated timber-steel-concrete ribbed decks : experimental study. V: WCTE 2018 : Proceedings, World conference on timber engineering, Seoul, Republic of Korea, August 20-23, 2018. Seoul: Republic of Korea. 2018, str. 1-9, ilustr. [COBISS.SI-ID 8870241],

TATIČ, Uroš, UGOVŠEK, Aleš, STARMAN, Jernej, ŠUBIC, Barbara, GANTAR, Uroš, LOPATIČ, Jože, KOVAČIČ, Aljaž, FAJDIGA, Gorazd. Okenski sestav z ojačitvenimi elementi za prerazporeditev napetosti : patent SI 25708 A, 2020-03-31. Ljubljana: Urad Republike Slovenije za intelektualno lastnino, 2020. 13 f., ilustr. [COBISS.SI-ID 24608003]

KROFL, Žiga, GANTAR, Uroš, MOČNIK, David, SITAR, Aljaž, LOPATIČ, Jože. Razvoj stika lesenih elementov z izboljšano togostjo = Development of timber joints with improved stiffness. 40. zborovanje gradbenih konstruktorjev Slovenije, Bled, 19.-20. 11.2018. Ljubljana: Slovensko društvo gradbenih konstruktorjev. 2018, str. 299-306, ilustr. [COBISS.SI-ID 8615009]

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	VODNE GRADNJE
Course title:	
	INTRODUCTION TO DRAINAGE ENGINEERING

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni	Ni členitve (študijski program)	3. letnik	Zimski

Univerzitetna koda predmeta/University course code:	1680
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Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
40	0	15	0	5	60	4

Nosilec predmeta/Lecturer:	Andrej Kryžanowski, Matjaž Mikoš
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Vrsta predmeta/Course type:	Obvezni strokovni /Obligatory professional
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Jeziki/Languages:	Predavanja/Lectures:	Slovenščina
	Vaje/Tutorial:	Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Opravljen izpit iz predmetov Hidrologija, Hidromehanika in Hidravlika.	Passed exams in Hydrology, Hydromechanics, and Hydraulics.

Vsebina:	Content (Syllabus outline):
Predavanja Zajem, zadrževanje in razbremenjevanje zalednih voda: dimenzioniranje in izvedba globokih in plitvih drenaž, zasnova vodnih zadrževalnikov. Urejanje manjših površinskih voda: dimenzioniranje in izvedba (obcestni jarki, strme drče, pragovi, preliivi, kanalete, zajemni objekti, prepusti). Površinska erozija med gradnjo in protierozijski ukrepi med gradnjo in po njej. Visoke vode; začasni in trajni protipoplavni ukrepi; protipoplavna gradnja objektov; presoja primerne poplavne varnosti	Lectures Capture, retention and discharging rainfall surface runoff waters: design and implementation of deep and shallow drainage, design of water reservoirs. Control of smaller surface waters: design and execution (roadside ditches, steep chutes, sills, overflows, canalettes, intake structures, culverts). Surface soil erosion during construction and anti-erosion measures during and after construction. High waters; temporary and permanent flood protection measures; flood-safe construction of

urbaniziranih površin pred lastnimi in zalednimi padavinskimi vodami.	buildings; assessment of adequate flood protection of urbanized areas against their own and rainfall surface runoff waters.
Seminarske vaje	Tutorials
Računske vaje iz tehnične hidravlike.	Computational tutorials in technical hydraulics.
Terensko delo	Field work
Zasnova in izvedba vodnih gradenj na terenu (gradbišča).	Preliminary design and execution of small hydraulic works in the field (construction sites).

Temeljna literatura in viri/Readings:

Brilly, M., Mikoš, M., Šraj, M. 1999. Vodne ujme – varstvo pred poplavami, erozijo in plazovi. Univerzitetni učbenik, UL FGG, 186 p.

Goldman, S. J., Bursztynsky, T.A., Jackson, K. 1986. Erosion and sediment control handbook. McGraw-Hill, 449 p.

Mikoš M. 2008. Inženirska hidrotehnika – zbirka rešenih primerov, verzija 2008, UL FGG, Katedra za splošno hidrotehniko, 200 p.

Patt, H., Gonsowski, P. 2011. Wasserbau - Grundlagen, Gestaltung von wasserbaulichen Bauwerken und Anlagen. 7. Auflage, Springer Verlag, 410 p.

Spletne strani resornega ministrstva (MKO) s področja vodne infrastrukture (vodnih objektov).

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

Cilji - Podati osnovna znanja o vodnih gradnjah, - podati inženirske osnove za načrtovanje in dimenzioniranje vodnih gradenj, - podati različne načine odvodnjavanja površin v grajenem okolju (mestne površine, cestne površine) in naravni krajini (zaledne vode, poplavne vode) ter njihovega kontroliranega zadrževanja. Pridobljene kompetence - Zna umestiti manj zahtevne sisteme in posamezne vodne objekte za odvodnjavanje v prostor, - zna dimenzionirati take objekte po enostavnejših metodah ter oceniti njihovo stabilnost.	Objectives - To provide basic knowledge of small hydraulic works (drainage engineering works), - to give engineering basics for planning and design of small hydraulic works, - to provide different ways of draining areas in the built environment (urban areas, road surfaces) and in natural landscape (rainfall surface runoff waters, flood waters) and their controlled detention. Gained competencies - To be able to place less demanding systems and individual drainage works in the space, - to be able to design such works using simpler methods and assess their stability.
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Predvideni študijski rezultati:**Intended learning outcomes:**

Iz osnov hidravlike in hidrologije izpeljano inženirsko znanje o možnostih izbire ustreznega načina površinske odvodnje raznih objektov in inženirskih gradenj ter načinov protipoplavne gradnje objektov.	From the basics of hydraulics and hydrology derived engineering knowledge to choose an appropriate method of surface drainage works for various buildings and civil engineering works, and of flood-safe construction of buildings.
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• Zasnova, načrtovanje, izvajanje in vzdrževanje objektov za površinsko odvodnjavanje in protipoplavne gradnje objektov. • Razumevanje delovanja objekta ali inženirske gradnje od zasnove do izvedbe. • Interdisciplinarnost in sodelovanje z drugimi strokami pri obvladovanju procesov. • Komunikacija z uporabniki inženirskih storitev.	• Design, planning, implementation and maintenance of surface drainage works and flood-safe construction of buildings. • Understanding of the operation of buildings or civil engineering works from concept to implementation. • Interdisciplinarity and collaboration with other disciplines in managing processes. • Communication with users of engineering services.
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Metode poučevanja in učenja:**Learning and teaching methods:**

Predavanja, seminarske vaje, terensko delo.	Lectures, seminar tutorials, field work.
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Načini ocenjevanja:**Delež/Weight****Assessment:**

Seminarske vaje	40,00 %	Seminar tutorials
Terensko delo	10,00 %	Field work report
Pisni in/ali ustni izpit	50,00 %	Written and/or oral examination

Reference nosilca/Lecturer's references:

SODNIK, Jošt, MIKOŠ, Matjaž. Vodarstvo in vzdrževanje vodne infrastrukture v Sloveniji = Water management and maintenance of water infrastructure in Slovenia. Gradbeni vestnik, ISSN 0017-2774, 2013, letn. 62, str. 166-173.

SODNIK, Jošt, MIKOŠ, Matjaž. Varstvo pred poplavami v Sloveniji. V: ZORN, Matija (ur.), et al. Neodgovorna odgovornost, (Knjižna zbirka Naravne nesreče, ISSN 1855-8879, 2). Ljubljana: Založba ZRC, 2011, str. 51-57.

MIKOŠ, Matjaž. Upravljanje tveganj in nova Evropska direktiva o poplavnih tveganjih = Risk management and the new European directive on flood risks. Gradbeni vestnik, ISSN 0017-2774, 2007, letn. 56, št. 11, str. 278-285.

KRYŽANOWSKI, Andrej, MIKOŠ, Matjaž, PLANINC, Igor, ŠUŠTERŠIČ, Jakob. Searching for an optimal technical solution and concrete mixture for erosion prevention in dam slides. V: 4th International Structural Engineering and Construction Conference, ISEC-4, Melbourne, Australia. XIE, Yie-Min (ur.), PATNAIKUNI, I. (ur.). Innovations in structural engineering and construction : proceedings of the Fourth International structural engineering and construction conference (ISEC-4), Melbourne, Australia, 26-28 September, 2007, (Balkema - Proceedings and monographs in engineering, water and earth sciences). London [etc.]: Taylor & Francis, cop. 2008, str. 509-515.

KRYŽANOWSKI, Andrej, MIKOŠ, Matjaž, ŠUŠTERŠIČ, Jakob, PLANINC, Igor. Abrasion Resistance of Concrete in Hydraulic Structures. ACI materials journal, ISSN 0889-325X, 2009, letn. 106, št. 4, str. 349-356.

BOGATAJ, Dejan, MIKOŠ, Matjaž, KRYŽANOWSKI, Andrej. Predlog celovite ureditve obvodnega prostora HE Brežice = A proposal for integrated development of the water area of the Brežice HPP. Acta hydrotechnica, ISSN 0352-3551. [Tiskana izd.], 2006, 24, št. 41, str. 67-82.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	OSNOVE BETONSKIH IN ZIDANIH KONSTRUKCIJ
Course title:	
	INTRODUCTION TO CONCRETE AND MASONRY STRUCTURES

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni (v postopku)	Ni členitve (študijski program)	3. letnik	2. semester	obvezni

Univerzitetna koda predmeta/University course code:	0038826
Koda učne enote na članici/UL Member course code:	1171

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
45	0	45	0	0	90	6

Nosilec predmeta/Lecturer:	Jože Lopatič, Sebastjan Bratina
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Vrsta predmeta/Course type:	Obvezni strokovni /Obligatory professional
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Jeziki/Languages:	Predavanja/Lectures:	Slovenščina
	Vaje/Tutorial:	Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Opravljen izpit iz predmeta Osnove mehanike.	Passed exam from the course Introduction to Structural Mechanics.

Vsebina:	Content (Syllabus outline):
Glavne mehanske in reološke lastnosti betona in mehke armature. Izhodišča analize in dimenzioniranja elementov betonskih konstrukcij. Metoda mejnih stanj betonskih konstrukcij. Mejna nosilnost in dimenzioniranje armiranobetonskih prerezov na upogibno-osno obremenitev - enojni	Main mechanical and rheological properties of concrete and reinforcing steel. Starting points for the analysis and design of concrete structural members. Limit state design of concrete structures. Ultimate resistance and design of reinforced concrete cross-sections to combined bending and

upogib armiranobetonskega prereza v kombinaciji z osno silo v območju velike in male ekscentričnosti. Uporaba pomožnih tabel in interakcijskih diagramov za dimenzioniranje betonskih prerezov. Mejna nosilnost in dimenzioniranje armiranobetonskih elementov na strižno obremenitev - račun mejne nosilnosti armiranobetonskih elementov glede na prečno silo in torzijo. Poenostavljen račun razpok in pomikov armiranobetonskih konstrukcij. Temeljna pravila armiranja elementov armiranobetonskih konstrukcij. Mehanske lastnosti zidakov, malte in zidovja. Nosilni mehanizmi in dimenzioniranje zidanih konstrukcij na osno-upogibno in strižno obremenitev. Izvedba potresnovarnih enostavnih zidanih konstrukcij.	axial force (large and small uniaxial eccentricity of the axial force). Use of tables and interaction diagrams for the design of reinforced concrete cross-sections. Ultimate resistance and design of reinforced concrete elements exposed to shear and torsion. Simplified calculation of crack widths, crack spacing and deflections of reinforced concrete members. Basic principles and rules for reinforcing of concrete structural members. Mechanical properties of bricks, mortar and masonry. Load-bearing mechanisms and design of masonry structures subjected to bending, axial and shear loading. Execution of earthquake resistant simple masonry structures.
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Temeljna literatura in viri/Readings:

Priročnik za projektiranje gradbenih konstrukcij, IZS. 2009. (Deli, ki se nanašajo na SIST EN 1990, SIST EN 1992-1-1, SIST EN 1996-1-1, SIST EN 1998-1)

Concrete Best Practice-Guidance from a European perspective, Concrete Society. 2001. 180 str.

Structural Concrete, Vol. 1. 1999. Strani 1-109, fib (CEB-FIP).

Structural Concrete, Vol. 2. 1999. 305 strani, fib (CEB-FIP).

Curtin, W.G., Shaw, G., Beck, J.K., Bray, W.A. 2006. Structural Masonry Designers' Manual, Blackwell Science, strani 1-177.

Standardi za gradbene konstrukcije Evrokod 0, Evrokod 2, Evrokod 6, Evrokod 8 (SIST EN 1990, SIST EN 1992-1-1, SIST EN 1992-1-2, SIST EN 1996-1-1, SIST EN 1998-1).

Cilji in kompetence:**Cilji**

- Spoznati mehanske in reološke lastnosti osnovnih materialov, nosilne mehanizme in načine računskega modeliranja obnašanja betonskih in zidanih konstrukcij.

Pridobljene kompetence

- Zna dimenzionirati elemente enostavnih betonskih in zidanih konstrukcij na upogibno-osno in strižno obremenitev,
- v okviru mejnega stanja uporabnosti zna po poenostavljenih postopkih določiti medsebojno oddaljenost in širino razpok ter
- oceniti pomike preprostih razpokanih armiranobetonskih linijskih konstrukcij.

Objectives and competences:**Objectives**

- Learn about mechanical and rheological properties of basic materials, load-bearing mechanisms and principles of computational modelling of the behaviour of reinforced concrete and masonry structures.

Gained competences

- Student learns to design elements of simple concrete and masonry structures to bending, axial and shear loading
- student is capable to calculate the widths and spacing of cracks of simple reinforced concrete members,
- student is capable to calculate the deflections of simple reinforced concrete members considering the influence of cracks.

Predvideni študijski rezultati:**Intended learning outcomes:**

• Poznavanje glavnih mehanskih in reoloških lastnosti osnovnih materialov betonskih in zidanih konstrukcij. • Okvirno poznavanje tehnične regulative s področja betonskih in zidanih konstrukcij. • Razumevanje načinov zagotavljanja potrebne varnosti betonskih in zidanih konstrukcij. Razumevanje nosilnih mehanizmov elementov zidanih konstrukcij. • Razumevanje računskih modelov za določitev nosilnosti in za dimenzioniranje prečnih prereзов in elementov armiranobetonskih konstrukcij. • Razumevanje in poznavanje temeljnih načel za armiranje enostavnih betonskih konstrukcij. • Uporaba postopkov za praktično dimenzioniranje prečnih prereзов in elementov armiranobetonskih in zidanih konstrukcij. • Uporaba osnovnih pravil za zagotavljanje potresne varnosti enostavnih zidanih konstrukcij.	• Knowledge of the main mechanical and rheological properties of basic materials of concrete and masonry structures. • Basic knowledge of the technical regulations from the area of concrete and masonry structures. • Understanding the possible methods for providing the safety of concrete and masonry structures. • Understanding loading mechanisms of masonry structural members. • Understanding the computational models to define ultimate resistance and design of reinforced concrete structural members. • Understanding the basic principles of reinforcing simple concrete structures. • Application of procedures for the practical design of reinforced concrete and masonry structural members. • Application of basic rules to provide the earthquake resistant simple masonry structures.
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Metode poučevanja in učenja:**Learning and teaching methods:**

Predavanja in seminarske vaje v klasični učilnici.	Lectures and seminar tutorials in classical classroom.
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Načini ocenjevanja:**Delež/Weight****Assessment:**

Vaje	20,00 %	Tutorials
Teoretični del izpita	40,00 %	Theoretical part of exam
Računski del izpita (možno opraviti s kolokviji)	40,00 %	Computational part of exam (can be completed by mid-term exams)

Reference nosilca/Lecturer's references:

LOPATIČ, Jože. Vpliv dolgotrajnih visokih nivojev napetosti na tlačno trdnost betona = Influence of sustainable high stress levels on compressive strength of concrete. Gradbeni vestnik, ISSN 0017-2774, april 2003, let. 52, str. 74-80.

LOPATIČ, Jože, SAJE, Franc. Non-linear analysis of time-dependent response of civil engineering structures. V: TOPPING, Barry H. V. (ur.), MONTERO, G. (ur.), MONTENEGRO, R. (ur.). Proceedings of the eighth International conference on computational structures technology, Las Palmas de Gran Canaria-Spain, 12-15 September 2006. Stirling: Civil-Comp, cop. 2006, str. 1-20.

SAJE, Drago, LOPATIČ, Jože. The effect of constituent materials on the time development of the compressive strength of high-strength concrete. Magazine of Concrete Research, ISSN 0024-9831, 2010, letn. 62, št. 4, str. 291-300.

BRATINA, Sebastjan, SAJE, Miran, PLANINC, Igor. On materially and geometrically non-linear analysis of reinforced concrete planar beams. International journal of solids and structures, ISSN 0020-7683. [Print ed.], 2004, letn. 41, str. [7181]-7207.

KRAUBERGER, Nana, BRATINA, Sebastjan, SAJE, Miran, SCHNABL, Simon, PLANINC, Igor. Inelastic buckling load of a locally weakened reinforced concrete column. Engineering structures, ISSN 0141-0296. [Print ed.], 2012, letn. 34, št. 1, str. 278-288.

MARKOVIČ, Mojca, SAJE, Miran, PLANINC, Igor, BRATINA, Sebastjan. On strain softening in finite element analysis of RC planar frames subjected to fire. Engineering structures, ISSN 0141-0296. [Print ed.], dec. 2012, letn. 45, str. 349-361.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	PRAKTIČNO USPOSABLJANJE
Course title:	
	PRACTICAL TRAINING

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni	Ni členitve (študijski program)	3. letnik	Letni

Univerzitetna koda predmeta/University course code:	1317
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Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
6	0	0	0	80	34	4

Nosilec predmeta/Lecturer:	Andreja Istenič Starčič
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Vrsta predmeta/Course type:	Obvezni strokovni /Obligatory professional
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Jeziki/Languages:	Predavanja/Lectures:	Slovenščina
	Vaje/Tutorial:	Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:

Vsebina:	Content (Syllabus outline):
Izdelava hidroloških študij; izdelava hidravličnih računov manj zahtevnih objektov; izvedba terenskih meritev; izvajanje manj zahtevnih vodarskih del v okviru javne vodnogospodarske službe; sodelovanje na gradbiščih pri gradnji manj zahtevnih objektov; izdelava kartografskih podlag in prikazov za potrebe načrtovanja posegov v vodni prostor; sodelovanje v postopkih izdajanja soglasij za posege v prostor v javni upravi na lokalni in državni ravni.	Preparation of hydrological studies; preparation of hydraulic accounts for less demanding installations; implementation of field measurements; implementation of less demanding installations in the context of public water management services; participation at construction sites in the construction of less complex objects; production of cartographic bases and presentations for the design of interventions in the water space; participation in procedures for issuing approvals for interventions in space in public administration at local and national level.

Temeljna literatura in viri/Readings:

Viri so izbrani v sodelovanju z mentorjem praktičnega usposabljanja glede na vsebine, ki so predpisane in z njimi razpolaga organizacija, ki izvaja praktično usposabljanje. / Resources are selected in collaboration with the supervisor of practical training in relation to the contents prescribed and disposed of by the organization conducting the practical training.

Interna in druga gradiva v delovni organizaciji.

Smernice za praktično usposabljanje na Univerzi v Ljubljani, Ljubljana, september 2007, dostopno na spletu.

Govekar, Okoliš et.al. 2010. Praktično usposabljanje študentov v delovnih organizacijah in primeri dobrih praks. Ljubljana, UL FF, Center za pedagoško izobraževanje.

Učno gradivo v spletni učilnici UL FGG.

Cilji in kompetence:**Cilji**

- Spoznati operativno delo v ciljnih poklicih, organizacijsko strukturo subjektov na področju vodarstva in okoljskega inženirstva,
- vključiti se v delo javne komunalne in vodnogospodarske službe na državni ali lokalni ravni, v delo gradbenih in vodnogospodarskih podjetij, lahko tudi v delo v raziskovalnih ali izobraževalnih ustanovah,
- študent spozna dejavnike kariernega načrtovanja in razvoja in procese povezane s kariernim razvojem,
- študentu se omogoči samoevalvacijo kompetenc in dejavnikov, ki podpirajo procese poklicne identifikacije v povezavi akademskega okolja in delovnih okolij,
- študent spozna značilnosti učenja na delovnem mestu in značilnosti delovnih okolij ter značilnosti opazovanja in registriranja delovnih procesov.

Pridobljene kompetence

- Kompetence, ki si jih študent pridobi s strokovno prakso, so pogojene z delovnim okoljem. Študent zna uporabiti in prenesti v prakso teoretična znanja, ki jih pridobi v času študija pri predavanjih, vajah ter terenskem pouku.

Objectives and competences:**Objectives**

- Introduction to operational work in targeted occupations, the organizational structure of entities in the field of water management and environmental engineering,
- inclusion in the work of public utility services and water management at national or local level, in the work of construction and water companies, possibly also in the work of research or educational institutions,
- students learn about the elements of career planning and development and the processes related to career development,
- students are qualified for self-assessment of competences and factors that support the processes of professional identification in the context of academic and working environments,
- students learn about the characteristics of workplace learning and working environment characteristics and features of observation and registration of workflows.

Gained competences

- Competences that students gain with professional practice are conditioned by the work environment. Student is able to use in practice the theoretical knowledge acquired from courses during study in the form of lectures, tutorials and field work.

Predvideni študijski rezultati:

- Študent pridobi praktična znanja in izkušnje za področju nalog in storitev vodarske stroke.
- Prenos in uporaba znanj študijskih predmetov v delovnem okolju praktičnega usposabljanja.

Intended learning outcomes:

- Students acquire practical knowledge and experience in the field of tasks and services of the profession.
- Transfer and application of knowledge from courses in the study programme to the workplace of practical training.

• Lažje in hitrejšo uvajanje v delo po končanem študiju, razumevanje različnih vodarskih subjektov in njihove vloge v družbi. • Sinteza pridobljenih znanj tekom študija z aktualnimi delovnimi nalogami oz. raba aktualnih znanj in pripomočkov pri izpolnjevanju nalog, ki jih opravlja organizacija, v kateri poteka praktično usposabljanje. • Pridobljena znanja mu koristijo tudi pri izdelavi diplomske naloge. • Pridobljena znanja in spretnosti je možno prenesti na kasnejše delo v teku študijskega procesa (izdelava diplomske naloge), kakor tudi kasneje ob uvajanju na delovnem mestu. • Praktično delo v izobraževalnem procesu je za ta poklic zelo potrebno. Omogočena je sinteza znanj, razvijanje komunikacijskih spretnosti in timskega dela. • Študent zna ovrednotiti svoje delo glede na zastavljene in dosežene cilje. Strokovno delo reflektira na osnovi zbranih informacij. • Študent razvija kompetence za načrtovanje lastne kariere in samoevalvacijo znanja in kompetenc.	• Efficient introduction after graduation, understanding of different entities in the field and their role in society. • Synthesis of knowledge acquired during the course of the current work tasks and application of current knowledge and tools in fulfilling the tasks carried out by the organization where training is being conducted. • Obtained knowledge is useful in the preparation of the final thesis. • Knowledge and skills can be transferred to subsequent work within the study process (final thesis), as well as later at the workplace. • Practical work in the educational process for this profession is very necessary. It enables the synthesis of knowledge, communication skills and teamwork. • Student is able to evaluate own work against the objectives and targets achieved. • Professional work reflects on the basis of the information collected. Student develops skills for planning his/her career and self-assessment of skills and competencies.
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Metode poučevanja in učenja:**Learning and teaching methods:**

Terensko delo, mentorstvo, demonstracije, konzultacije, pisanje in vodenje dnevnika in portfolia prakse.	Field work, mentoring, demonstrations, consultations, writing and managing diary and portfolio practices.
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Načini ocenjevanja:**Delež/Weight****Assessment:**

Dnevnik prakse	40,00 %	Diary of practical work,
Portfolio	30,00 %	Portfolio
Ustni zagovor	30,00 %	Oral presentation

Reference nosilca/Lecturer's references:

ISTENIČ STARČIČ, Andreja. Students' perception of field placement in professional competency and identity construction : transdisciplinary study in education, health and engineering. V: MILLWATER, Jan (ur.), EHRICH, Lisa Catherine (ur.), BEUTEL, Denise (ur.). Practical experiences in professional education : a transdisciplinary approach. Mt Gravatt: Post Pressed, 2011, str. 155-170.

ŠUBIC KOVAČ, Maruška, ISTENIČ STARČIČ, Andreja. Kompetence diplomantov gradbeništva - evropski raziskovalni projekt TUNING = Competences of graduates in civil engineering - the European Research Project TUNING. Gradb. vestn., julij 2006, letn. 55, str. 178-186.

FOUCHAL, Farid, HASSAN, Tarek M., BLEICHER, David, ISTENIČ STARČIČ, Andreja. Industrialised, Integrated, Intelligent Construction Training Concept. V: WALLIS, Ian (ur.). Industrialised, Integrated, Intelligent Construction : I3con, Handbook 1. Berkshire: Bsria: I3con, 2009, str. 184-193.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	DIPLOMSKO DELO
Course title:	
	DIPLOMA WORK

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni	Ni členitve (študijski program)	3. letnik	Letni

Univerzitetna koda predmeta/University course code:	1742
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Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
0	0	0	0	75	75	5

Nosilec predmeta/Lecturer:	
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Vrsta predmeta/Course type:	Obvezni strokovni /Obligatory professional
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Jeziki/Languages:	Predavanja/Lectures:	Slovenščina
	Vaje/Tutorial:	Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Odobrena tema in mentor s strani Študijskega odbora Oddelka za okoljsko gradbeništvo skladno s Pravilnikom o študiju na I. in II. stopnji.	Approved topic and supervisor by the Study Board of the Department of Environmental Civil Engineering according to the Rules of 1st and 2nd cycle studies.

Vsebina:	Content (Syllabus outline):
Diplomsko delo se izdelava pod mentorstvom izbranega učitelja. Delo se javno predstavi ob zaključku študija. Vsebovati mora: - Uvod - Delovno hipotezo - Pregled virov - Material in metode	Thesis shall be made under the supervision of a selected teacher. The work is presented in public at the end of the study. It must include: - Introduction - The working hypothesis - Overview of sources - Material and methods

- Rezultate - Razpravo - Povzetek Praviloma se v diplomskem delu obravnavajo praktični strokovni problemi ali raziskovalne teme s področja vodarstva, okoljskega inženirstva in okoljskega gradbeništva ter podajajo rešitve, do katerih pridejo s pomočjo študija in izsledkov lastnega dela.	- Results - Discussion - Summary The thesis will ordinarily deal with practical professional problems or research themes from the area of water science, environmental engineering or environmental civil engineering that provide solutions derived from the study and from the results of students' own work.
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Temeljna literatura in viri/Readings:

Literatura s področja vsebine magistrskega dela.

T.Koler-Povh, G. Turk: Navodila za oblikovanje visokošolskih del na FGG in navajanje virov, FGG UL, Ljubljana, 2011, 39 strani, priloge. Dostopno na:

[http://www3.fgg.uni-lj.si/fileadmin/user_upload/UL_FGG - Pr 10 Navodila za oblikovanje visokosolskih del na UL FGG 2011 07.pdf](http://www3.fgg.uni-lj.si/fileadmin/user_upload/UL_FGG_-_Pr_10_Navodila_za_oblikovanje_visokosolskih_del_na_UL_FGG_2011_07.pdf)

Literature from the field of the contents of the thesis.

Instructions for writing thesis and citing references at the UL Faculty of Civil and Geodetic Engineering.

Cilji in kompetence:**Cilji in kompetence**

- Uporabiti pridobljena znanja v strokovni ali raziskovalni nalogi, skladno z odobreno temo diplomske naloge,
- pod mentorstvom izdelati koncept dela, v katerem so opredeljeni namen, cilji, metode in viri za izdelavo tega dela,
- razvijanje samostojnega, kritičnega in etičnega načina dela.
- z javno predstavitvijo diplomskega dela pridobiti komunikacijske spretnosti in sposobnosti.

Objectives and competences:**Objectives and gained competences**

- To use the knowledge gained by professional or research study on the thesis topic,
- under supervisor's supervision student prepares a concept, where the purposes, goals, methods and references for the thesis are presented.
- to develop independent, critical and ethical way of working.
- student obtains communication skills and abilities with public presentation.

Predvideni študijski rezultati:

Pridobitev znanja v vseh fazah, ki so del samostojnega reševanja konkretnih problemov in nalog na področju okoljskega gradbeništva.

Prenos znanj iz teoretičnega dela šolanja v reševanje konkretnih problemov.

Sinteza znanj, komunikacijske spretnosti, samostojna nadgradnja znanj.

Intended learning outcomes:

Acquiring knowledge in all phases, which are part of an independent problem in environmental civil engineering.

Transfer of knowledge from theoretical part of education to solving concrete problems.

Synthesis of knowledge, communication skills, independent upgrading of knowledge.

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

Mentorsko vodeno samostojno delo	Independent work under supervision.
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Načini ocenjevanja:**Delež/Weight****Assessment:**

Diplomska naloga	50,00 %	Written thesis
Zagovor	50,00 %	Presentation of the topic

Reference nosilca/Lecturer's references:

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UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	OSNOVE STATISTIKE V VODARSTVU
Course title:	
	BASIC STATISTICS IN WATER SCIENCE

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni	Ni členitve (študijski program)		Letni, Zimski

Univerzitetna koda predmeta/University course code:	1723
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Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	0	30	0	0	60	4

Nosilec predmeta/Lecturer:	Dejan Zupan, Goran Turk
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Vrsta predmeta/Course type:	Izbirni strokovni /Elective professional
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Jeziki/Languages:	Predavanja/Lectures:	Slovenščina
	Vaje/Tutorial:	Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Opravljen izpiti Matematika I, Matematika II.	Passed exams from the courses Mathematics I and Mathematics II.

Vsebina:	Content (Syllabus outline):
Uvod v statistiko, predstavitev podatkov; verjetnostni račun (uvod, dogodek, verjetnost dogodka), Bayesov izrek in njegova uporaba v preprostih primerih pri odločitvenih drevesih (vodenje gradbenih projektov); slučajne spremenljivke in slučajni vektorji, izpeljane porazdelitve, momenti; verjetnostne porazdelitve, ki jih pogosto uporabimo v tehniki, binomska, Poissonova, eksponentna, Pearsonova porazdelitev, normalna porazdelitev, logaritemsko normalna porazdelitev, porazdelitve ekstremnih vrednosti,	Introduction to statistics, data representation; theory of probability (introduction, event, probability of an event), Bayes theorem and its use in simple civil engineering cases, decision trees, project management; random variables and vectors, derived distributions, moments; distributions commonly used in technical applications: binomial, Poisson, exponential, Pearson, normal, log-normal, extreme value distributions; the use in hydrology, structural engineering, traffic engineering; sampling, characteristics of basic statistics, sample mean and

uporaba v hidrologiji, uporaba pri dimenzioniranju objektov, uporaba v analizi prometnih tokov; vzorčenje (lastnosti osnovnih statistik, povprečje vzorca, varianca vzorca); ocenjevanje parametrov (točkovne in intervalne ocene); preizkušanje domnev (osnove teorije preizkušanja domnev, klasični primeri preizkušanja domnev, preizkušanje skladnosti - test »hi-kvadrat«, neparametrični testi); bivariatna analiza (preizkušanje statistične odvisnosti, preizkušanje linearne povezanosti, linearna in nelinearna regresija, ki se pogosto uporablja pri modeliranju različnih pojavov); analiza variance s primeri v gradbeniški praksi.	variance; parameter estimation (point and interval estimates); hypothesis testing (introduction, some commonly used statistical tests, general statistical tests, e.g. hi-squared goodness-of-fit test); bivariate analyses (hypothesis testing of statistical and linear independence, linear and non-linear regression, the use of the least squares method); analysis of variance with some examples from civil engineering.
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Temeljna literatura in viri/Readings:

Turk G. 2012. Verjetnostni račun in statistika. Ljubljana, UL FGG.

Drobne S., Turk G. 2009. Statistika, Vaje. 2. popravljena in dopolnjena izd. Ljubljana, UL FGG.

Jamnik, R. 1986. Verjetnostni račun in statistika. Ljubljana, DZS.

Benjamin, J.R., Cornell, C.A. 1970. Probability, Statistics and Decision for Civil Engineers. McGraw Hill.

Kottegoda, N.T., Rosso, R., Statistics. 1997. Probability and Reliability for Civil and Environmental Engineering. McGraw-Hill.

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

Cilji Spoznati osnovne pojme verjetnostnega računa in najpogostejše uporabljene statistične metode v okoljskem gradbeništvu. Pridobljene kompetence Pozna in uporablja osnovne pojme verjetnostnega računa, pozna in uporablja v gradbeništvu najpogostejše uporabljene porazdelitve, pozna pomen in lastnosti karakterističnih vrednosti, ki so osnova dimenzioniranja gradbenih objektov, uporablja osnovne statistične metode v gradbeništvu, samostojno zna uporabiti ustrezno statistično metodo glede na naravo problema.	Objectives To learn about the basics of the theory of probability and statistical methods commonly used in environmental civil engineering. Gained competences To know the basics of the theory of probability, to know statistical distributions most commonly used in civil engineering, to know and understand the meaning of characteristic values which are the basis for structural design, to be able to apply basic statistical methods used in civil engineering, to know and be able to apply corresponding statistical method with respect to the problem.
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Predvideni študijski rezultati:**Intended learning outcomes:**

- Razume osnovne pojme verjetnostnega računa, - pozna porazdelitvene zakone, pogosto uporabljane v gradbeništvu,	To understand the basic concepts of the theory of probability,
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• spozna osnovne statistične metode, kot so intervali zaupanja, preizkušanje domnev, bivariatna analiza in analiza variance, • samostojno izbira ustrezno statistično metodo glede na obravnavani problem in jo samostojno izvede, • razume, kaj so prednosti (in slabosti) podajanja zaključkov z določenim nivojem tveganja, • zna uporabljati domačo in tujo literature, • spretnost zbiranja in obdelave podatkov ter sposobnost predstavljanja rezultatov, • zna uporabljati pripravljena računalniška orodja in programe (Word, Excel, Mathematica).	to know basic statistical distributions commonly used in geodesy; learns about the basic statistical methods, i.e. confidence intervals, hypothesis testing, bivariate analysis, ANOVA, to be able to choose the most suitable statistical methods with respect to the problem and is able to perform the analysis, to understand the shortcomings and advantages of forming conclusions based on risk level, to be able to use of Slovenian and foreign literature, to be able to collect and analyze data, ability to represent data, • to be able to use different software (Word, Excel, Mathematica).
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Metode poučevanja in učenja:**Learning and teaching methods:**

Polovica poučevanja predstavlja predavanja ex-katedra s pogosto uporabo modernih učnih pripomočkov: prikazi programske opreme, simulacij in drugo. Druga polovica so seminarske vaje, ki jih opravimo v računalniški učilnici, v okviru katerih se rešuje relativno preproste naloge iz verjetnostnega računa in statistike.	One half of the teaching is performed through lectures with frequent use of modern teaching techniques: demonstration of statistical software, simulations, etc. The second half is teaching and learning in the computer lab where relatively simple problems of probability theory and statistics are solved.
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Načini ocenjevanja:**Delež/Weight****Assessment:**

Sprotno delo (oddane rešitve nalog)	50,00 %	Exercises during the semester
Ustni izpit	50,00 %	Oral examination

Reference nosilca/Lecturer's references:

SCHNABL, Simon, PLANINC, Igor, TURK, Goran. Buckling loads of two-layer composite columns with interlayer slip and stochastic material properties. J. eng. mech., 2013, letn. 139, št. 8, str. 1124-1132.

KREGAR, Klemen, TURK, Goran, KOGOJ, Dušan. Statistical testing of directions observations independence. Surv. rev. - Dir. Overseas Surv., 2013, letn. 45, št. 329, str. 117-125.

TRTNIK, Gregor, KAVČIČ, Franci, TURK, Goran. The use of artificial neural networks in adiabatic curves modeling. Autom. constr.. [Print ed.], 2008, letn. 18, št. 1, str. 10-15.

ČEŠAREK, Peter, SAJE, Miran, ZUPAN, Dejan. Dynamics of flexible beams: Finite-element formulation based on interpolation of strain measures. Finite elem. anal. des., 2013, letn. 72, str. 47-63.

RODMAN, Urban, SAJE, Miran, PLANINC, Igor, ZUPAN, Dejan. The lateral buckling of timber arches. International journal of structural stability and dynamics, 2013, letn. 13, št. 8, str. 1-16.

ČEŠAREK, Peter, SAJE, Miran, ZUPAN, Dejan. Kinematically exact curved and twisted strain-based beam. Int. j. solids struct., 2012, letn. 49, št. 13, str. 1802-1817.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	NAPREDNE STATISTIČNE METODE V VODARSTVU
Course title:	
	ADVANCED STATISTICAL METHODS IN WATER SCIENCE

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni	Ni členitve (študijski program)		Letni, Zimski

Univerzitetna koda predmeta/University course code:	1766
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Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	0	30	0	0	60	4

Nosilec predmeta/Lecturer:	Dejan Zupan, Goran Turk
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Vrsta predmeta/Course type:	Izbirni strokovni/Elective professional
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Jeziki/Languages:	Predavanja/Lectures:	Slovenščina
	Vaje/Tutorial:	Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Opravljen izpiti Matematika I, Matematika II.	Passed exams from the courses Mathematics I and Mathematics II.

Vsebina:	Content (Syllabus outline):
Osnove metode Monte Carlo, generiranje vzorcev slučajnih vektorjev, generiranje slučajnih polj. Metode zmanjševanja variance. Prostorska statistika, slučajna polja in procesi, variogram, kovariančna funkcija, kriganje. Robustna statistika. Definicija mer robustnosti posameznih statistik, primerjava običajnih in robustnih statistik, aplikacija robustne statistike v linearni regresiji.	Basic Monte Carlo method, random variate/vector generation, generation of random fields, variance reduction methods. Spatial statistics, random fields and processes, variogram, covariance function, kriging. Robust statistics, the definition of robustness measures of some basic statistics, comparison between common and robust statistics, application of robust statistics in linear regression.

Analiza variance, vzorčenje s ponavljanji in brez, posterione metode analize variance.	Analysis of variance, sampling with or without repetitions, post-anova methods.
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Temeljna literatura in viri/Readings:

Turk G. 2012. Verjetnostni račun in statistika. Ljubljana, UL FGG.

Drobne S., Turk G. 2009. Statistika, Vaje. 2. popravljena in dopolnjena izd. Ljubljana, UL FGG.

Chiles, J.-P.; Delfiner, P., 1999, Geostatistics, Modeling Spatial Uncertainty, John Wiley & Sons

Cressie, N.A.C., 1993, Statistics for Spatial Data, John Wiley & Sons.

Olive D.J., 2008, Applied Robust Statistics, South Illinois University, Carbondale, Illinois.

Cilji in kompetence:

Cilji

Spoznati različne statistične metode, ki so pogosto uporabljene v okoljskem gradbeništvu.

Pridobljene kompetence

Uporablja različne statistične metode v gradbeništvu,

uporablja prostorsko statistiko, kjer je to potrebno

uporablja robustno statistiko, kjer je to potrebno,

samostojno zna uporabiti ustrezno statistično metodo glede na naravo problema.

Objectives and competences:

Objectives

To learn about different statistical methods commonly used in environmental civil engineering.

Gained competences

To be able to apply different statistical methods used in civil engineering,

to be able to use spatial statistics if necessary,

to be able to use robust statistics if necessary,

to know and be able to apply corresponding statistical method with respect to the problem.

Predvideni študijski rezultati:

- Spozna različne statistične metode, kot so intervali zaupanja, preizkušanje domnev, bivariatna analiza in analiza variance, posterione analize variance,
- spozna osnove prostorske statistike in razume razliko in pomen prostorske statistike glede na običajno statistiko,
- spozna osnove robustne statistike in razume razliko med robustno in običajno statistiko,
- samostojno izbira ustrezno statistično metodo glede na obravnavani problem in jo samostojno izvede,
- razume, kaj so prednosti (in slabosti) podajanja zaključkov z določenim nivojem tveganja,
- zna uporabljati domačo in tujo literaturo,
- spretnost zbiranja in obdelave podatkov ter sposobnost predstavljanja rezultatov,
- zna uporabljati pripravljena računalniška orodja in programe (na primer Mathematica).

Intended learning outcomes:

- Learns about different statistical methods, i.e. confidence intervals, hypothesis testing, bivariate analysis, ANOVA, postANOVA,
- learns the basics on spatial statistics and understands the relationship between common and spatial statistics,
- learns the basics on robust statistics and understands the relationship between common and robust statistics,
- to be able to choose the most suitable statistical methods with respect to the problem and is able to perform the analysis,
- to understand the shortcomings and advantages of forming conclusions based on risk level,
- to be able to use of Slovenian and foreign literature,
- to be able to collect and analyze data, ability to represent data,
- to be able to use different software (e.g. Mathematica).

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

Polovica poučevanja predstavlja predavanja ex-katedra s pogosto uporabo modernih učnih pripomočkov: prikazi programske opreme, simulacij in drugo.

Druga polovica so seminarske vaje, ki jih opravimo v računalniški učilnici, v okviru katerih se spoznamo z aplikacijo različnih statističnih metod na realnih podatkih

One half of the teaching is performed through lectures with frequent use of modern teaching techniques: demonstration of statistical software, simulations, etc.

The second half is teaching and learning in the computer lab where the application of different statistical methods on actual data is introduced.

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

Sprotno delo (oddane rešitve nalog)	50,00 %	Exercises during the semester
Ustni izpit	50,00 %	Oral examination

Reference nosilca/Lecturer's references:

ŽNIDARIČ, Aleš, TURK, Goran, ZUPAN, Eva. Determination of strain correction factors for bridge weight-in-motion systems. Engineering structures, ISSN 0141-0296. [Print ed.], 2015, letn. 102, str. 387-394.

PIRC, Jure, TURK, Goran, ŽURA, Marijan. Using the robust statistics for travel time estimation on highways. IET intelligent transport systems, ISSN 1751-956X. [Print ed.], maj 2015, letn. 9, št. 4, str. 442-452.

KREGAR, Klemen, TURK, Goran, KOGOJ, Dušan. Statistical testing of directions observations independence. Surv. rev. - Dir. Overseas Surv., 2013, letn. 45, št. 329, str. 117-125.

TURK, Goran. Verjetnostni račun in statistika. 1. izd. Ljubljana: Fakulteta za gradbeništvo in geodezijo, 2012. VI, 264 str.

ČEŠAREK, Peter, SAJE, Miran, ZUPAN, Dejan. Dynamics of flexible beams: Finite-element formulation based on interpolation of strain measures. Finite elem. anal. des., 2013, letn. 72, str. 47-63.

RODMAN, Urban, SAJE, Miran, PLANINC, Igor, ZUPAN, Dejan. The lateral buckling of timber arches. International journal of structural stability and dynamics, 2013, letn. 13, št. 8, str. 1-16.

ČEŠAREK, Peter, SAJE, Miran, ZUPAN, Dejan. Kinetically exact curved and twisted strain-based beam. Int. j. solids struct., 2012, letn. 49, št. 13, str. 1802-1817.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	GRADBENE TEHNOLOGIJE V VODARSTVU
Course title:	
	CONSTRUCTION TECHNOLOGIES IN WATER WORKS

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni	Ni členitve (študijski program)		Letni

Univerzitetna koda predmeta/University course code:	1584
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Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	0	30	0	0	60	4

Nosilec predmeta/Lecturer:	Andrej Kryžanowski
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Vrsta predmeta/Course type:	Izbirni strokovni /Elective professional
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Jeziki/Languages:	Predavanja/Lectures:	Slovenščina
	Vaje/Tutorial:	Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:

Vsebina:	Content (Syllabus outline):
Predavanja Splošni principi projektiranja glede na tip vodne zgradbe (obrežna zgradba, jezovna zgradba ...); terenske in laboratorijske raziskave: (1) geološke in tektonske raziskave vplivnega območja gradnje (geološke, geotehnične, geofizične metode raziskav); (2) geomehanske raziskave za potrebe temeljenja in raziskav nahajališč materiala (geomehanske, seizmotektonske raziskave); (3) temeljenje in hidravlična stabilnost objektov - protifiltracijski ukrepi. Organizacija gradbišč za gradnjo v vplivnem območju vode: (1) izvedba gradbene jame na suhem	Lectures General design principles in relation to water works types (riparian structures, weir structures etc.); field work and laboratory studies: (1) geological and tectonic investigations of the construction impact area (geological, geotechnical, geophysical investigation methods); (2) geomechanical investigations required for foundation work and investigation of material localities (geomechanical, seizmotectonic investigations); (3) foundation and hydraulic stability of structures – anti-filtration measures. Construction site organisation in the

in v vodi; (2) zaščitni ukrepi varovanja gradbene jame (zavarovanje brežin, protifiltracijski ukrepi ...); (3) gradbena mehanizacija in oprema pri izvajanju in zaščiti gradbenih jam v vodi. Tehnologija gradnje vodnih zgradb: (1) gradnja obrežnih in jezovnih zgradb iz konvencionalnih materialov (beton, zemeljski material, skalomet ...); (2) gradnja obrežnih in jezovnih zgradb iz nekonvencionalnih materialov (valjani beton, stabilizirana zemljina ...); (3) uporaba konvencionalnih in specialnih oblog pri erozijski zaščiti objektov; (4) izbira in priprava materiala za gradnjo: (analiza lokacij, zunanji-notranji transporti, priprava materiala za gradnjo, organizacija gradnje po tipu in materialu ...); (5) gradbena mehanizacija; (6) zagotavljanje in kontrola kvalitete gradnje. Seminarske vaje Izdelava tehnoloških projektov priprave gradnje za različne tipe vodnih zgradb; izdelava tehnoloških projektov gradnje za primer uporabe različnih tipov vgradnih materialov.	impact area of water: (1) construction pit execution; In the dry and underwater; (2) construction pit protection measures (protection of banks, anti-filtration measures etc.); (3) construction machinery and equipment for execution and protection of construction pits under water. Technology of water works: (1) construction of riparian and weir constructions from conventional materials (concrete, earth, rockfill etc.); (2) construction of riparian and dam structures from non-conventional materials (roller compacted concrete, soil stabilization etc.); (3) use of conventional and special linings for anti-erosion protection of structures; (4) choice and preparation of building materials (site analysis, off-site/on-site transport, preparation of material for building, organisation of building in relation to type, material etc.); (5) construction machinery; (6) provision and quality control in construction. Tutorials Elaboration of technological projects of construction preparation for different types of water works; elaboration of technological construction projects by using various types of installation materials.
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Temeljna literatura in viri/Readings:

Strobl, T. Zunic, F. 2006. Wasserbau: Aktuelle Grundlagen – Neue Entwicklungen, Springer, 604 str.

Blindt, H. 1987. Wasserbauten aus Beton. Berlin, Ernst & Sohn, 493 str.

Nonveiller, E. 1983. Nasute brane. Zagreb, Školska knjiga, 359 str.

Tehničar – građevinski priručnik – 6. 1989. Beograd, Građevinska knjiga.

Učno gradivo v spletni učilnici UL FGG.

Cilji in kompetence:**Cilji**

- Podati osnovne koncepte za projektiranje in izvedbo osnovnih tehnoloških procesov pri načrtovanju in gradnji vodnih zgradb.
- Pridobljene kompetence
- Sposobnost izdelave osnovnih tehnoloških projektov v pripravljalni fazi ter upravljanje osnovnih tehnoloških procesov med gradnjo vodnih zgradb,
 - sposobnost prepoznavanja, spremljave in načrtovanje procesa umeščanja vodnih zgradb v okolje in prostor,

Objectives and competences:**Objectives**

- To learn about the basic concepts of design and execution of basic technological processes in planning and construction of water works.
- Gained competences
- Ability to elaborate basic technological design projects in the preparation stage, and management of basic technological processes during water works construction,
 - ability to recognise, monitor and plan the process of site selection and placement of water works,

- sposobnost prepoznavanja materialov in tehnoloških postopkov priprave materialov pri gradnji vodnih zgradb.

- ability to recognise materials and technological processes of material preparation in water works construction.

Predvideni študijski rezultati:**Intended learning outcomes:**

- Pridobljeno poglobljeno znanje za načrtovanje tehnoloških projektov priprave in organizacije gradnje vodnih zgradb,
- osvojene računske spretnosti za dimenzioniranje zaščitnih ukrepov na vodnih zgradbah,
- sposobnost izdelati tehnološke elaborate v vseh fazah procesa gradnje vodnih zgradb.

- Acquired in-depth knowledge for planning of technological projects of preparation and organisation of water works construction,
- acquired calculation skills for dimensioning of protection measures of water structures,
- ability to elaborate technological reports in all stages of water work construction.

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

Predavanja in seminarske vaje.

Lectures and tutorials.

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

Vaje	50,00 %	Tutorials
Pisni izpit	50,00 %	Written examination

Reference nosilca/Lecturer's references:

KRYŽANOWSKI, Andrej, MIKOŠ, Matjaž, PLANINC, Igor, ŠUŠTERŠIČ, Jakob. Searching for an optimal technical solution and concrete mixture for erosion prevention in dam slides. V: 4th International Structural Engineering and Construction Conference, ISEC-4, Melbourne, Australia. XIE, Yie-Min (ur.), PATNAIKUNI, I. (ur.). Innovations in structural engineering and construction : proceedings of the Fourth International structural engineering and construction conference (ISEC-4), Melbourne, Australia, 26-28 September, 2007, (Balkema - Proceedings and monographs in engineering, water and earth sciences). London [etc.]: Taylor & Francis, cop. 2008, str. 509-515.

KRYŽANOWSKI, Andrej, MIKOŠ, Matjaž, ŠUŠTERŠIČ, Jakob, UKRAINCZYK, Velimir, PLANINC, Igor. Testing of concrete abrasion resistance in hydraulic structures on the lower Sava river. Stroj. vestn., apr. 2012, vol. 58, no. 4, str. 245-254.

MIKOŠ, Matjaž, KRYŽANOWSKI, Andrej. Debris-flow breakers as an unconventional dam type. V: Dams - recent experiences on research, design, construction and service : international symposium : proceedings, Skopje, 17th - 18th November, 2011. Skopje: Macedonian committee on large dams, 2011, str. 63-70.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	OPERACIJSKE RAZISKAVE V GRADBENIŠTVU
Course title:	
	OPERATIONAL RESEARCH IN CIVIL ENGINEERING

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni	Ni členitve (študijski program)		Letni

Univerzitetna koda predmeta/University course code:

1318

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
45	0	30	0	0	75	5

Nosilec predmeta/Lecturer:

Goran Turk, Marijan Žura

Vrsta predmeta/Course type:

Izbirni strokovni /Elective professional

Jeziki/Languages:

Predavanja/Lectures:

Slovenščina

Vaje/Tutorial:

Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

Prerequisites:

Opravljen izpiti Matematika I, Matematika II, Izbirni predmet Statistika.

Passed exams in Mathematics I, Mathematics II and Elective Course Statistics.

Vsebina:

Content (Syllabus outline):

Uvod v matematično programiranje; linearno programiranje, metoda Simplex; nelinearno programiranje, Newtonova metoda, genetski algoritmi; dinamično programiranje, diskretno dinamično programiranje; osnove stohastičnih procesov, Markovske verige; problemi odločanja, drevesa odločanja; osnove simulacij, različni principi in načini simuliranja; osnove geoinformatike, vloga tehnologije GIS; grafične baze podatkov; pregled prostorskih analiz.

Introduction to mathematical programming; linear programming, Simplex method; nonlinear programming, Newton's method, genetic algorithms; dynamic programming, discrete dynamic programming; basics of stochastic processes, Markov chains; problems of decisions, decision trees; introduction to simulations, different approaches and types of simulations; introduction to geoinformatics, the role of GIS technology; graphical data bases; the overview of spatial analyses.

Temeljna literatura in viri/Readings:

Turk G. 2012. Verjetnostni račun in statistika, UL FGG, Ljubljana, 2012.

Zadnik Stirn, L. 2001. Metode operacijskih raziskav za poslovno odločanje. Novo mesto, Visoka šola za upravljanje in poslovanje.

Benjamin, J.R., Cornell, C.A. 1970. Probability, Statistics and Decision for Civil Engineers, McGraw Hill, str. 321-348, 524-581.

Hiller, F.S.; Lieberman, G.J. 2001. Introduction to operations research, McGraw Hill.

Benjamin, J.R., Cornell, C.A. 1970. Probability, Statistics and Decision for Civil Engineers, McGraw Hill.

Cilji in kompetence:**Cilji**

- Spoznati osnove teorije optimalnega upravljanja in modelirati praktični problem s primernim modelom,
- spoznati uporabo matematičnega programiranja pri reševanju problemov optimalnega upravljanja,
- aktivno spoznati osnove in uporabo informacijske tehnologije, kot npr. geografskih informacijskih sistemov.

Pridobljene kompetence

- Zna praktično uporabiti metode optimalnega upravljanja pri različnih problemih s področja vodarstva in okoljskega inženirstva,
- pozna možnosti uporabe geografskih informacijskih sistemov.

Objectives and competences:**Objectives**

- Student learns about basics operational research, optimal management and modeling of the projects,
- student is introduced to mathematical programming as a tool for optimal management,
- student obtains active knowledge of information technology, e.g. geographical information systems.

Gained competences

- Student is able to use the methods of optimal management in different problems from the field of environmental civil engineering,
- student is introduced in the use of geographical information systems.

Predvideni študijski rezultati:

- Študent pozna osnove teorije optimalnega upravljanja. Zna modelirati problem s primernim modelom (na primer: linearni model) in ga reši z metodami matematičnega programiranja.
- Spozna osnove determinističnih in stohastičnih procesov in njihovo uporabo v transportnih in oskrbovalnih problemih.
- Spozna geografski informacijski sistem, kot enega izmed osnovnih informacijskih sistemov, s katerimi se inženir vodarstva in komunalnega inženirstva srečuje v praksi.
- Študent razume, kako izvesti proces zapisa različnih sistemov (transporta, strežba, skladiščenje...) v matematične modele, kot je na primer model za linearno programiranje, s katerim nato problem reši.
- Prenos teoretičnega znanja, pridobljenega na predavanjih in iz študijske literature, na uporabo v praktičnih primerih preprostih problemov optimizacije upravljanja (na primer v komunalnem inženirstvu).

Intended learning outcomes:

- Student understands the basic concepts of operational research. Student is able to use the appropriate model (e.g. linear model) and solve the problem with the use of mathematical programming.
- Student learns about the basics of deterministic and stochastic processes and their use in transport and supply problems.
- Student learns about geographical information systems as one of the basic information systems used by environmental and civil engineers.
- Student understands how to transform the process data into mathematical form suitable for analysis, e.g. linear programming model.
- Transfer of theoretical knowledge obtained during study into practical problems of searching for optimal management strategy.
- Ability to use different software (Excel, Mathematica, ArcGIS ...).

- V okviru tega predmeta študentje spoznajo vrsto uporabnih funkcij in modulov različne programske opreme (Excel, Mathematica, ArcGIS ipd.), ki jim olajša delo pri drugih predmetih.

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

Polovica poučevanja predstavlja predavanja ex-katedra s pogosto uporabo modernih učnih pripomočkov: prikazi programske opreme, simulacij in drugo.

One half of the teaching is performed through the lectures with often use of modern teaching techniques: demonstration of statistical and other software, simulations, etc.

Druga polovica so vaje, ki jih opravimo v računalniški učilnici, v okviru katerih rešuje relativno preproste optimizacije upravljanja oziroma operacijskih raziskav.

The second half is teaching and learning in the computer lab where relatively simple problems in optimization of management and operational research.

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

Sprotno delo (oddane rešitve nalog)	50,00 %	Exercises during the semester
Ustni izpit	50,00 %	Oral examination

Reference nosilca/Lecturer's references:

KREGAR, Klemen, TURK, Goran, KOGOJ, Dušan. Statistical testing of directions observations independence. Surv. rev. - Dir. Overseas Surv., 2013, letn. 45, št. 329, str. 117-125.

MARJETIČ, Aleš, AMBROŽIČ, Tomaž, TURK, Goran, STERLE, Oskar, STOPAR, Bojan. Statistical Properties of Strain and Rotation Tensors in Geodetic Network. J. surv. eng., avgust 2010, letn. 136, št. 3, str. 102-110.

TRTNIK, Gregor, KAVČIČ, Franci, TURK, Goran. The use of artificial neural networks in adiabatic curves modeling. Autom. constr.. [Print ed.], 2008, letn. 18, št. 1, str. 10-15.

ŠELIH, Jana, KNE, Anžej, SRDIČ, Aleksander, ŽURA, Marijan. Multiple-criteria decision support system in highway infrastructure management. Transport (Vilnius (Spausd.)). [Print ed.], 2008, letn. 23, št. 4, str. 299-305.

ŽURA, Marijan, SRDIČ, Aleksander, ZUPANČIČ, Dušan, NAGODE, Petra. Decision and control model - case of national highway network realisation process. WSEAS Trans. Syst., 2006, letn. 5, št. 3, str. 591-597.

ČERNE, Tomaž, ŽURA, Marijan, RAKAR, Albin. Informacijska podpora gospodarjenju z javnimi površinami v urbanem okolju = Information support for public area management. Geod. vestn.. [Tiskana izd.], 2010, letn. 54, št. 1, str. 46-60.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	HIDROINFORMATIKA
Course title:	
	HYDROINFORMATICS

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni	Ni členitve (študijski program)		Letni

Univerzitetna koda predmeta/University course code:	1647
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Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
10	10	40	0	0	60	4

Nosilec predmeta/Lecturer:	Mateja Škerjanec
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Vrsta predmeta/Course type:	Izbirni strokovni /Elective professional
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Jeziki/Languages:	Predavanja/Lectures:	Slovenščina
	Vaje/Tutorial:	Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:**Prerequisites:**

Osnovna znanja o atributnih opisnih in grafičnih prostorskih podatkih in podatkovnih bazah, pridobljena npr. pri gradbeni informatiki, pri predmetih o vodnih zgradbah ali o modeliranju z vodami povezanih procesov (tj. navezava na podatke, potrebne za ekološko, hidrološko in hidravlično modeliranje).	Basic skills knowledge of descriptive attribute and graphical spatial data and databases, obtained for example at, e.g., courses on construction informatics, engineering communication, hydraulic structures or gained from during modelling of water-related processes (i.e. data collection for ecological, hydrological or hydraulic modelling).
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Vsebina:**Content (Syllabus outline):**

Predavanja	Lectures
- Teoretične osnove hidroinformatičnih sistemov. - Pregled in prostorski prikaz podatkov, povezanih z upravljanjem voda (državni in občinski nivo). - Obdelava podatkov (poizvedovanje, povezovanje, rudarjenje) za podporo	- Theoretical basis of hydro-information systems. - Review and spatial representation of data related to water administering (state and municipal level).

modeliranju/odločanju na področju upravljanja voda. Vaje • Uporaba podatkovnih baz in spletnih pregledovalnikov, povezanih z rabo, urejanjem in varstvom voda. • Analiza prosto dostopnih atributnih podatkov (poizvedbe, podatkovno rudarjenje). • Obdelava prostorskih podatkov v izbranem GIS orodju (prekrivanje podatkovnih slojev in izvajanje prostorskih analiz). • Priprava vhodnih podatkov za modeliranje procesov, povezanih z vodo. Seminar Študent izdela poročilo, v katerem na osnovi obstoječih prosto dostopnih podatkov, shranjenih v podatkovnih bazah in spletnih pregledovalnikih, pripravi hidroinformacijske podlage za izbrano vodnogospodarsko tematiko.	• Data processing (querying, linking, data mining) for modelling/decision support in the field of water management. Exercises • Use of databases and web browsers, related to water use, management and protection. • Analysis of freely available attribute data (queries, data mining). • Spatial data processing within the selected GIS tool (applying overlay methods and other spatial analyses). • Preparation of input data for modelling water-related processes. Project Report The prepared Project Report should contain the hydro-information basis for the selected water management topic by applying existing freely available data stored in databases and web browsers.
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Temeljna literatura in viri/Readings:

Abbott, M.B. 1991. Hydroinformatics – Information Technology and the Aquatic Environment. Avebury, UK.

Breiting, T. 2006. Techniken und Methoden der Hydroinformatik. Stuttgart, Universität Stuttgart, Institut für Wasser- und Umweltsystemmodellierung.

Kumar, P., Folk, M., Markus, M. in Alameda, J.C. 2006. Hydroinformatics. CRC Press.

La Loggia, G., Freni, G., Puleo, V. in De Marchis, M. (ur.). 2018. HIC 2018. Proceedings of the 13th International Conference on Hydroinformatics, Palermo, Italy, 1-6 July 2018. EasyChair.
https://easychair.org/publications/volume/HIC_2018

Peck, A., Neuwirth, C. in Simonovic, P.S. 2014. Coupling System Dynamics with Geographic Information Systems: CCar Project Report No 086. London, Ontario, Canada, Western University.

Učno gradivo v spletni učilnici UL FGG.

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

Cilji • Spoznati osnovne teoretične podlage hidroinformacijskih sistemov. • Seznanitev z različnimi formati podatkov in orodji za njihovo obdelavo. • Spoznati različne vrste podatkov, ki vstopajo v procese upravljanja voda na državnem in občinskem nivoju. • Seznanitev z javno dostopnimi podatki in njihovo uporabo v postopku modeliranja z vodami povezanih procesov. • Seznanitev z izbranim GIS orodjem. Kompetence	Objectives • Gaining basic theoretical background in hydroinformatics systems. • Introduction to various data formats and tools for their processing. • Gaining knowledge of different data types that enter the water administering processes at the state and municipal level. • Familiarization with publicly available data and their use in the process of modelling water-related processes. • Familiarization with the selected GIS tool. Competences
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- Razumevanje podatkovnih struktur hidro informacijskih sistemov. - Sposobnost uporabe atributnih in prostorskih podatkov za podporo odločanju na področju upravljanja voda in pripravo vhodnih podatkov za modeliranje procesov, povezanih z vodo. - Samostojna uporaba izbranega GIS orodja.	- Understanding data structures of hydro-information systems. - Ability of using attribute and graphical spatial data to support decision-making in the field of water management and to prepare input data for modelling water-related processes. - Independent use of the selected GIS tool.
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Predvideni študijski rezultati:**Intended learning outcomes:**

Znanje in razumevanje - Pridobljeno poglobljeno znanje o hidro informacijskih sistemih. - Pridobljeno znanje o podatkovnih strukturah hidro informacijskih sistemov. - Pridobljeno znanje o uporabi podatkov hidro informacijskih sistemov za podporo odločanju na področju priprave vhodnih podatkov in za potrebe modeliranja procesov, povezanih z vodo, na vodah ter za predstavitev rezultatov oz. vključitev v podatkovne strukture. Prenosljive spretnosti - Sposobnost uporabe in kritične presoje podatkovnih struktur hidro informacijskih sistemov na širšem področju upravljanja voda.	Knowledge and understanding - Acquired knowledge about hydro-information systems. - Lessons learned about data structures in hydro-information systems. - Lessons learned on the use of hydro-information systems for decision support in water management and, for the input data preparation collecting for modelling water-related processes modelling and the presentation or inclusion of results in the data storages. Transferable skills - Ability to use of application and critically assessment of and apply of the data structures in hydro-information systems for integrated water management.
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Metode poučevanja in učenja:**Learning and teaching methods:**

Predavanja, usposabljanje s posameznimi orodji in uporaba pridobljenih znanj pri vajah, sinteza znanj v samostojno izdelani seminarski nalogi.	Lectures, demonstrations and exercising on open-source software, skills synthesis within individual Project Report.
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Načini ocenjevanja:**Delež/Weight****Assessment:**

Seminarska naloga	50,00 %	Project Report
Pisni in/ali ustni izpit	50,00 %	Final written and/or oral exam

Reference nosilca/Lecturer's references:

ŠKERJANEC, Mateja, KREGAR, Klemen, ŠTEBE, Gašper, RAK, Gašper. 2022. Analysis of floating objects based on non-intrusive measuring methods and machine learning. *Geomorphology : an international journal of pure and applied geomorphology*, 408, 108254. DOI: [10.1016/j.geomorph.2022.108254](https://doi.org/10.1016/j.geomorph.2022.108254).

RADINJA, Matej, **ŠKERJANEC, Mateja**, ŠRAJ, Mojca, DŽEROSKI, Sašo, TODOROVSKI, Ljupčo, ATANASOVA, Nataša. 2021. Automated modelling of urban runoff based on domain knowledge and equation discovery. *Journal of Hydrology*, 603 (part c). DOI: [10.1016/j.jhydrol.2021.127077](https://doi.org/10.1016/j.jhydrol.2021.127077).

MORI, Nataša, DEBELJAK, Barbara, **ŠKERJANEC, Mateja**, SIMČIČ, Tatjana, KANDUČ, Tjaša, BRANCELJ, Anton. 2019. Modelling the effects of multiple stressors on respiration and microbial biomass in the hyporheic zone using decision trees. *Water research*, 149: 9-20. DOI: [10.1016/j.watres.2018.10.093](https://doi.org/10.1016/j.watres.2018.10.093).

ŠKERJANEC, Mateja, ATANASOVA, Nataša, ČEREPNALKOSKI, Darko, DŽEROSKI, Sašo, KOMPARE, Boris. 2014. Development of a knowledge library for automated watershed modeling. *Environmental Modelling & Software*, 54: 60-72. DOI: 10.1016/j.envsoft.2013.12.017.

GIDEON, Gal, **ŠKERJANEC, Mateja**, ATANASOVA, Nataša. 2013. Fluctuations in water level and the dynamics of zooplankton : a data-driven modelling approach. *Freshwater Biology*, 58 (4): 800-816. DOI: [10.1111/fwb.12087](https://doi.org/10.1111/fwb.12087).

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	MERITVE V HIDROLOGIJI
Course title:	
	HYDROMETRY

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni	Ni členitve (študijski program)		Letni

Univerzitetna koda predmeta/University course code:	1724
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Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	0	20	0	10	60	4

Nosilec predmeta/Lecturer:	Matjaž Mikoš , Simon Rusjan
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Vrsta predmeta/Course type:	Izbirni strokovni /Elective professional
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Jeziki/Languages:	Predavanja/Lectures:	Slovenščina
	Vaje/Tutorial:	Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Opravljen izpiti iz predmeta Hidrologija in Hidravlika na 1. stopnji študijskega programa oz. osvojena ustrezna primerljiva znanja.	Basic courses on Hydrology and Hydraulics (BA level) or adequate attained skills.

Vsebina:	Content (Syllabus outline):
Predavanja Osnove merilne tehnike: izrazoslovje in standardi (ISO 772). Meritve rečne struge: klasične metode in daljinsko zaznavanje. Meritve vodostajev: klasične metode. Meritve pretokov: različne metode in pretočna krivulja. Meritve rečnega transporta sedimentov: vzorčevanje sedimentov, meritve kalnosti (suspendiranih snovi), meritve prodonosnosti, vzorčevanje kakovosti vode in vsebnosti raztopljenih snovi. Objekti za meritve	Lectures Basics of the measuring techniques: terminology and standards (ISO 772). Measurements of the stream channel: classic methods and remote sensing. Measurements of water level: classic methods. Discharge measurements: different methods and discharge curve. Measurements of river sediment transport: sediment sampling, turbidity measurements (suspended solids), measurements of bedload transport, water quality sampling and

površinskega toka: prelivi in jezovi. Hidrološka mreža opazovalnic in merilnih postaj: monitoring. Analiza napake meritev in kontrola kakovosti; zapisovanje podatkov, prenos podatkov in arhiviranje podatkov (podatkovne baze), postopki kontrole kakovosti, statistična in analitična ocena napake, negotovost. Posebna poglavja: vremenski radar, satelitsko daljinsko zaznavanje, izotopsko sledenje, dendrokronologija, starost sedimentov. Vaje Seminarske vaje (računske vaje iz obdelave različnih hidroloških terenskih meritev; obdelava časovnih serij hidroloških podatkov; segmentacija in trend). Laboratorijske vaje (demonstracija delovanja in uporaba instrumentov v laboratorijskih pogojih). Terensko delo Terenske meritve, uporabljajoč različne instrumente.	dissolved solids concentrations. Hydraulic structures for measuring surface flow: weirs. Network of hydrological stations: monitoring system. Analysis of measurement errors and quality control: data recording, data transmission and archiving (data bases), procedures of quality assurance, statistical and analytical errors, uncertainty. Special chapters: weather radar, satellite remote sensing, trace studies (isotopes), dendrochronology, sediment age analysis. Tutorials Seminar tutorials (computational exercises for analysis of hydrological field measurements; hydrological time series analysis; segmentation and trends). Laboratory tutorials (demonstration of the measuring instruments use in laboratory conditions). Field work Field measurements using different instruments.
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Temeljna literatura in viri/Readings:**Knjižni viri (izbrana poglavja) / Books (selected chapters):**

Boiten, W. (2008). Hydrometry – a comprehensive introduction to the measurement of flow in open channels. 3rd Ed. CRC Press / Balkema, Taylor Francis Group, 247 str.

Hersch, R.W. (ed.) (1998): Hydrometry: principles & practices. 2nd Ed. John Wiley & Sons, New York, 376 str.

Hersch, R.W. (2009): Streamflow measurements, 3rd Ed. Routledge, Taylor and Francis Group, 507 str.

Shaw, E.M. (1993): Hydrology in Practice, 3rd Ed. Chapman and Hall, 569 str.

Elektronski viri / Other sources:

Spletna učilnica UL FGG / Web classroom UL FGG: <http://ucilnica1516.fgg.uni-lj.si/>

Cilji in kompetence:**Cilji:**

- Spoznavanje moderne merilne tehnike in sodobnih tehnologij,
- spoznavanje z zasnovo in izvedbo terenskih meritev,
- razumevanje razlik med meritvami za potrebe spremljanja stanja in trendov, obratovalnega monitoringa in podrobnejšega spremljanja stanja vodnega režima,
- pridobitev izkušenj ob praktičnem delu s posameznimi merilnimi napravami.

Kompetence:**Objectives and competences:****Objectives:**

- To extend knowledge about modern measuring techniques and new technologies,
- to extend knowledge of designing and implementation of field measurements,
- understanding the differences between measurements for status monitoring and trend analysis, operational monitoring and detailed monitoring of the state of the water regime,
- obtaining practical experiences with the use of the measuring instruments.

Competences:

• Sposobnost izbire ustrezne merilne tehnike za določeni problem, • pridobljena spretnost pri rokovanju in delu z merilnimi instrumenti.	• Ability to identify the suitability of the measuring equipment for the use in particular problem, • Obtaining knowledge about the handling and practical use of the measuring instruments.
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Predvideni študijski rezultati:**Intended learning outcomes:**

Znanje in razumevanje Pridobljeno poglobljeno teoretično znanje o merilnih principih in tehnikah. Razumevanje delovanja merilnih instrumentov. Uporaba • Uporaba izbranih merilnih instrumentov. Refleksija • Dobro razumevanje delovanja merilne tehnike je dobra osnova za načrtovanje in izvedbo terenskih meritev, opazovanj ali monitoringa. Prenosljive spretnosti Sposobnost presoje kakovosti meritev v naravi kot vhodnih podatkov v modele ali osnov za dimenzioniranje hidrotehničnih objektov. Spretnost uporabe tehničnih merilnih instrumentov.	Knowledge and understanding • Detailed theoretical knowledge of the measurements principles and techniques • Understanding the functioning of the measuring instruments. Use • Practical use of the measuring instruments. Reflection • Good understanding of the functioning of the measuring instruments presents good basis for planning and implementation of the field measurements, observations and monitoring. Skills • Ability to assess the quality of the field measurements as an important input data for the models or designing of the hydrotechnical structures. • Ability to use technical measuring equipment
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Metode poučevanja in učenja:**Learning and teaching methods:**

Predavanja (30 ur), seminarske vaje (10 ur) in laboratorijske vaje (10 ur), terensko delo (10 ur – 2 terenska dneva).	Lectures (30 hours), lab tutorials (10 hours) and class tutorials (10 hours), and field work (10 hours – 2 field days).
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Načini ocenjevanja:**Delež/Weight****Assessment:**

Pisni in/ali ustni izpit	30,00 %	Written and/or oral examination
Laboratorijske in seminarske vaje	60,00 %	Lab and class tutorials
Udeležba in poročilo s terenskega dela	10,00 %	Presence & Individual field work

Reference nosilca/Lecturer's references:

BABIĆ MLADENOVIĆ, Marina, BEKIĆ, Damir, GROŠELJ, Samo, MIKOŠ, Matjaž, KUPUSOVIĆ, Tarik, DIJANA, Oskoruš. Establishment of the Sediment Monitoring System for the Sava River Basin. Water Research and Management, ISSN 2217-5237, 2015, letn. 5, št. 4, str. 3-14.

HÜBL, Johannes, MIKOŠ, Matjaž. Monitoring von Murgängen = Debris flow monitoring. Wildbach- und lawinenverbau, 2014, letn. 78, št. 173, str. 50-66.

MIKOŠ, Matjaž. Metode terenskih meritev suspendiranih sedimentov v rekah = Methods of field measurements of suspended sediment in rivers. Gradbeni vestnik, ISSN 0017-2774, jul. 2012, letn. 61, str. 151-158.

BEZAK, Nejc, ŠRAJ, Mojca, RUSJAN, Simon, KOGOJ, Mojca, VIDMAR, Andrej, SEČNIK, Matej, BRILLY, Mitja, MIKOŠ, Matjaž. Primerjava dveh sosednjih eksperimentalnih in hudourniških porečij: Kuzlovec in Mačkov graben = Comparison between two adjacent experimental torrential watersheds: Kuzlovec and Mačkov graben. Acta hydrotechnica, ISSN 1581-0267. [Spletna izd.], 2013, letn. 26, št. 45, str. 85-97,

VIDMAR, Andrej, BRILLY, Mitja, RUSJAN, Simon. Practical Experience of Discharge Measurement in Flood Conditions with ADP. Geophysical research abstracts, ISSN 1607-7962, 2009, letn. 11, 1 str.

ŠRAJ, Mojca, RUSJAN, Simon, MIKOŠ, Matjaž, PETAN, Sašo, VIDMAR, Andrej, BRILLY, Mitja. The experimental watershed in Slovenia. V: XXIVth Conference of the Danubian Countries on the Hydrological Forecasting and Hydrological Bases of Water Management, Bled, Slovenia, 2-4 June 2008. BRILLY, Mitja (ur.), ŠRAJ, Mojca (ur.). Conference papers. Ljubljana: Slovenian National Committee for the IHP Unesco, 2008, str. 1-14.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	NARAVNE NESREČE IN NJIHOV VPLIV NA OKOLJE, PROSTOR IN DRUŽBO
Course title:	NATURAL DISASTERS AND THEIR IMPACT ON ENVIRONMENT AND SOCIETY

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni	Ni členitve (študijski program)		Letni, Zimski

Univerzitetna koda predmeta/University course code:

1585

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
60	30	0	0	0	90	6

Nosilec predmeta/Lecturer:

Andrej Kryžanowski, Primož Banovec

Vrsta predmeta/Course type:

Izbirni strokovni /Elective professional

Jeziki/Languages:

Predavanja/Lectures:

Slovenščina

Vaje/Tutorial:

Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

Prerequisites:

Predmet je namenjen študentom drugih študijskih programov, predvsem s področja družboslovja, zanje ni pogojev pristopa, ne more pa ga izbrati študent študijskih programov s področja gradbeništva ali vodarstva in okoljskega inženirstva

The course is intended to students of other study programs, mainly those from social sciences; no prerequisites are foreseen, but it cannot be selected by students of civil engineering or water science and environmental engineering.

Vsebina:

Content (Syllabus outline):

Predavanja

Opredeletitev tipov naravnih nesreč. Organizacijski okvir izvajanja nalog zaščite in reševanja: (1) Vrste in pristojnosti državnih organov, regijskih in občinskih organov na področju zaščite in reševanja; (2)

Lectures

Definition of the types of natural disasters. Organisation framework for performing the protection and rescue tasks: (1) Types and competences of state agencies, regional and

Evropske institucije in mehanizmi na področju zaščite in reševanja; (3) moduli civilne zaščite in razvoj novih modulov; (4) Bilateralno sodelovanje; (5) standardni cikel zaščite in reševanja; (6) proces aktiviranja sil zaščite in reševanja.; (7) mehanizmi in postopki vodenja intervencij; (8) viri financiranja za delovanje sistema zaščite in reševanja. Zakonodaja na področju zaščite in reševanja, obveščanja in alarmiranja. Obnašanje in odziv javnosti v primeru nastopa naravnih nesreč. Mehanizmi ocenjevanja ogroženosti, postopki ocenjevanja posledic nesreč, blaženje posledic in zmanjševanje ogroženosti. Vpliv zanesljivosti (uporabljenih) podatkov in izbiro ustreznih modelov na končno oceno posledic in na obseg škode, ter pravilno zasnovano obveščanje in ukrepanje. Naravne nesreče v Republiki Sloveniji za katere obstajajo analize ogroženosti in načrti zaščite in reševanja. Sistemi za hiter odziv in podpora odločanju v primeru naravne nesreče: (1) vloga ekspertov (okoljsko gradbeništvo) v procesih cikla civilne zaščite; (2) sodelovanje in odziv javnosti v ciklu civilne zaščite v primeru naravnih nesreč. Vpliv zanesljivosti (merjenih in analiziranih) podatkov na ustrezno in pravočasno ukrepanje ob nastopu dogodka in posledični obseg škode. Sanacija posledic naravnih nesreč – pristojnosti in postopki. Percepcija in odzivi.

Seminar

Uporaba pridobljenega znanja pri individualni nalogi, ki obsega uporabo modelov za določanje nevarnosti, ranljivosti in ogroženosti pred naravnimi nesrečami. Izdelava ocene ogroženosti, ocena posledic (PAR; LOL) izdelava načrta zaščite in reševanja (tudi analiza in validacija podatkov). Analiza scenarijev razvoja možne naravne nesreče. Kritično tolmačenje rezultatov in predstavitev naloge.

municipal bodies in the field of civil protection and rescue; (2) European institutions and mechanisms for civil protection and rescue; (3) EU modules of civil protection and development of new modules; (4) bilateral cooperation; (5) standard protection and rescue cycle; (6) process of activating the protection and rescue services; (7) mechanisms and procedures of intervention management; (8) sources of financing that enable the functioning of the civil protection and rescue system. Legislation in the field of: civil protection and rescue, communication/information and alarming. Behaviour and response of public in case of natural disasters. Mechanisms of risk evaluation, procedures of disaster damage assessment, disaster mitigation and risk reduction. Data validation and selection of adequate models on the final evaluation of consequences and on the scope of damage, and impact of the data validation process on the response planning. Natural disasters in the Republic of Slovenia for which risk assessments and protection/rescue plans are prepared. Rapid response systems and decision making process in the event of natural disaster: (1) role of experts (environmental civil engineering) in the processes of the civil protection cycle; (2) cooperation and response of the public in the civil protection cycle in the event of natural disaster. Influence of (measured and analysed) data reliability on adequate and timely measures in the event of a disaster and the resulting scope of damage. Mitigation of natural disasters – competences and procedures. Perception and responses.

Seminar

Use of the acquired knowledge in individual seminary work that includes the use of models for the definition of risk, vulnerability and hazard of natural disasters. Elaboration of risk assessment, assessment of consequences (PAR; LOL) elaboration of protection and rescue plan (incl. data analysis and validation) Analysis of scenarios of possible natural disaster development. Critical interpretation of results and presentation of the work.

Temeljna literatura in viri/Readings:

Blaikie, P.; Cannon, T.; Davis, I.; Wisner, B. 2003. At risk: natural hazards, people's vulnerability and disasters 2nd edition, Routledge, 336 str.

Gaetani F., Parodi A., Siccardi F., Miozzo D. and Trasforini E. 2008. Disaster Risk Reduction for South Eastern Europe, SEEDRMAP report 114 str.

Izbrani članki iz revije: International Journal of Disaster Risk Reduction (npr.: J. Richard Eiser. 2012. Risk interpretation and action: A conceptual framework for responses to natural hazards).

Kline, M., Polič, M. Zabukovec, V. 1998. Javnost in nesreče – obveščanje, opozarjanje, vplivanje, Ljubljana, 227 str.

Modelna orodja za aktivni odziv v primeru naravnih nesreč (poplave, potresi, razlitja idr.)

Uradni list (področna zakonodaja) Dostopno na:

<http://www.preventionweb.net/english/professional/publications/>.

Dokumenti, ki obravnavajo delovanje sistema zaščite in reševanja – civilne zaščite v EU. Spletne strani FEMA (Federal Emergency Management Agency). Dostopno na:

http://ec.europa.eu/echo/civil_protection/civil/index.htm.

Cilji in kompetence:

Objectives and competences:

Cilji	Objectives
- Poznavanja organizacije zaščite in reševanja, - poznavanje pristojnosti posameznih organizacij in inštitucij, ki se vključujejo v varstvo pred naravnimi nesrečami in ukrepanje ob nastopu le-teh, - poznavanje postopkov, ki jih te organizacije izvajajo, - prepoznavanje vrst naravnih nesreč – mehanizmov nastanka in razvoja posamezne vrste in možnih posledic, - poznavanje specifičnosti posamezne vrste naravne nesreče in možnosti zgodnjega ukrepanja, omilitve škode, odziva sil zaščite in reševanja, - razumevanje razvoja naravne nesreče na učnih primerih s poudarkom na klasifikaciji ključnih faz razvoja nesreče, - razumevanje pomena preventivnega ukrepanja in ustreznega, predvsem pa pravočasnega ukrepanja v času dogodka, - razumevanje pomena zajema podatkov in uporabe primerne vzorca pri modeliranju pojavov in pri pripravi načrtov zaščite in reševanja ter kasnejšem ukrepanju. Pridobljene kompetence - Prepoznavanje različnih tipov naravnih nesreč in razvoja možnih scenarijev, - razumevanje mehanizmov nastanka naravne nesreče in različnih faz odziva nanje, - poznavanje organizacije zaščite in reševanja ter sposobnost vključevanja v strukturo civilne zaščite, - poznavanje protokolov obveščanja in alarmiranja ter protokolov ukrepanja,	- Understanding the protection and rescue organisation - understanding the competences of individual organisations and institutions involved in the protection against natural disasters and their actions taken in such events, - understanding the procedures applied by these organisations, - recognising the types of natural disasters – mechanisms of their appearance, development of individual types and the possible consequences, - understanding the specifics of individual type of natural disaster and possibilities of early actions, damage mitigation, protection and rescue response actions, - understanding the development of natural disaster on case studies with the emphasis on the classification of key phases of disaster development, - understanding the importance of preventive actions and adequate, most importantly timely, actions during the event, - understanding the importance of data acquisition and use of appropriate sample for modelling the phenomena and preparing the protection and rescue plans as well as subsequent actions. Gained competences - Recognising different types of natural disasters and development of possible scenarios, - understanding mechanisms for the appearance of natural disaster and different phases of response to it,

• sposobnost razumevanja državnega in mednarodnega okolja v katerem sile zaščite in reševanja delujejo.	• understanding the protection and rescue organisation and ability of participating in the civil protection structure/processes. • understanding the communication and alarm protocols as well as action protocols, • ability to understand national and international environment where the protection and rescue services operate.
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Predvideni študijski rezultati:

• Razumevanje osnovnih terminov na področju varstva pred naravnimi in drugimi nesrečami, • organizacijske sheme zaščite pred naravnimi nesrečami in reševanja v primeru nastopa le-teh, • poznavanje protokolov obveščanja in alarmiranja, • razlikovanje med preventivnimi ukrepi in ukrepanjem med in po dogodkih • poznavanje specifičnih procesov, ki se navezujejo na postopke odločanja v primeru naravnih nesreč, • poznavanje faz načrtovanja oz. pripravljenosti/preventive kot ključne faze za sistemsko zmanjšanje ogroženosti, • poznavanje faz intervencije in njenih specifičnih elementov, • poznavanje faz blaženja posledic (mitigacija) in njenih specifičnih elementov, • vloge različnih znanj in strokovnjakov (ekspertov) v procesu varstva pred naravnimi nesrečami in nadalje ob nastopu naravne nesreče, • znanje za prenos rezultatov modelov za analizo nevarnosti naravne nesreče s ciljem podpore institucijam zaščite in reševanja, • prenos znanj o modeliranju pojavov v praktično okolje, ki jim je uporabnik izpostavljen v primeru naravnih nesreč, • uporaba znanj pri kritičnem snovanju rešitev v vsakodnevni praksi, • uporaba pridobljenega znanja pri predmetih, kjer se obravnava pojave, ki so lahko tudi naravne nesreče za poglobljeno razumevanje namena modeliranja.	Intended learning outcomes: • Understanding of basic terms in the area of protection against natural and other disasters, • To know organisation schemes of protection against natural disasters and rescue in case of disasters, • To know communication and alarm protocols, • To distinguishing between preventive measures and actions during and after events, • To know specific processes related to the decision making actions in events of natural disasters, • To know phases of planning or preparedness/prevention as key phases for systematic risk reduction, • To know intervention phases and their specific elements, • To know mitigation phase and its specific elements, • roles of different knowledge and experts in the process of protection against natural disasters and later with the appearance of natural disaster, • knowledge related to the transfer of results of models for the risk analysis of natural disaster with the aim to support protection and rescue institutions, • Transfer of knowledge on modelling the phenomena that a user is exposed to in the event of natural disaster into practical environment, • use of the acquired knowledge for critical design of solutions in everyday practice, • use of the acquired knowledge in courses that deal with phenomena which may also be natural disasters, for in-depth understanding of the purpose of modelling.
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Metode poučevanja in učenja:

Predavanja in uporaba pridobljenih znanj pri izdelavi individualne seminarske naloge.	Learning and teaching methods: Lectures and use of the acquired knowledge for the elaboration of individual seminar work.
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Načini ocenjevanja:**Delež/Weight****Assessment:**

Seminarska naloga	50,00 %	Seminar work
Pisni in/ali ustni izpit	50,00 %	Written and/or oral exam

Reference nosilca/Lecturer's references:

HUMAR, Nina, SCHNABL, Simon, KRYŽANOWSKI, Andrej. How to manage the dam safety and the risk with a support of Slovenian legislation. V: Sharing experience for safe and sustainable water storage : proceedings [of the] 9th ICOLD European Club Symposium, 10-12 April 2013, Venice, Italy. Roma: ITCOLD (Italian Committee on Large Dams), cop. 2013, str. 1-8.

KRYŽANOWSKI, Andrej, ŠIRCA, Andrej, RAVNIKAR TURK, Mojca, HUMAR, Nina. The VODPREG project : creation of dam database, identification of risks and preparation of guidelines for civil protection, warning and rescue actions. V: Sharing experience for safe and sustainable water storage : proceedings [of the] 9th ICOLD European Club Symposium, 10-12 April 2013, Venice, Italy. Roma: ITCOLD (Italian Committee on Large Dams), cop. 2013, str. 1-8.

HUMAR, Nina, SCHNABL, Simon, KRYŽANOWSKI, Andrej. Sometimes simple measure can reduce the hazard considerably. V: WINTER, Jan (ur.), KOSIK, Anna, WITA, Andrzej. Zapory - bezpieczeństwo i kierunki rozwoju, (Monografie Instytutu Meteorologii i Gospodarki Wodnej). Warszawa: Instytut Meteorologii i Gospodarki Wodnej - Państwowy Instytut Badawczy, 2013, str. 52-61.

KRYŽANOWSKI, Andrej, HUMAR, Nina. Dam safety practice in Slovenia. V: WINTER, Jan (ur.). Bezpieczeństwo zapor - nowe wyzwania. Warszawa: Instytut meteorologii i gospodarki wodnej państwowy, 2011, str. 200-207.

STEINMAN, Franci, KLASINC, Roman, BANOVEC, Primož. Ermittlung der erwarteten Schadengröße bei Überflutungen hochwassergefährdeter Gebiete unter Verwendung moderner Technologien = Determination of expected damage resulting from the inundation of areas exposed to flood risks, using up-to-date technologies. Österr. Wasser- Abfallwirtsch.. [Print ed.], 2001, jg. 53, h. 9/10, str. 242-247.

BANOVEC, Primož, CERK, Matej, CVERLE, Andrej. Upravljanje poplavne ogroženosti kot sestavni del integrirane odpornosti urbanih območij = Management of flood risks as an integral part of urban resilience. V: Geodezija pri upravljanju z vodami : 41. geodetski dan, Dolenjske Toplice 19. - 20. oktober 2012 : [zbornik prispevkov], (Geodetski vestnik, Letn. 56 (2012), št. 4). Ljubljana: Zveza geodetov Slovenije, 2012, dec. 2012, letn. 56, št. 4, str. 838-845.

HOLTEN LÜTZHOFT, Hans-Christian, DONNER, Erica, WICKMAN, Tonie, ERIKSSON, Eva, BANOVEC, Primož, MIKKELSEN, Peter Steen, LEDIN, Anna. A source classification framework supporting pollutant source mapping, pollutant release prediction, transport and load forecasting, and source control planning for urban environments. Environ. sci. pollut. res. int.. [Print ed.], maj 2012, letn. 19, št. 4, str. 1119-1130, doi:10.1007/s11356-011-0627-9.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	UPORABNA EKOLOGIJA IN EKOTOKSIKOLOGIJA
Course title:	
	APPLIED ECOLOGY AND ECOTOXICOLOGY

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni	Ni členitve (študijski program)	2. letnik	Letni

Univerzitetna koda predmeta/University course code:	1644
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Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	0	30	0	0	60	4

Nosilec predmeta/Lecturer:	Damjana Drobne
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Vrsta predmeta/Course type:	Obvezni strokovni /Obligatory professional
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Jeziki/Languages:	Predavanja/Lectures:	Slovenščina
	Vaje/Tutorial:	Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:

Vsebina:	Content (Syllabus outline):
Ekotoksikologija and ekologija (osnovni pojmi, historični pregled); struktura in delovanje ekosistemov; primeri različnih ekosistemov; vplivi na ekosisteme zaradi človekove dejavnosti (onesnaževanje, klimatske spremembe ipd.); onesnaževanje okolja (viri, načini ugotavljanja razsežnosti onesnaževanja); vplivi kemikalij na organizme, strupenost; strupenostni testi (osnovno razumevanje izvedbe testa, tipi testov strupenosti in podatkov pridobljenih v testih strupenosti ter njihova uporaba pri oceni tveganja); pregled najbolj uporabljenih rutinskih testov strupenosti;	Ecotoxicology and ecology (basic definitions, historical overview); structure and functioning of ecosystem, examples of different ecosystems; effects of human activities on ecosystem (pollutants, climate changes etc.); pollution of environment (sources, ways of determining pollution); effects of chemicals on organisms, toxicity; toxicity tests (basic understanding, types of tests, analysis of toxicity tests data, environmental risk assessment); overview of routine toxicity testing; biomonitoring (biomarkers and bioindicators); environmental policy

biomonitoring (biomarkerji and bioindikatorji); pregled okoljskih standardov; najnovejši izzivi na področju varovanja okolja (nanotoksikologija, hormonski motilci).	overview; emerging topics in environmental pollution (nanotoxicology, endocrine disruptors).
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Temeljna literatura in viri/Readings:

Hoffman, B.A. Rattner, G.A. Burton and J. Cairns. 2002. Handbook of Ecotoxicology. Second Edition. Lewis, Boca Raton, FL, USA.

Walker C. H. et al. 2001, 2012. Principles of ecotoxicology. CRC, Francis and Taylor Group, Boca Raton, FL, USA.

Cilji in kompetence:**Cilji**

- Posredovanje osnovnega znanja o ekosistemu ter o posledicah vplivov na ekosistem. Med temi vplivi bo v ospredju onesnaževanje.
- Poudarek pri predmetu bo tudi na razumevanju kvarnega delovanja onesnažil na organizme in združbe.
- Slušatelji se bodo seznanili z načini ugotavljanja posledic onesnaževanja. Ti načini so: testiranje strupenosti, dolgotrajno spremljanje stanja v okolju (monitoring) in modeliranje razsežnosti vplivov. Ta znanja bodo združili pri oceni tveganja na okolje.
- Cilj predmeta je usposobiti slušatelje za delovanje v interdisciplinarnem timu zadolženem za sprejemanje odločitev o okolju.

Pridobljene kompetence

- Sposobnost razumevanja bioloških in kemijskih podatkov pridobljenih v postopku ocene tveganja (rezultati testiranja strupenosti, podatki kemijskega in biološkega monitoringa stanja okolja, interpretacija zakonodaje na področju okolja).
- Sposobnost sodelovanja pri oblikovanju zakonodaje iz področja okolja; del, ki se nanaša na posege v okolje, varovanje narave, načrtovanje spremljanja stanja ipd.)
- Iskanje, razumevanje in povezovanje vrhunskih znanstvenih objav, strokovnih poročil in v laboratoriju ali na terenu pridobljenih podatkov o stanju v okolju.

Objectives and competences:**Objectives**

- To educate on the basic knowledge regarding ecosystem and effects of pollution on the ecosystems.
- The focus will be set on the understanding of pollutants' toxic effects on organisms and communities.
- The means of determining toxic effects will be introduced. Among these are: toxicity tests, biomonitoring, and environmental modelling. This information will be used in risk assessment.
- The aim of the course is to teach the students to participate in teams designed to take action in environmental policy decisions.

Gained competences

- The ability to understand biological and chemical data gained in toxicity tests and biomonitoring,
- The ability to participate in the design of environmental policy, environment preservation schemes and projects, environmental protection plans,
- The knowledge required to search, understand and link scientific publications, skills to write work reports in the field as well as in the laboratory.

Predvideni študijski rezultati:

- Znanje in razumevanje osnovnih terminov iz področja ekologije, ekotoksikologije in ocene tveganja osnove ekologije (odnosi med organizmi ter odnosi med organizmi in okolje) razumevanje onesnaževanja okolja, posledice le-

Intended learning outcomes:

- Knowledge and understanding of basic definitions from the field of ecology, ecotoxicology and risk assessment, basics of ecology (intra-, inter- species relations)

tega in razumevanje načinov vrednotenja razsežnosti onesnaževanja in posledic na ekosistem. • Sodelovanje v interdisciplinarnih timih. • Kritično presojanje rezultatov testiranja strupenosti in okoljskega monitoring. • Sodelovanje pri oceni tvegana za okolje. • Uporaba pridobljenega znanja pri presojanju nastajanja zakonskih aktov, priporočil in spremembah le-teh.	understanding of environmental pollution control and prevention. • Participations in interdisciplinary work teams. • Critical judgment of toxicity test and environmental risk assessment data. • Participation in environmental risk assessments. • Use of acquired knowledge to develop environmental policy regulations.
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Metode poučevanja in učenja:**Learning and teaching methods:**

Predavanja in problemsko učenje ob laboratorijskih vajah; demonstracijske vaje.	Lectures, laboratory exercises, demonstration exercises.
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Načini ocenjevanja:**Delež/Weight****Assessment:**

Vaje	50,00 %	Lab tutorials
Pisni in/ali ustni izpit	50,00 %	Written and/or oral exam

Reference nosilca/Lecturer's references:

UDOVIČ, Metka, DROBNE, Damjana, LEŠTAN, Domen. An in vivo invertebrate bioassay of Pb, Zn and Cd stabilization in contaminated soil. Chemosphere (Oxford). [Print ed.], 2013, vol. 92, issue 9, str. 1105-1110.

NOVAK, Sara, DROBNE, Damjana, GOLOBIČ, Miha, ZUPANC, Jernej, ROMIH, Tea, GIANONCELLI, Alessandra, KISKINOVA, Maya Petrova, KAULICH, Burkhard, PELICON, Primož, VAUPETIČ, Primož, JEROMEL, Luka, OGRINC, Nina, MAKOVEC, Darko. Cellular internalisation of dissolved cobalt ions from ingested CoFe₂O₄ nanoparticles : in vivo experimental evidence. Environ. sci. technol.. [Print ed.], 2013, vol. 47, no. 10, str. 5400-5408.

UDOVIČ, Metka, DROBNE, Damjana, LEŠTAN, Domen. Bioaccumulation in Porcellio scaber (Crustacea, Isopoda) as a measure of the EDTA remediation efficiency of metal-polluted soil. Environ. pollut. (1987). [Print ed.], 2009, vol. 157, iss. 10, str. 2822-2829.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	UVOD V OKOLJSKE TEHNOLOGIJE
Course title:	
	INTRODUCTION TO ENVIRONMENTAL TECHNOLOGIES

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni	Ni členitve (študijski program)		Letni

Univerzitetna koda predmeta/University course code:	1774
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Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
20	10	30	0	0	60	4

Nosilec predmeta/Lecturer:	Mario Krzyk, Nataša Atanasova
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Vrsta predmeta/Course type:	Izbirni strokovni/Elective professional
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Jeziki/Languages:	Predavanja/Lectures:	Slovenščina
	Vaje/Tutorial:	Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Opravljen izpit iz predmeta Uvod v okoljsko inženirstvo študijskega programa VOI-BA oz. osvojena ustrezna primerljiva znanja.	Finished course in Introduction to Environmental Engineering of the study programme VOI-BA or equivalent.

Vsebina:	Content (Syllabus outline):
Predavanja: V okviru tega predmeta so prikazane osnove za načrtovanje okoljskih tehnologij in celostne rešitve okoljskih problemov. 1. Omejenost naravnih virov; 2. Podnebne spremembe, naravni viri in zasnove ravnanja z naravnimi viri; 3. Procesi čiščenja vode;	Lectures: The lectures will present the latest environmental technologies and integrated solutions for environmental problems. 1. Limitations of natural resources; 2. Climate Change, natural resources and management concepts for natural resources; 3. Water treatment processes;

4. Tehnologije priprave pitne in čiščenja odpadne vode; 5. Čiščenje izcednih in visoko obremenjenih voda; 6. Ekoremediacije, okoljske rešitve na osnovi naravnih procesov, alge tehnologije; 7. Ponovna uporaba vode in hranil. Seminar: Študentje pod vodstvom izberejo določen okoljski problem in ga poskušajo obdelati s čim več vidikov. Nato ocenijo, katera bi bila optimalna rešitev.	4. Technologies for water and wastewater treatment; 5. Treatment of Leachate and Highly Loaded Wastewater; 6. Ecoremediation, nature-based solutions, algae based technologies; 7. Water and nutrients reuse. Seminary work: Students approach specific environmental problem from different aspects and try to find an optimal solution.
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Temeljna literatura in viri/Readings:**Knjižni viri:**

Malcolm J. Brandt; K. Michael Johnson; Andrew J. Elphinston; Don D. Ratnayaka (2016) Twort's Water Supply, Seventh Edition. Butterworth-Heinemann, 2016.

Larsen, T. A., Kai M. Udert and Judit Lienert, Editors. Source Separation and Decentralization for Wastewater Management, 2013, IWA Publishing.

World resources institute, 2011. World resources Report 2010-2011. ISBN 978-1-56973-774-3.

Atanasova, N., in Griessler Bulc, T., 2018. Okoljske tehnologije, skripta v nastajanju.

Metcalfe & Eddy, Inc. Wastewater Engineering : Treatment and Reuse. Boston :McGraw-Hill, 2003. Print.

Costanza, R., Joergensen, S.E., 2002. Understanding and solving environmental problems in the 21st. century - Toward a new, integrated hard problem science. Elsevier. ISBN: 0-08-044111-4.

Weber, W.J., Jr., 2001. Environmental systems and processes. Wiley Inter-science. ISBN 0-471-40518-3.

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

Cilji: Cilj predmeta je študentom dati dodatna znanja in spretnosti pri reševanju najbolj kompleksnih okoljskih problemov. Kompetence: Študent se nauči pravilno analizirati okoljski problem in razgraditi na posamezne obvladljive komponente, nato te podprobleme ustrezno reši in sestavi celovito rešitev. Rešitev variantira in poskuša optimizirati v širšem kontekstu.	Goals: Introduce students to additional knowledge and skills for solving complex environmental problems. Competences: Students will learn how to tackle environmental problem by decomposing it into smaller manageable components, finding suitable solutions for those components and also integrating those solutions into one for the entire problem. The student should be able to select an optimal solution in a wider context.
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Predvideni študijski rezultati:**Intended learning outcomes:**

Znanje in razumevanje: Razumevanje okoljskih problemov in sposobnost analitskega ter sinteznega pristopa. Prenosljive spretnosti: Izvajanje projektov sanacij okoljskih problemov.	Knowledge and understanding: Understanding complex environmental problems and ability of applying analytical and integrative approaches. Skills: Implementation of projects for solving environmental problems.
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Metode poučevanja in učenja:**Learning and teaching methods:**

Predavanja, prezentacija, uporaba pridobljenih znanj pri izdelavi seminarja, klinične (laboratorijske) vaje.	Lectures, presentations, use of knowledge in elaborating seminary work, laboratory work.
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Načini ocenjevanja:**Delež/Weight****Assessment:**

Vaje	30,00 %	Exercises
Seminar	30,00 %	Project Report
Pisni in/ali ustni izpit	40,00 %	Written and/or oral exam

Reference nosilca/Lecturer's references:

ATANASOVA, Nataša, DALMAU, Montserrat, COMAS, Joaquim, POCH ESPALLARGAS, Manel, RODRIGUEZ-RODA, Ignasi, BUTTIGLIERI, Gianluigi. Optimized MBR for greywater reuse systems in hotel facilities. Journal of environmental management, ISSN 0301-4797, 2017, letn. 193, št. maj, str. 503-511, ilustr., doi: 10.1016/j.jenvman.2017.02.041. [COBISS.SI-ID 8125793]

ŠIVIC, Ana, **ATANASOVA**, Nataša, PUIG, Sebastià, **GRIESSLER BULC**, Tjaša. Ammonium removal in landfill leachate using SBR technology - dispersed versus attached biomass. Water science and technology, ISSN 0273-1223, 2017, vol. 77, iss. 1, str. 27-38, ilustr., doi: 10.2166/wst.2017.519. [COBISS.SI-ID 8181089]

DALMAU, Montserrat, **ATANASOVA**, Nataša, GABARRÓN, Sara, RODRIGUEZ-RODA, Ignasi, COMAS, Joaquim. Comparison of a deterministic and a data driven model to describe MBR fouling. The chemical engineering journal, ISSN 1385-8947. [Print ed.], jan. 2015, letn. 260, str. 300-308, ilustr., doi: [10.1016/j.cej.2014.09.003](https://doi.org/10.1016/j.cej.2014.09.003). [COBISS.SI-ID 6754401]

KRZYK, Mario, DREV, Darko, KOLBL, Sabina, PANJAN, Jože. Self-purification processes of Lake Cerknica as a combination of wetland and SBR reactor. Environmental science and pollution research international, ISSN 0944-1344., 2015, str. 1-9, ilustr., doi: 10.1007/s11356-015-5088-0. [COBISS.SI-ID 7133793]

KRZYK, Mario, MALUS, Davor, PANJAN, Jože. Meritve kakovostnih parametrov za modeliranje prvega vala onesnaženih voda s cestnih površin = Measurements of quality parameters for the modeling of the first flush of polluted water from roads. Gradbeni vestnik, ISSN 0017-2774, jul. 2013, letn. 62, str. 159-164, ilustr. [COBISS.SI-ID 6310497]

KRZYK, Mario, PANJAN, Jože. Občutljivostna analiza parametrov modeliranja prvega vala onesnaženih voda s cestnih površin = A sensitivity analysis modeling parameters of the first wave of polluted water from road surface. Gradbeni vestnik, ISSN 0017-2774, dec. 2012, letn. 61, str. 275-283, ilustr. [COBISS.SI-ID 6129505]

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	TEMELJI EKONOMSKE ANALIZE
Course title:	
	INTRODUCTION TO ECONOMIC ANALYSIS

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni (v postopku)	Ni členitve (študijski program)		1. semester	izbirni

Univerzitetna koda predmeta/University course code:	0038820
Koda učne enote na članici/UL Member course code:	1312

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
45	0	0	0	0	45	3

Nosilec predmeta/Lecturer:	POLONA DOMADENIK MUREN
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Vrsta predmeta/Course type:	Izbirni strokovni/Elective professional
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Jeziki/Languages:	Predavanja/Lectures:	Slovenščina
	Vaje/Tutorial:	Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:

Vsebina:	Content (Syllabus outline):
1. Razmišljati kot ekonomist. Vloga ekonomske analize za inženirje Osnove ponudbe in povpraševanja Obnašanje potrošnika. 2. Povpraševanje na področju vodnih storitev, upravljanje s povpraševanjem, stanje; oblikovanje ponudbe na področju vodnih storitev, regulacija trgov vodnih storitev.	1. Thinking like economist. The role of economic analysis for engineers. Fundamentals of demand and supply. Consumer behavior. 2. Demand for water services, water demand management, supply of water services, regulation of market for water services. 3. Fundamentals of production and cost theories. Cost evaluation for engineers.

3. Osnove teorije proizvodnje in stroškov. Ocenjevanje stroškov za inženirje.	4. Costs of water services, cost theory, scarcity of resources, deriving supply curve in the field of water service.
4. Stroški vodnih storitev, teorija stroškov, omejenost virov, oblikovanje krivulje ponudbe na področju vodnih storitev.	5. Time equivalent of money, interests and principle of equivalence – theory of cost and benefit analysis. Present value and internal rate of return.
5. Časovna vrednost denarja, obresti in načelo ekvivalence – teorija analize stroškov in koristi. Sedanja vrednost in notranja stopnja donosa.	6. Examples of evaluation in the field of water management (different mass evaluation, political decisions).
6. Primeri vrednotenja na področju upravljanja z vodami. (različna masovna vrednotenja, politične odločitve).	7. Investment documentation, preparation of investment documentation, types of investment documentation, examples, treatment of investment documentation, risk management.
7. Investicijska dokumentacija, priprava investicijske dokumentacije, vrste investicijske dokumentacije, primeri, obravnava investicijske tveganji dokumentacije, upravljanje s tveganji.	8. New business models and circular economy.
8. Novi poslovni modeli in krožno gospodarstvo.	9. Fundamentals of macroeconomics.
9. Osnove makroekonomije.	

Temeljna literatura in viri/Readings:

Prašnikar, J., Domadenik, P., Koman M. 2015. Mikroekonomija. Ljubljana: Ekonomska fakulteta.

Newnan, D., Eschenbach, T., Lavelle, J. 2020. Engineering Economic Analysis, Oxford University Press. 14th Edition.

Izbrani znanstveni in strokovni članki / Selected scientific and professional papers

Cilji in kompetence:

Cilji	Objectives and competences:
- Seznaiti slušatelja z osnovnim ekonomskim analitičnim aparatom, ki omogoča razumevanje in razčlenitev realnih ekonomskih problemov. - nadgraditi osnovno ekonomsko terminologijo s specifikami s področja vodarstva in okolijskega inženirstva.	- To acquaint student with the basic economic analytical framework that allows understanding of real economic problems. - Upgrade the basic economic terminology with specifics in the field of water and environmental engineering.
Pridobljene kompetence	Gained competences
- Sposobnost pravilne presoje ekonomskih odločitev, - sposobnost razumevanja osnovnih ekonomskih pojavov na mikro in makroekonomskem nivoju, - sposobnost aplikacije ekonomskih konceptov na primerih vodarstva in okolijskega inženirstva. - Sposobnost kritične presoje.	- Ability to assess economic decisions, - ability to understand basic economic phenomena on micro and macroeconomic levels, - ability to apply economic concepts in the field of water and environmental engineering, - ability of critical assessment.

Predvideni študijski rezultati:

- Znanje in razumevanje osnovnih pojmov mikro in makroekonomije, - znanje in razumevanje osnovnih pojmov ekonomike, vezane na inženirske probleme, - razumevanje medsebojnega vpliva procesov na ravni podjetja in v gospodarstvu, - razumevanje delovanja numeričnih modelov pri reševanju problemov ekonomike,	Intended learning outcomes:
	- Knowledge and understanding of basic concepts in the field of micro and macroeconomics, - knowledge and understanding of basic concepts in the field of engineering economics, - understanding of interaction of processes on the level of company and economy, - understanding of operations of numerical models in solving business problems,

- uporaba modelov marginalnega ocenjevanja škod in koristi pri presoji inženirskih rešitev,
- kritično presojanje inženirskih rešitev,
- uporaba pridobljenega znanja pri predmetih, kjer je potrebno znanje ekonomike.

- using models of marginal assessment of damages and benefits in evaluating engineering solutions,
- critical assessment of engineering solutions,
- use of knowledge in courses where basic economic concepts are necessary

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

Predavanja, študije primerov, uporaba programske opreme pri reševanju problemov.

Lectures, case studies, use of software in solving problems.

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

Dva kolokvija	67,00 %	Two midterm tests
Pisni izpit	33,00 %	Final exam
Ocene: 6-10 pozitivno, 5- negativno (skladno s Statutom UL)		Grades: 6-10 positive, 5- negative (in accordance with the UL Statute)

Reference nosilca/Lecturer's references:

BANOVEC, Primož, DOMADENIK, Polona. Water governance as a key element of sound water management system. V: 8th International Conference "Challenges of Europe: Financial Crisis and Climate Change", May 21-23, 2009, Split-Bol, Croatia : working papers. Split: Faculty of Economics, 2009, 12 str.

BANOVEC, Primož, DOMADENIK MUREN, Polona. Paying too much or too little? : pricing approaches in the case of cross border water supply. Water science and technology: water supply. Apr. 2018, vol. 18, iss. 2, str. 577-585. ISSN 1606-9749. DOI: 10.2166/ws.2017.126.

DOMADENIK MUREN, Polona, FRANCA, Valentina. National recovery and resilience plan : Slovenia. Italian labour law e-journal. 2022, vol. 15, spec. iss.1, str. 1-15. ISSN 1561-8048.

DOMADENIK MUREN, Polona, KOMAN, Matjaž, MRAMOR, Dušan, REDEK, Tjaša. Achieving growth that matters : a new economic narrative. V: DOMADENIK MUREN, Polona (ur.), KOMAN, Matjaž (ur.), REDEK, Tjaša (ur.). Achieving growth that matters : a new economic paradigm. 1st printing. Ljubljana: Časnik Finance, 2021. Str. 13-30. ISBN 978-961-6541-62-6. [COBISS.SI-ID 81759747]

DOMADENIK MUREN, Polona, MRAMOR, Dušan, BOHNEC, Klara, DURAKOVIĆ, Irma, MLINAR, Anja. Low-carbon energy transition. V: DOMADENIK MUREN, Polona (ur.), KOMAN, Matjaž (ur.), REDEK, Tjaša (ur.). Achieving growth that matters : a new economic paradigm. 1st printing. Ljubljana: Časnik Finance, 2021. Str. 99-121. ISBN 978-961-6541-62-6. [COBISS.SI-ID 81793539]

KOMAN, Matjaž, DOMADENIK MUREN, Polona, REDEK, Tjaša. How far is the European Union from sustainable development goals?. V: ŽABKAR, Vesna (ur.), REDEK, Tjaša (ur.). Challenges on the path toward sustainability in Europe : social responsibility and circular economy perspectives. 1st ed. Bingley: Emerald, 2021. Str. 31-53. ISBN 978-1-80043-973-3. DOI: 10.1108/978-1-80043-972-620201004.

DOMADENIK MUREN, Polona, PASTORE, Francesco, KOMAN, Matjaž, REDEK, Tjaša. Innovation for a greener and more profitable future : a conceptual approach. V: ŽABKAR, Vesna (ur.), REDEK, Tjaša (ur.). Challenges on the path toward sustainability in Europe : social responsibility and circular economy perspectives. 1st ed. Bingley: Emerald, 2021. Str. 127-145. ISBN 978-1-80043-973-3. DOI: 10.1108/978-1-80043-972-620201008.

REDEK, Tjaša, DOMADENIK MUREN, Polona, KOMAN, Matjaž. Sustainable development goals in the EU and the challenges in their implementation. V: ŽABKAR, Vesna (ur.), REDEK, Tjaša (ur.). Challenges on the path

toward sustainability in Europe : social responsibility and circular economy perspectives. 1st ed. Bingley: Emerald, 2021. Str. 11-29. ISBN 978-1-80043-973-3. DOI: 10.1108/978-1-80043-972-620201003.

CIRMAN, Andreja, DOMADENIK, Polona, KOMAN, Matjaž, REDEK, Tjaša. The Kyoto protocol in a global perspective. Econ. bus. rev, February 2009, vol. 11, no. 1, str. 29-54.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	
	NAPREDNE METODE EKONOMSKE ANALIZE
Course title:	
	ADVANCED METHODS OF ECONOMIC ANALYSIS

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Vodarstvo in okoljsko inženirstvo, prva stopnja, univerzitetni (v postopku)	Ni členitve (študijski program)		1. semester	izbirni

Univerzitetna koda predmeta/University course code:	0643630
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Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
45	0	0	0	0	45	3

Nosilec predmeta/Lecturer:	POLONA DOMADENIK MUREN
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Vrsta predmeta/Course type:	Izbirni strokovni/Elective professional
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Jeziki/Languages:	Predavanja/Lectures:	Slovenščina
	Vaje/Tutorial:	Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Opravljen predmet Temelji ekonomske analize (FGG UL) ali mikroekonomija 1 (EF UL)	Completion of the course Foundations of Economic Analysis (FGG UL) or Microeconomics 1 (EF UL)

Vsebina:	Content (Syllabus outline):
10. Sprejemanje ekonomskih odločitev. Etika in njene dimenzije pri sprejemanju odločitev. 11. Ocenjevanje stroškov in koristi. Inkrementalna analiza. Ocenjevanje koristi. Različni načini ocenjevanja stroškov. Natančnost. Izzivi pri ocenjevanju. Modeli ocenjevanja. Diagrami denarnega toka 12. Časovna vrednost denarja, obresti in načelo ekvivalence v primeru ponavljajočih denarnih	16. Making economic decisions. Ethics and its dimensions in decision-making. 17. Estimating costs and benefits. Incremental analysis. Estimating benefits. Types of cost estimates. Accuracy of estimate. Difficulties in estimation. Estimating models. Cash Flow Diagrams. 18. Time value of money, interest and equivalence principle in the case of recurring cash flows.

tokov. Analiza sedanje vrednosti in notranje stopnje donosa. Odločanje v primeru negotovosti 13. Ekonomska analiza v javnem sektorju. Investicijski cilji. Izbira obrestne mere. Inkrementalna analiza stroškov in koristi. Financiranje projektov. 14. Poslovni modeli in krožnost. Uvod v načrtovanje linearnih in krožnih poslovnih modelov s primeri. Korporativna trajnost, sodelovanje in vpliv globalne dobavne verige. Merjenje krožnega napredka v poslovanju. Vodilne prakse podjetij 15. Modeliranje krožnosti pri upravljanju voda. Optimizacija več deležnikov. Tipologija poslovnih modelov v kontekstu upravljanja voda (linearni in krožni koncept).	Present value and internal rate of return analysis. Decision making in case of uncertainty 19. Economic analysis in the public sector. Investment goals. Interest rate selection. Incremental cost-benefit analysis. Project financing. 20. Business models and circularity. Introduction to designing linear and circular business models with examples. Corporate sustainability, collaboration and global supply chain impact. Measuring circular progress in business. Leading corporate practices Modelling circularity in water management. Multi-stakeholder optimization. Typology of business models in the context of water management (linear and circular concept)
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Temeljna literatura in viri/Readings:

Newnan, D., Eschenbach, T., Lavelle, J. 2020. Engineering Economic Analysis, Oxford University Press. 14th Edition.

Achterberg E., Hinfelaar, J., Bocken N.: The Value Hill Business Model Tool: identifying gaps and opportunities in a circular network. scienceandtheenergychallenge.nl, 2016.

Izbrani znanstveni in strokovni članki / Selected scientific and professional papers

Cilji in kompetence:**Cilji**

- Seznaniti slušatelja z naprednim ekonomskim analitičnim aparatom, ki omogoča reševanje realnih ekonomskih problemov.
- Prikaz uporabe analitičnih metod na primerih s področja okoljskega inženirstva.
- Razviti širok in sistematičen vpogled v pomen uporabe krožnih načel pri upravljanju voda,
- Razviti sposobnost empirične ocene dejavnikov, ki podpirajo ali ovirajo krožne priložnosti, in identificirati glavne ovire za krožno preobrazbo v danem ekosistemu.

Pridobljene kompetence

- Sposobnost kritične presoje ekonomskih odločitev,
 - sposobnost razumevanja ekonomskih pojavov in izbire ustreznega analitičnega orodja,
 - sposobnost aplikacije ekonomskih konceptov na primerih okoljskega inženirstva,
- sposobnost razumeti specifične in načine oblikovanja krožnega poslovnega modela.

Objectives and competences:**Objectives**

- To acquaint student with the analytical framework that allows understanding of real economic problems.
- Demonstrating of the use of analytical methods on examples from the field of environmental engineering.
- Develop a broad and systematic insight into the importance of the application of circular principles to water management
- Develop the ability to empirically assess the factors supporting or hindering circular opportunities and identify main obstacles for the circular transformation in a given ecosystem

Gained competences

- Ability to critically assess economic decisions,
 - ability to understand economic phenomena in the case of environmental engineering,
- the ability to understand the specifics and ways of creating a circular business model.

Predvideni študijski rezultati:**Intended learning outcomes:**

• Znanje in razumevanje naprednih metod ekonomske analize, • razumevanje medsebojnega vpliva procesov na ravni podjetja in v gospodarstvu, • razumevanje delovanja numeričnih modelov pri reševanju problemov ekonomike, • uporaba modelov marginalnega ocenjevanja škod in koristi pri presoji inženirskih rešitev, • kritično presojanje inženirskih rešitev, • uporabiti pridobljeno znanje v realni projektni nalogi, • spoznati specifične dela v skupini in pridobiti neposredne izkušnje s sodelovanjem v skupinski projektni nalogi.	• Knowledge and understanding of advanced concepts of economic analysis, • understanding of interaction of processes on the level of company and economy, • understanding of operations of numerical models in solving business problems, • using models of marginal damage and benefit assessment in evaluating engineering solutions, • critical assessment of engineering solutions, • use of knowledge in courses where basic economic concepts are necessary, • apply the acquired knowledge in a real-life project assignment, • learn about collaboration and acquire a first-hand experience through the collaboration in the group project assignment.
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Metode poučevanja in učenja:**Learning and teaching methods:**

Predavanja, študije primerov, uporaba programske opreme pri reševanju problemov.

Lectures, case studies, use of software in solving problems.

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

Projekt	50,00 %	Project
Pisni izpit	50,00 %	Final exam
Ocene: 6-10 pozitivno, 5- negativno (skladno s Statutom UL)		Grades: 6-10 positive, 5- negative (in accordance with the UL Statute)

Reference nosilca/Lecturer's references:

BANOVEC, Primož, DOMADENIK, Polona. Water governance as a key element of sound water management system. V: 8th International Conference "Challenges of Europe: Financial Crisis and Climate Change", May 21-23, 2009, Split-Bol, Croatia : working papers. Split: Faculty of Economics, 2009, 12 str.

BANOVEC, Primož, DOMADENIK MUREN, Polona. Paying too much or too little? : pricing approaches in the case of cross border water supply. Water science and technology: water supply. Apr. 2018, vol. 18, iss. 2, str. 577-585. ISSN 1606-9749. DOI: 10.2166/ws.2017.126.

DOMADENIK MUREN, Polona, FRANCA, Valentina. National recovery and resilience plan : Slovenia. Italian labour law e-journal. 2022, vol. 15, spec. iss.1, str. 1-15. ISSN 1561-8048.

DOMADENIK MUREN, Polona, KOMAN, Matjaž, MRAMOR, Dušan, REDEK, Tjaša. Achieving growth that matters : a new economic narrative. V: DOMADENIK MUREN, Polona (ur.), KOMAN, Matjaž (ur.), REDEK, Tjaša (ur.). Achieving growth that matters : a new economic paradigm. 1st printing. Ljubljana: Časnik Finance, 2021. Str. 13-30. ISBN 978-961-6541-62-6. [COBISS.SI-ID 81759747]

DOMADENIK MUREN, Polona, MRAMOR, Dušan, BOHNEC, Klara, DURAKOVIĆ, Irma, MLINAR, Anja. Low-carbon energy transition. V: DOMADENIK MUREN, Polona (ur.), KOMAN, Matjaž (ur.), REDEK, Tjaša (ur.). Achieving growth that matters : a new economic paradigm. 1st printing. Ljubljana: Časnik Finance, 2021. Str. 99-121. ISBN 978-961-6541-62-6. [COBISS.SI-ID 81793539]

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