Univerza
v Ljubljani
Fakulteta
za gradbeništvo
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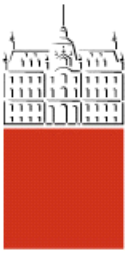

Učni načrti

Univerzitetni študijski program prve stopnje

VODARSTVO IN OKOLJSKO INŽENIRSTVO (BA)

Course Syllabi

1st cycle academic study

WATER SCIENCE AND ENVIRONMENTAL ENGINEERING (BA)

Velja od študijskega leta 2018/19
Valid from study year 2018/2019

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UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Matematika I
Course title:	Mathematics I

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Vodarstvo in okoljsko inženirstvo – prva stopnja UN		1	1
Water Science and Environmental Engineering – first cycle academic		1	1

Vrsta predmeta / Course type: Obvezni splošni / Obligatory general

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
75		75			150	10

Nosilec predmeta / Lecturer: Marjeta Kramar Fijavž, Mitja Lakner

Jeziki / Languages:	
Predavanja / Lectures:	slovenski / Slovene
Vaje / Tutorial:	slovenski / Slovene

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

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 geometrija v prostoru. Številska zaporedja in vrste: omejenost in konvergenca, Cauchyjev kriterij, limita, računska pravila, konvergenca številske vrste, geometrijska in harmonična vrsta, konvergenčni kriteriji. Limita in zveznost funkcije realne spremenljivke: limita funkcije v dani točki, računska pravila, posplošene	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, 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

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.	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.

Temeljni 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:	**Objectives and competences:**
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 - sposobnost abstraktne formulacije konkretnih problemov, - krepiti smisel za sistematičnost, jasnost in preciznost formulacij, - razvijanje matematičnega mišljenja - sklepanje od splošnega k posebnemu in obratno.	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 - 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.

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.

Metode poučevanja in učenja:	Learning and teaching methods:
predavanja, seminarske vaje, konzultacije, internet	lectures, tutorials, consultations, internet

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Izpit (teoretični del)	**30 %**	Exam (theoretical part)
Računske naloge in sprotno delo	**70 %**	Exercises and homework

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.

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.
KRAMAR FIJAVŽ, Marjeta, LAKNER, Mitja, ŠKAPIN-RUGELJ, Marjeta. An equal-area method for scalar conservation laws. The Anziam journal, 2012, vol. 53, iss. 2, str. 156-170.
SKUBIC, Blaž, LAKNER, Mitja, PLAZL, Igor. Sintering behavior of expanded perlite thermal insulation board : modeling and experiments. Ind. eng. chem. res. [Print ed.], 2013, vol. 52, no. 30, str. 10244-10249.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Fizika
Course title:	Physics

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Vodarstvo in okoljsko inženirstvo – prva stopnja UN		1	1
Water Science and Environmental Engineering – first cycle academic		1	1

Vrsta predmeta / Course type: Obvezni splošni / Obligatory general

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
75	15	45			135	9

Nosilec predmeta / Lecturer: Zvonko Jagličić

Jeziki / Languages:	
Predavanja / Lectures:	slovenski / Slovene
Vaje / Tutorial:	slovenski / Slovene

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

Prerequisites:

Vsebina:

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; indukcija (*); elektromagnetno valovanje; sevanje segretih 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

Content (Syllabus outline):

Physics and measurements; (*)kinematics ; forces, torques, dynamics; momentum and angular momentum; work, power, energy; gravitation (Keppler'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 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

teorija relativnosti. Vsebine označene z (*) bodo podrobneje obravnavane na seminarjih ali kot računski zgledi na seminarskih vajah.	quanta of light; special theory of relativity. Topics labelled with (*) will be discussed in more detail at seminars or as assigned exercises.

Temeljni 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.

Cilji in kompetence:	**Objectives and competences:**
- 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.	- 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:	**Intended learning outcomes:**
- 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 pojavov in tehnoloških procesov ter pridobili sposobnost kritične analize le teh.	- 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.

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

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Računski del (pisno)	**50 %**	Written solution of assigned problems
Teoretični del (pisno in ustni zagovor)	**40 %**	Written or oral answers to selected theoretical questions
Projekt (seminarska naloga)	**10 %**	Written seminar report

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 program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Vodarstvo in okoljsko inženirstvo – prva stopnja UN		1	1
Water Science and Environmental Engineering – first cycle academic		1	1

Vrsta predmeta / Course type: Obvezni strokovni / Obligatory professional

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30			20	10	60	4

Nosilec predmeta / Lecturer: Mihael Jožef Toman

Jeziki / Languages:	
Predavanja / Lectures:	slovenski / Slovene
Vaje / Tutorial:	slovenski / Slovene

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

Prerequisites:

Vsebina:

Razlaga pojmov biologija, mikrobiologija, ekologija, varstvo okolja; abiotske 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; iotske značilnosti tekočih voda, življenjske združbe perifitona, bentoških nevretenčarjev; saprobnost, samočistilni procesi; metode biološkega vrednotenja ekološkega stanja celinskih voda; onesnaževanje in obremenjevanje vodnih ekosistemov; biološka čiščenja in vloga mikroorganizmov pri procesih razgradnje; terciarno čiščenje in ekoremediacije

Content (Syllabus outline):

Rlucidation 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 communities of plankton and benthos; tropic 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; tertiary treatment and ecoremediation.

Temeljni literatura in viri / Readings:

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.
Barnes, R.S.K. & Mann, K. H. 1991. Fundamentals of Aquatic Ecology. Blackwell Science, London, 270 str.
Sorokin, Y. 1999. Aquatic Microbial Ecology. Backhuys Publ., Leiden, 248 str.

Cilji in kompetence:

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 and competences:

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.

Predvideni študijski rezultati:

- Poznavanje in razumevanje osnovnih znanj iz biologije, mikrobiologije in ekologije,
- uporaba ekoloških zakonitosti pri reševanju okoljskih problemov,
- razumevanje metod vrednotenja okolja,
- sposobnost kritične presoje podatkov dobljenih pri okoljskih raziskavah,
- sposobnost sklepanja od splošnega ekološkega k posebnemu in obratno,
- spretnost uporabe in razumevanje okoljske literature.

Intended learning outcomes:

- 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,
- the ability of reaching conclusions from the general to the specific and vice versa,
- the ability to use and understand environmental literature.

Metode poučevanja in učenja:

Predavanja, delo v laboratoriju in terensko delo.

Learning and teaching methods:

Lectures, laboratory work and field work.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Način (pisni izpit, ustno izpraševanje, naloge, projekt):		Type (write or oral exam, coursework, project):
ustni/pisni izpit	**50 %**	oral/written exam
kolokvij iz vaj	**50 %**	mid-term exam

Reference nosilca / Lecturer's references:

TOMAN, Mihael Jožef. Biological assessment of wastewater treatment plant conditions using sludge biotic index. Verh. Internat. Verein. Limnol., 2002, letn. 28, str. 692-694.
ŽIŽEK, Suzana, HORVAT, Milena, GIBIČAR, Darija, FAJON, Vesna, TOMAN, Mihael Jožef. Bioaccumulation of mercury in benthic communities of a river ecosystem affected by mercury mining. Sci. total environ., 2007, letn. 377, str. 407-415.
KRIVOGRAD-KLEMENČIČ, Aleksandra, TOMAN, Mihael Jožef. Influence of environmental variables on benthic algal associations from selected extreme environments in Slovenia in relation to the species identification. Period. biol., 2010, letn. 112, str. 179-191.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Uvod v okoljsko inženirstvo
Course title:	Introduction to environmental engineering

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Vodarstvo in okoljsko inženirstvo – prva stopnja UN		1	1
Water Science and Environmental Engineering – first cycle academic		1	1

Vrsta predmeta / Course type: Obvezni strokovni / Obligatory professional

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
45	15	30			90	6

Nosilec predmeta / Lecturer: Simon Rusjan

Jeziki / Languages:	
Predavanja / Lectures:	slovenski / Slovene
Vaje / Tutorial:	slovenski / Slovene

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

Prerequisites:

Vsebina:

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. 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

Content (Syllabus outline):

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 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

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.	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.

Temeljni 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:	**Objectives and competences:**
Cilji - 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:	**Intended learning outcomes:**
- Pridobiti osnovna znanja in spretnosti za prepoznavanje in reševanje okoljskih problemov. - Pridobljeno znanje bo študent uporabil, oz. nadgradil pri nadaljevalnih predmetih.	- To gain basic knowledge and skills for recognising and solving environmental problems. - 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 (v %) / Weight (in %)	Assessment:
Pogoj za pristop k izpitu so opravljene vse ostale obveznosti.		Conditions to approach the exam are successfully elaborated other duties.
seminarske vaje	**20 %**	Tutorials-seminar exercises
samostojno delo (seminarska naloga)	**30 %**	seminar work (individual work)
pisni izpit	**50 %**	written exam

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.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Osnove kemije
Course title:	Basic chemistry

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Vodarstvo in okoljsko inženirstvo – prva stopnja UN		1	2
Water Science and Environmental Engineering – first cycle academic		1	2

Vrsta predmeta / Course type:	Obvezni splošni / Obligatory general
Univerzitetna koda predmeta / University course code:	

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30			30		60	4

Nosilec predmeta / Lecturer:	Romana Cerc Korošec

Jeziki / Languages:	**Predavanja / Lectures:**	slovenski / Slovene
	Vaje / Tutorial:	slovenski / Slovene

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.

Temeljni literatura in viri / Readings:

Lazarini, F., Brenčič, J.V. 2004. Splošna in anorganska kemija. Ljubljana, UL FKKT.
Čeh, B. 2005. Splošna in anorganska kemija, 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 (v %) / Weight (in %)	**Assessment:**
Pisni izpit ali pisni izpit s testi	**50 %**	Written exam, written exam done by tests
Kolokvij iz laboratorijskih vaj	**30 %**	Test – chemical calculations
Laboratorijske vaje	**20 %**	Laboratory work

Reference nosilca / Lecturer's references:

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.

RETKO, Klara, ROPRET, Polonca, CERC KOROŠEC, Romana. Surface-enhanced Raman spectroscopy (SERS) analysis of organic colourants utilising a new UV-photoreduced substrate. Journal of Raman spectroscopy, 2014, vol. 45, issue 11-12, str. 1140-1146.
SLUBAN, Melita, ROZMAN, Nejc, PREGELJ, Matej, BITTENCOURT, Carla, CERC KOROŠEC, Romana, SEVER ŠKAPIN, Andrijana, MRZEL, Aleš, ŠKAPIN, Srečo D., UMEK, Polona. Transformation of hydrogen titanate nanoribbons to TiO2 nanoribbons and the influence of the transformation strategies on the photocatalytic performance. Beilstein journal of nanotechnology, 2015, vol. 6, str. 831-844.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Matematika II
Course title:	Mathematics II

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Vodarstvo in okoljsko inženirstvo – prva stopnja UN		1	2
Water Science and Environmental Engineering – first cycle academic		1	2

Vrsta predmeta / Course type:	Obvezni splošni / Obligatory general
Univerzitetna koda predmeta / University course code:	

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
60		60			120	8

Nosilec predmeta / Lecturer:	Marjeta Kramar Fijavž, Mitja Lakner

Jeziki / Languages:	**Predavanja / Lectures:**	slovenski / Slovene
	Vaje / Tutorial:	slovenski / Slovene

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 Rn ,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 spremenjivk (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	Scalar functions of several real variables: metrics of the space Rn, 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 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:

elementarna ploskev, parametrizacija, tangentna ravnina, površina. Krivuljni integral: krivuljni integral 1. vrste skalarnega polja po krivulji, orientacija krivulje, krivuljni integral 2. vrste vektorskega polja po orientirani krivulji, Greenova formula. Ploskovni integral: ploskovni integral 1. vrste skalarnega 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.	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.

Temeljni 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:	**Objectives and competences:**
Cilji - Omogočiti razumevanje matematičnega aparata, ki ga uporabljajo strokovni predmeti, - usposobiti za kritične presojo 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 - 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:	**Intended learning outcomes:**
- 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,	- 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,

- 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.	- 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:	**Learning and teaching methods:**
predavanja, seminarske vaje, konzultacije, internet	lectures, tutorials, consultations, internet

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Izpit (teoretični del)	**30 %**	Exam (theoretical part)
Naloge in sprotno delo	**70 %**	Exercises and homework

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.

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.
KRAMAR FIJAVŽ, Marjeta, LAKNER, Mitja, ŠKAPIN-RUGELJ, Marjeta. An equal-area method for scalar conservation laws. The Anziam journal, 2012, vol. 53, iss. 2, str. 156-170.
SKUBIC, Blaž, LAKNER, Mitja, PLAZL, Igor. Sintering behavior of expanded perlite thermal insulation board : modeling and experiments. Ind. eng. chem. res.. [Print ed.], 9. jul. 2013, vol. 52, no. 30, str. 10244-10249.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Geodezija
Course title:	Geodetic engineering

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Vodarstvo in okoljsko inženirstvo – prva stopnja UN		1	2
Water Science and Environmental Engineering – first cycle academic		1	2

Vrsta predmeta / Course type: Obvezni strokovni / Obligatory professional

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30			30		60	4

Nosilec predmeta / Lecturer: Dušan Kogoj

Jeziki / Languages:	
Predavanja / Lectures:	slovenski / Slovene
Vaje / Tutorial:	slovenski / Slovene

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 (značilnosti, načini izdelave, vrste, uporabnost). Geodetske evidence (zemljiški kataster, kataster stavb, DMR, GIS). Splošno o geodezija pri gradnji objektov in drugih posegih v prostor (raba prostora, pridobivanje dovoljenj za posege, izvedba posega). Osnovne metode zakoličevanja. Geodetska dela pri	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 (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

visokih gradnjah (zakoličba, spremljanje gradnje, ugotavljanje stabilnosti objekta – primeri iz prakse). Geodetska dela pri nizkih gradnjah (geodetske podlage, zakoličba, spremljanje gradnje, merjenja ob obremenilnih preizkušnjah, ugotavljanje stabilnosti in deformacij objekta – primeri iz prakse). Hidrografska merjenja.	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.

Temeljni 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:	**Objectives and competences:**
Cilji - Študenti se seznanijo 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.	Objectives - 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:	**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 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	- 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 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

kvalitete opravljenih del. Razumevanje geodetskih postopkov in izdelkov omogoča kritično presojo kvalitete ter objektivno ovrednotenje skladnosti teoretičnih načel in praktičnega ravnanja.	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.

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.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Izpit	**50 %**	Examination
Vaje	**50 %**	Tutorial

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 program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Vodarstvo in okoljsko inženirstvo – prva stopnja UN		1	2
Water Science and Environmental Engineering – first cycle academic		1	2

Vrsta predmeta / Course type: Obvezni splošni / Obligatory general

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30	25		30	5	90	6

Nosilec predmeta / Lecturer: Mojca Šraj

Jeziki / Languages:	
Predavanja / Lectures:	slovenski / Slovene
Vaje / Tutorial:	slovenski / Slovene

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

Prerequisites:

Vsebina:

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 (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 globin, gladin in hitrosti

Content (Syllabus outline):

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; 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

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 Poglobljena obravnava posamezne hidrološke tematike ali celostna analiza manjšega vodotoka.	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.

Temeljni 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:	**Objectives and competences:**
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. 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.	Objectives - To learn about the basics of hydrology, hydrometry and the use of the analytical methods in hydrology, - 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.

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, - spretnosti 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).

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).

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Način (pisni izpit, ustno izpraševanje, naloge, projekt):		Type (examination, oral, coursework, project):
Oddane vaje	**30 %**	Coursework/lab exercises
Seminarska naloga s predstavitvijo in sovrstniškim ocenjevanjem	**20 %**	Seminar with the oral presentation and peer assessment
Dva kolokvija ali izpit:		Two mid-term exams or final exam:
Računski del	**30 %**	Practical part
Teoretični del	**20 %**	Theoretical part

Reference nosilca / Lecturer's references:

BEZAK, Nejc, BRILLY, Mitja, ŠRAJ, Mojca. Comparison between the peaks over treshold 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 program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Vodarstvo in okoljsko inženirstvo – prva stopnja UN		1	2
Water Science and Environmental Engineering – first cycle academic		1	2

Vrsta predmeta / Course type: Obvezni strokovni / Obligatory professional

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30			30		60	4

Nosilec predmeta / Lecturer: Violeta Bokan Bosiljkov

Jeziki / Languages:	
Predavanja / Lectures:	slovenski / Slovene
Vaje / Tutorial:	slovenski / Slovene

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

Prerequisites:

Vsebina:

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. 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

Content (Syllabus outline):

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 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-

gradiva. Izbrane metode preskušanja gradiv.	use and recycling of materials and construction products. Incorporation of secondary raw materials in the construction products. Selected methods of materials testing.

Temeljni literatura in viri / Readings:

Žarnić, R. 2005. Osnove gradiv. Ljubljana, UL FGG.
Žarnić, R., Bokan-Bosiljkov, V., Bosiljkov, V. 2013. Gradiva – vaje. Ljubljana, UL FGG.
Taylor, G.D. 2000. Materials in Construction: An Introduction, 3rd edition. Pearson Education Limited.

Cilji in kompetence:	**Objectives and competences:**
- 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.	- 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:	**Intended learning outcomes:**
- 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 - 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	- 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; 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

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.	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.

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.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Delovni zvezek	**20 %**	Log book
2 kolokvija	**80 %**	Two mid-term exams
ali		or
Pisni izpit	**80 %**	Exam

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, ŽARNIĆ, 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, ŽARNIĆ, 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, ŽARNIĆ, Roko, BOKAN-BOSILJKOV, Violeta. Portable 3D optical microscope as a tool for identification of clima change influence on heritage assets. V: ŽARNIĆ, Roko (ur.), RAJČIĆ, 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, ŽARNIĆ, Roko. Time evolution of properties of SCC mixtures produced using crushed limestone aggregate and high content of limestone filter. 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.
DUH, David, ŽARNIĆ, Roko, BOKAN-BOSILJKOV, Violeta. Strategies for finding the adequate air void threshold value in computer assisted determination of air void characteristics in hardened concrete. Comput. Concr. Int. J. (Print), april 2008, letn. 5, št. 2, str. 101-116.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Digitalno načrtovanje in programiranje
Course title:	Digital design and programming

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Vodarstvo in okoljsko inženirstvo – prva stopnja UN		1	2
Water Science and Environmental Engineering – first cycle academic		1	2

Vrsta predmeta / Course type: Obvezni strokovni / Obligatory professional

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
15			60		75	5

Nosilec predmeta / Lecturer: Tomo Cerovšek

Jeziki / Languages:	
Predavanja / Lectures:	slovenski / Slovene
Vaje / Tutorial:	slovenski / Slovene

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); 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	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). 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,

(pred in po-procesiranje – parsanje); osnove deterministčnih regularnih izrazov in uporaba za avtomatsko obdelavo podatkov; OLAP - pivot tabele in vizualizacija podatkov. Programiranje za inženirje: Algoritmi in procedure ter klasifikacija funkcij Programiranju (osnove dela z matlab in/ali Mathematica – prikaz na praktičnih zgledih); podajanje 2D in 3D grafike z Mathematico.	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.

Temeljni 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:	**Objectives and competences:**
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 računalniškim programom, - sposobnost reševanja problemov in ponovljivih operacij z računalniškimi algoritmi.	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.

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,	- 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

- samostojno izdelani regularni izrazi za avtomatsko obdelavo podatkov konkretnih problemov, - sposobnost samostojne izdelave programa v okolju Matlab/Mathematica.	expression to solve given parsing problems. - to be able to independently develop procedures in Matlab/Mathematica.

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.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Domače naloge 1. in 2. kolokviji (teorija + vaje) 40 + 40 ali Izpit (teorija + vaje)	**20 %** **80 %**	Homework 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 program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Vodarstvo in okoljsko inženirstvo – prva stopnja UN		2	3
Water Science and Environmental Engineering – first cycle academic		2	3

Vrsta predmeta / Course type: Obvezni strokovni / Obligatory professional

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
45			30		75	5

Nosilec predmeta / Lecturer: Matjaž Četina

Jeziki / Languages:	
Predavanja / Lectures:	slovenski / Slovene
Vaje / Tutorial:	slovenski / Slovene

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

Opravljeni izpiti iz predmetov Fizika, Matematika I in II.

Prerequisites:

Passed exams in Physics, Mathematics I and II.

Vsebina:

Predavanja
Lastnosti tekočin, primerjava hidromehanike in mehanike trdnih teles (razlike).
Osnovne enačbe: kontinuitetna, dinamična, energijska, enačba stanja.Princip reševanja hidrodinamičnih problemov. Hidrostatika: tlaki in sile na ravne in krive ploskve, vzgon, stabilnost plavanja. Kinematika idealne nestisljive tekočine: tokovnice, trajektorije, sledi. Rotor hitrosti, primeri vrtinčnega toka, potencialni tok in primeri iz gradbene prakse. Dinamika idealne nestisljive tekočine: energijska, Bernoullijeva, Cauchyjeva enačba. Teorem o gibalni tekočini. Tok podtalnice, Darcyjev zakon.Tok realne tekočine: dinamična podobnost, laminarni in turbulentni tok, mejna plast, upor teles. Konvekcijsko difuzijska enačba za transport snovi v vodi.

Content (Syllabus outline):

Lectures
Fluid properties, comparison of hydromechanics and solid mechanics (differences).
Basic equations: continuity, momentum, energy, 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: streamlines, path lines, streak lines. Velocity curl, examples of rotational flow, irrotational (potential) flow and examples from civil engineering practice. Dynamics of ideal incompressible fluid: energy, Bernoulli, Cauchy equations. Momentum theorem. Groundwater flow, Darcy's law. Flow of real fluid: dynamic similarity, laminar and turbulent flow, boundary layer, fluid drag. Convective-diffusion equation for mass turbulent transport in water.

Laboratorijske vaje Izračun sil in prijemališč na ravne in krive ploskve, stabilnosti in kota nagiba plavačev in pontonskih mostov. Potencialni tok - tok v kotu in kolenu, izvor in potencialni vrtinec, izvor in paralelni tok. Uporaba za podtalnico. Uporaba Bernoullijeve enačbe za tok v cevovodih. Črpalke in turbine v hidravličnih sistemih. Uporaba impulznega stavka za račun sil na kolena cevovodov ter lopatice turbin. Realna tekočina: upor teles, padalec, letalsko krilo, steber. Eksperimentalne vaje na fizičnih modelih in primerjava meritev z računskimi rezultati.	Laboratory tutorials Computation of forces and their points of application on flat and curved planes, stability and angles of inclination of floating bodies and pontoon bridges. Potential flow – flow in the corner and bend, source and potential vortex, source and parallel flow. The use for groundwater flow. The use of Bernoulli's equation for flow in pipelines. Pumps and turbines in hydraulic systems. The use of momentum theorem for the computation of forces on pipeline bends and turbine shoulder-blades. Real fluid: fluid drag, parachute, air foil, pier. Experimental tests on physical models and the comparison of measurements with computational results.

Temeljni literatura in viri / Readings:

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:	**Objectives and competences:**
Cilji - Študent dobi osnovno znanje mehanike tekočin, ki mu omogoča reševanje mnogih problemov gradbene prakse, - študent se nauči splošnega načina reševanja inženirskih tehničnih problemov - od zbiranja podatkov, izbire ustreznih enačb, presoje njihove točnosti itd. do verifikacije rezultatov, - s pomočjo teoretičnih in laboratorijskih vaj ter terenskih ogledov študentje utrdijo pridobljeno teoretično znanje in spoznajo njegovo uporabnost za reševanje praktičnih problemov.	Objectives - Student gets basic knowledge about fluid mechanics which enables him to solve numerous problems from civil engineering practice, - Student learns the general way of solving engineering technical problems – from collecting data, choosing adequate equations, assessment of their accuracy, etc., to verification of results, - With the help of theoretical and laboratory tutorials as well as with field work students consolidate the acquired theoretical knowledge and recognize its applicability to solve practical problems.
Pridobljene kompetence - Študent zna uporabljati poenostavljene enačbe mehanike tekočin, ki izhajajo iz splošnih enačb v prostoru ter razume, da so poenostavljene enačbe le njihovi posebni primeri. - Študent zna uporabljati osnovne enačbe hidrostatike za določanje tlakov, sil in njihovih prijemališč na ravne in krive ploskve. - Študent razume teorijo potencialnega toka za določanje toka podtalnice in rešuje enostavne probleme. - Študent zna uporabiti Bernoullijevo oz. energijsko enačbo za določanje toka idealne nestisljive tekočine v cevovodih. Študent za	Gained competences - Student knows how to use simplified equations of fluid mechanics arising from general equations in space and understands that simplified equations are only special cases. - Student knows how to use basic equations of hydrostatics to determine pressures, forces and their points of application on flat and curved planes. - Student understands the theory of potential flow to determine groundwater flow and can solve simple problems. - Student knows how to use Bernoulli or energy equation to determine the flow of ideal

realne tekočine razume principe laminarnega in turbulentnega toka ter modelne podobnosti; zna praktično uporabiti enačbo za račun upora teles v toku.	incompressible fluid in pipes. For real fluids student understands the principles of laminar and turbulent flow as well as model similarity; he is able to use the equation of fluid drag for practical purposes.

Predvideni študijski rezultati:	**Intended learning outcomes:**
- 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 hidrostatičnega pritiska na zapornice, pregrade in nasipe. - S pomočjo teorije potencialnega toka študent zna preračunati tok podtalnice pri enostavnejših primerih toka proti vodnjaku. - Zelo dobro zna študent uporabiti Bernoullijevo enačbo za račun toka v kratkih cevovodih, kjer je možna predpostavka o idealni tekočini. - Pri modelni podobnosti študent zna preračunati izmerjene vrednosti iz modela v naravo. - S pomočjo enačbe upora in ustreznih tabel v priročnikih študent zna izračunati silo na telesa v toku. - Tekom študija predmeta se študent navaja na uporabo literature ter internetnih virov in se z oddajo pisnih izdelkov ter njihovim zagovorom navaja na pisno in ustno 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. - With the use of potential flow theory he knows how to compute groundwater flow in simpler cases of flow against wells. - Student is well prepared to use Bernoulli equation for flow calculation in short pipelines where the supposition of ideal fluid is possible. - Regarding the model similarity student can calculate measured values from a model to nature. - With the use of the fluid drag equation and appropriate tables in manuals student is able to compute the body force in fluid flow. - During the study of the subject student becomes familiar with the use of literature and internet sources and with the delivery of written course work and its defence gets used to written and oral reporting.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja bodo potekala kot kombinacija klasičnih predavanj, kjer bodo glavne izpeljave, pomembne za razumevanje snovi, podane na tablo. Teoretične vsebine bodo popestrene s prikazi praktičnih primerov preko računalniških projekcij in DVD filmov. Zelo pomembno je tudi, da si študentje predstavljajo, kako voda teče, zato bodo imeli študentje laboratorijske vaje v manjših skupinah. Predvidena je tudi enodnevna ekskurzija z ogledom delovanja čistilne naprave, strojnice in pregrade HE ter primer sanacije alpskega jezera.	Lectures will be held as a combination of classical lessons with the main derivations, important to understand study topics, given on the blackboard. Theoretical contents will be variegated by presentations of practical examples with computer projections and DVD movies. Because it is also very important for the students to imagine how water flows, they will have laboratory tutorials in smaller groups. It is also foreseen that they will attend a one day excursion including the visit of a purification station, power house and a dam site of a hydro- power plant and a site of the remediation of an alpine lake.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Domače naloge	**20 %**	Homework
Računski del izpita (naloge, pisni)	**40 %**	Computational part of the exam exercises, written)
Teoretični del izpita (pisni)	**40 %**	Theoretical part of the exam (written)

Reference nosilca / Lecturer's references:

DŽEBO, Elvira, ŽAGAR, Dušan, ČETINA, Matjaž, PETKOVŠEK, Gregor. Reducing the computational time of the SPH method with a coupled 2-D/3-D approach. Stroj. vestn., Oct. 2013, vol. 59, no. 10, str. 575-584.

KRZYK, Mario, GABRIJELČIČ, Primož, ČETINA, Matjaž. Modelling of flow in a kayak channel. V: ZHAOYIN, Wang (ur.). Proceedings of the 35th IAHR World Congress, September 8-13, Chengdu, China. The wise find pleasure in water : meandering through water science and engineering. Chengdu: IAHR, 2013, str. 1-8.

KRZYK, Mario, KLASINC, Roman, ČETINA, Matjaž. Two-dimensional mathematical modelling of a dam-break wave in a narrow steep stream. Stroj. Vestn., 2012, vol. 58, no. 4, str. 255-262.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Osnove mehanike
Course title:	Introduction to structural mechanics

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Vodarstvo in okoljsko inženirstvo – prva stopnja UN		2	3
Water Science and Environmental Engineering – first cycle academic		2	3

Vrsta predmeta / Course type: Obvezni strokovni / Obligatory professional

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
75		45			120	8

Nosilec predmeta / Lecturer: Dejan Zupan

Jeziki / Languages:	
Predavanja / Lectures:	slovenski / Slovene
Vaje / Tutorial:	slovenski / Slovene

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

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

Prerequisites:

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

Vsebina:

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 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 okviri: stopnja statične nedoločenosti; metode reševanja preprostih okvirjev. Geometrijske karakteristike prereza nosilca: ploščina; statični moment; vztrajnostni moment; sestavljeni prerezi.

Content (Syllabus outline):

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 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

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.	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.

Temeljni literatura in viri / Readings:

Hanaor, A. 1998. Principles of structures. Oxford, Blackwell.
Stanek, M., Turk, G. 2005. Statika I, učbenik. Ljubljana, UL FGG.
Srpčič, S. 2003. Mehanika trdnih teles, učbenik. Ljubljana, UL FGG.
Stanek, M., Turk, G. 1998. Osnove mehanike trdnih teles, učbenik. Ljubljana, UL FGG.
Krajnc, A., Frame2D, Računalniški program za statiko ravninskih okvirjev z navodili za uporabo.

Cilji in kompetence:	**Objectives and competences:**
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. 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.	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, - 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.

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.

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.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Domače naloge	**25 %**	Weekly home assignments
Dva pisna preizkusa znanja	**60 %**	Two written tests
Pisni izpit	**15 %**	Written examination

Reference nosilca / Lecturer's references:

KROFLIČ, Aleš, SAJE, Miran, PLANINC, Igor, ZUPAN, Dejan. Buckling of asymmetrically delaminated three-dimensional twisted composite beam: exact solution. J. eng. mech., 2013, vol. 139, No. 8, p. 1124–1132.
RODMAN, Urban, SAJE, Miran, PLANINC, Igor, ZUPAN, Dejan. The lateral bucling of timber arches. International journal of structural stability and dynamics, 2013, vol. 13, no. 8, p. 1-16
ČEŠAREK, Peter, SAJE, Miran, ZUPAN, Dejan. Dynamics of flexible beams: Finite-element formulation based on interpolation of strain measures. Finite elem. anal. des., 2013, vol. 72, p. 47-63.

ZUPAN, Eva, SAJE, Miran, ZUPAN, Dejan. Dynamics of spatial beams in quaternion description based on the Newmark integration scheme. Comput. mech., 2013, letn. 51, št. 1, str. 47-64.
ZUPAN, Eva, SAJE, Miran, ZUPAN, Dejan. On a virtual work consistent three-dimensional Reissner-Simo beam formulation using the quaternion algebra. Acta Mech., 2013, vol. 224, no. 8, p. 1709-1729.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Matematika III
Course title:	Mathematics III

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Vodarstvo in okoljsko inženirstvo – prva stopnja UN		2	3
Water Science and Environmental Engineering – first cycle academic		2	3

Vrsta predmeta / Course type: Obvezni splošni / Obligatory general

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
60		45			105	7

Nosilec predmeta / Lecturer: Marjeta Kramar Fijavž, Mitja Lakner

Jeziki / Languages:	
Predavanja / Lectures:	slovenski / Slovene
Vaje / Tutorial:	slovenski / Slovene

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Opravljena izpita 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. 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.	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 equation, Fourier series, initial and boundary value problem. Basics on graph theory: vertices, edges, isomorphism, adjacency and incidency, 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.

Temeljni 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:	**Objectives and competences:**
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, - zmožnost algoritmičnega razmišljanja, - sposobnost uporabe matematičnega znanja v inženirski praksi.	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, - ability of algorithmic thinking, - to be able to use mathematical knowledge in engineering problems.

Predvideni študijski rezultati:	**Intended learning outcomes:**
- Reševanje navadnih in parcialnih diferencialnih enačb, - pridobiti osnovna znanja o 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. -	- Solving ordinary and partial differential equations, - basic knowledge on 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 (v %) / Weight (in %)	Assessment:
Izpit (teoretični del)	**30 %**	Exam (theoretical part)
Računske naloge in sprotno delo	**70 %**	Exercises and homework

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.

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.
KRAMAR FIJAVŽ, Marjeta, LAKNER, Mitja, ŠKAPIN-RUGELJ, Marjeta. An equal-area method for scalar conservation laws. The Anziam journal, 2012, vol. 53, iss. 2, str. 156-170.
SKUBIC, Blaž, LAKNER, Mitja, PLAZL, Igor. Sintering behavior of expanded perlite thermal insulation board : modeling and experiments. Ind. eng. chem. res. [Print ed.], 2013, vol. 52, no. 30, str. 10244-10249.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Gospodarjenje s sekundarnimi in odpadnimi snovmi
Course title:	Secondary and waste materials management

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Vodarstvo in okoljsko inženirstvo – prva stopnja UN		2	3
Water Science and Environmental Engineering – first cycle academic		2	3

Vrsta predmeta / Course type: Obvezni strokovni / Obligatory professional

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
45		45			90	6

Nosilec predmeta / Lecturer: Violeta Bokan Bosiljkov

Jeziki / Languages:	
Predavanja / Lectures:	slovenski / Slovene
Vaje / Tutorial:	slovenski / Slovene

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

Opravljeni izpiti iz predmetov: Uvod v okoljsko inženirstvo, Osnove kemije, Gradiva.

Prerequisites:

Passed exams in the following subjects: Introduction to Environmental Engineering, Basic Chemistry, and Construction and Building Materials.

Vsebina:

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 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

Content (Syllabus outline):

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 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

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.	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.

Temeljni 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 kmetisjtvo in okolje – delovno področje odpadki. Dostopno na: http://www.mko.gov.si/si/delovna_podrocja/odpadki/.

Cilji in kompetence:	**Objectives and competences:**
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, - 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.	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 - 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.

Predvideni študijski rezultati:	Intended learning outcomes:
- 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.	- 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.

Metode poučevanja in učenja:	Learning and teaching methods:
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 različne nacionalne prakse gospodarjenja s sekundarnimi surovinami.	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 various national practices of secondary raw material management.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Vaje (opravljene in zagovor)	**50 %**	Seminar exercises and its defence
Kolokvij ali izpit	**50 %**	Mid-term exam or exam

Reference nosilca / Lecturer's references:

ŽARNIĆ, 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, ŽARNIĆ, 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 program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Vodarstvo in okoljsko inženirstvo – prva stopnja UN		2	4
Water Science and Environmental Engineering – first cycle academic		2	4

Vrsta predmeta / Course type: Obvezni strokovni / Obligatory professional

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30		30			60	4

Nosilec predmeta / Lecturer: Darko Drev

Jeziki / Languages:	
Predavanja / Lectures:	slovenski / Slovene
Vaje / Tutorial:	slovenski / Slovene

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

Prerequisites:

Vsebina:

Zgodovinski razvoj zdravstvene hidrotehnike. Izhodišča za vodooskrbo in čiščenje pitnih voda: izbira 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 voda, objekti na kanalizacijskih sistemih in komunalnih čistilnih napravah, osnove varstva pred naravnimi in drugimi nesrečami.

Content (Syllabus outline):

Historical development of sanitary engineering.

A platform for water supply and treatment of drinking water: selection of drinking water sources, consumption and quality of water, water supply systems and facilities,preparation, technological methods and techniques of treatment of drinking water. A platform for extraction and purification of polluted water from settlements: types and quantities of contaminated water, design of drainage systems in urban areas and highways and their dimensioning, basic technological methods and techniques for wastewater treatment, facilities for sewage water systems and waste water treatment plants, basics of protection against natural and other disasters.

Temeljni literatura in viri / Readings:

Panjan, J. 2005. Osnove zdravstveno hidrotehnične infrastrukture. Ljubljana, UL FGG, 289 str.
Panjan, J. 1999. Odvodnjavanje onesnaženih voda, Skripta, 103 str.
Izbrana poglavja iz:
Degremont, I. 1991. Water Tretment Handbook. Paris, Lavoisier Publishing, 1459 str.
Imhoff, K., Klaus, K. 1999. Taschenbuch der Stadtenwasserung, 29 Auflage. Olden- bourg, 472 str.
Hosang, W., Bischof, W. 1998. Abwassertechnik. Leipzig, B.G. Teubner Stuttgart, 724 str.

Cilji in kompetence:

Cilji
- Osvojiti osnovna znanja, ki so potrebna za zasnovo, projektiranje, gradnjo in vzdrževanje objektov in naprav na sistemih za oskrbo z zdravo 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.

Objectives and competences:

Objectives
- To master the basic knowledge that is necessary for the design, planning, construction and maintenance of facilities and equipment for the water supply systems and treatment of drinking water and draining of sewage water.

Gained competences
- to understand the importance of water supply and draining water,
- to know the ecological aspect of water protection,
- to knows the basics of technology and engineering execution facilities for the treatment of drinking and waste water.

Predvideni študijski rezultati:

- Zdravstveno hidrotehnične osnove oskrbe z zdravo 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.

Intended learning outcomes:

- Basics of sanitary engineering providing healthy drinking water, drainage and treatment of polluted waters and protection of waters.
- Student will learn and understand: the importance of water supply and drainage for public health, ecological aspects of water protection, basic technologies for the preparation of drinking water and treatment of waste water, technical implementation of structures intended to water supply and drainage of polluted water.
- Student will learn procedures of sanitary hydraulics in case of natural and other disasters.

Metode poučevanja in učenja:

Predavanja (power point), filmi, seminarske vaje, simulacije.

Learning and teaching methods:

Lectures (Power Point), video, tutorials, simulations.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Pisni izpit	**50 %**	Written exam
Seminarske vaje	**50 %**	Tutorials

Reference nosilca / Lecturer's references:

PANJAN, Jože, KRZYK, Mario, DREV, Darko, Self-purification processes of lake Cerknica as a combination of wetland and SBR reactor. Water environment. research, (v tisku dec. 2013, letn. 85, no. 12, str. 1-16,
BIERBAUM, Svenja, ESCABASSE, Jean-Yves, WELL, Andreas, KOMPARE, Boris, DREV, Darko, KRIVOGRAD-KLEMENČIČ, Aleksandra. Reducing fresh water consumption in paper industry by recycling AOP-treated effluents. Fresenius environmental bulletin, ISSN 1018-4619. [Print ed.], 2012, vol. 21, no. 8a, str. 2178-2184.
DREV, Darko, KRIVOGRAD-KLEMENČIČ, Aleksandra, ŠKARJA, Janez, PANJAN, Jože. Problem onesnaženja bazenskih voda s trihalometani v Sloveniji = Contamination of bathing waters with Trihalomethanes in Slovenia. Zdravniški vestnik, ISSN 1318-0347. [Tiskana izd.], okt. 2015, letn. 84, št. 10, str. 659-669.
FELICIJAN, Jože, MASTNAK, Mitja, KERŠ, Tomaž, DELIĆ, Marjan, DREV, Darko, SLANE, Mitja. Kolektorski sistem za pridobivanje čiste vode : patent : SI 23105 (A). Ljubljana: Urad Republike Slovenije za intelektualno lastnino, 2011.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Hidravlika
Course title:	Hydraulics

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Vodarstvo in okoljsko inženirstvo – prva stopnja UN		2	4
Water Science and Environmental Engineering – first cycle academic		2	4

Vrsta predmeta / Course type: Obvezni strokovni / Obligatory professional

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30	15		30		75	5

Nosilec predmeta / Lecturer: Franci Steinman

Jeziki / Languages:	
Predavanja / Lectures:	slovenski / Slovene
Vaje / Tutorial:	slovenski / Slovene

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

Opravljena izpita iz predmetov Matematika I in Fizika.

Prerequisites:

Passed exams from the courses Mathematics I and Physics.

Vsebina:

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 spoznavajo 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 odprtin in 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).

Content (Syllabus outline):

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, 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).

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 prelivi. 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.	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.

Temeljni 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., Feattherstone, 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:	**Objectives and competences:**
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. Pridobljene kompetence - 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.	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. Gained competences - 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.).

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, seminar in laboratorijske vaje.	Lectures, seminar and laboratory exercises.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Seminarska naloga	**30 %**	Seminar work
Računski del izpita (pisno)	**30 %**	Calculation assignments (written)
Teoretični del izpita (pisno ali ustno)	**40 %**	Theoretical part of the exam (written or oral)

Reference nosilca / Lecturer's references:

NOVAK, Gorazd, KOZELJ, Daniel, STEINMAN, Franci, BAJCAR, Tom. Study of flow at side weir in narrow flume using visualization techniques. Flow meas. instrum. [Print ed.], 2013, letn. 29, str. 45-51.
BAJCAR, Tom, STEINMAN, Franci, ŠIROK, Brane, PREŠEREN, Tanja. Sedimentation efficiency of two continuously operating circular settling tanks with different inlet- and outlet arrangements. Chem. eng. j. 1996. [Print ed.], 2011, vol. 178, str. 217-224.
GOSAR, Leon, PREŠEREN, Tanja, KOZELJ, Daniel, STEINMAN, Franci. Alpreserv Database: Sharing Information on Reservoirs. Wasser, Energ., Luft, 2006, št. 3, str. 198-206.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Uporabna ekologija in ekotoksikologija
Course title:	Applied ecology and ecotoxicology

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Vodarstvo in okoljsko inženirstvo – prva stopnja UN		2	4
Water Science and Environmental Engineering – first cycle academic		2	4

Vrsta predmeta / Course type: Obvezni strokovni / Obligatory professional

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30			30		60	4

Nosilec predmeta / Lecturer: Damjana Drobne

Jeziki / Languages:		
	Predavanja / Lectures:	slovenski / Slovene
	Vaje / Tutorial:	slovenski / Slovene

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.); onesnaženje 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 uporabljanih rutinskih testov strupenosti; biomonitoring (biomarkerji and bioindikatorji); pregled okoljskih standardov; najnovejši izzivi na področju varovanja okolja (nanotoksikologija, hormonski motilci).	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 overview; emerging topics in environmental pollution (nanotoxicology, endocrine disruptors).

Temeljni 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-tega in razumevanje načinov vrednotenja razsežnosti onesnaževanja in posledic na ekosistem.
- Sodelovanje v interdisciplinarnih timih.

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) understanding of environmental pollution control and prevention.
- Participations in interdisciplinary work teams.
- Critical judgment of toxicity test and environmental risk assessment data.

- 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.	- Participation in environmental risk assessments. - Use of acquired knowledge to develop environmental policy regulations.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja in problemsko učenje ob laboratorijskih vajah; demonstracijske vaje.	Lectures, laboratory exercises, demonstration exercises.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Vaje	**50 %**	Lab tutorials
Pisni in/ali ustni izpit	**50 %**	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:	Mehanika tal in inženirska geologija
Course title:	Soil mechanics and engineering geology

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Vodarstvo in okoljsko inženirstvo – prva stopnja UN		2	4
Water Science and Environmental Engineering – first cycle academic		2	4

Vrsta predmeta / Course type: Obvezni strokovni / Obligatory professional

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
60			40	5	105	7

Nosilec predmeta / Lecturer: Boštjan Pulko, Ana Petkovšek

Jeziki / Languages:	**Predavanja / Lectures:**	slovenski / Slovene
	Vaje / Tutorial:	slovenski / Slovene

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. Geološke raziskave za potrebe gradbeništva. Osnovne fizikalne in mehanske lastnosti zemljin in kamnin, osnove obnašanja zemljin, laboratorijske preiskave zemljin. Klasifikacija zemljin. Standardi v geotehniki. Prvotne in dodatne napetosti v tleh. Deformacije/posedki tal. Voda v tleh, pojem pornega tlaka, efektivnih in totalnih napetosti, strujanje vode. Konsolidacija tal. Osnove stabilnosti tal in pobočij.	The role of geology in civil engineering.Earth structure, plate tectonics, endogenous and exogenou. Classification of rocks based on origin, minerals and min. Rocks of the Slovenian territory. Geological time scale, tectonic events, geological enviro The basics of hydrogeology. Slope processes Rock properties and their determination Geological survey. Basic physical and mechanical properties of soils and roc. 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, effectiv. Consolidation Soil shear strength and basics of soil slope stability.

Temeljni 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 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

Intended learning outcomes:

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

(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.	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.

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.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Izdelava računskih vaj in nalog	**20 %**	Laboratory work and practical examples
Pisni in/ali ustni izpit (ali kolokviji)	**80 %**	Written exam (or midterm exams)

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.

MAČEK, Matej, MAUKO, Alenka, MLADENOVIČ, Ana, MAJES, Bojan, PETKOVŠEK, Ana. A comparison of methods used to characterize the soil specific surface area of clays. Appl. clay sci.. [Print ed.], oktober 2013, letn. 83-84, str. 144-152.
PETKOVŠEK, Ana, MAČEK, Matej, PAVŠIČ, Primož, BOHAR, Feri. Fines characterization through the methylene blue and sand equivalent test: comparison with other experimental techniques and application of criteria to the aggregate quality assessment. Bulletin of engineering geology and the environment, 2010, vol. 69, no. 4, str. 561-574.
PETKOVŠEK, Ana, MAČEK, Matej, MAJES, Bojan. A laboratory characterization of soils and clay- bearing rocks using the Enslin-Neff water-adsorption test = Laboratorijska karakterizacija zemljin in kamnin, ki vsebujejo glino, s preiskavo adsorpcije vode po Enslin - Neffu. Acta geotech. Slov., 2009, letn. 6, št. 2, str. 4-13.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Komunalne naprave
Course title:	Communal technical infrastructure

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Vodarstvo in okoljsko inženirstvo – prva stopnja UN		2	4
Water Science and Environmental Engineering – first cycle academic		2	4

Vrsta predmeta / Course type: Obvezni strokovni / Obligatory professional

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30		30			60	4

Nosilec predmeta / Lecturer: Maruška Šubic Kovač

Jeziki / Languages:	
Predavanja / Lectures:	slovenski / Slovene
Vaje / Tutorial:	slovenski / Slovene

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.	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.

Temeljni 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.
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.

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, - uporaba domače in tuje strokovne literature ter računalniške opreme in jezikov za projektiranje inženirskih objektov.	- 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, - the use of domestic and foreign language literature for the design of engineering structures.

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).

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Pisni izpit	**70 %**	Written exam
Samostojno izdelana vaja (projekt)	**30 %**	Individually done project

Reference nosilca / Lecturer's references:

RAKAR, Albin, ŠUBIC KOVAČ, Maruška, PERGAR, Petra, POLAJNAR, Matija, ČERNE, Tomaž, MESNER, Andrej, ZAJC, Tomaž, PUHAR, Martin, FLIS, Lara. Vrednost gospodarske infrastrukture in problematika zagotavljanja sredstev za njeno ohranitev : CRP - V5-1087 : končno poročilo o rezultatih raziskav. Ljubljana: Univerza v Ljubljani, Fakulteta za gradbeništvo in geodezijo, 2011. 148 str.
RAKAR, Albin, ŠUBIC KOVAČ, Maruška, ČERNE, Tomaž, PUHAR, Martin, MESNER, Andrej, PEGAN, Miloš, ŠUNTAR, Aleš, BELEC, Marjan, ŠARLAH, Nikolaj. Načrt vzpostavitve sistema za zaščito javne gospodarske infrastrukture : zaključno poročilo : težišče "skladnejši regionalni razvoj in izboljšanje gospodarjenja s prostorom" : CRP program "konkurenčnost Slovenije 2006-20013 v letu 2008". Ljubljana: Fakulteta za gradbeništvo in geodezijo, 2009. 64 str.
ŠUBIC KOVAČ, Maruška, SITAR, Metka. Slowenian Experience in Public-Private Partnership: Case studies: Tehnopolis, Šmartinska Partnership, Stožice Sports Park. V: PANAGOPOULOS, Thomas (ur.). New Models for Innovative management and Urban Dynamics : COST Action TU0602 Conference, 12.-14. October 2009, Universidade do Algarve, Faro, Portugal. University of Algarve: COST office, 2009, str. 53-58.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Organizacija gradbenih del in poslovanje
Course title:	Organization of construction works and operation

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Vodarstvo in okoljsko inženirstvo – prva stopnja UN		2	4
Water Science and Environmental Engineering – first cycle academic		2	4

Vrsta predmeta / Course type: Obvezni strokovni / Obligatory professional

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
45		45			90	6

Nosilec predmeta / Lecturer: Jana Šelih

Jeziki / Languages:	
Predavanja / Lectures:	slovenski / Slovene
Vaje / Tutorial:	slovenski / Slovene

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

Prerequisites:

Vsebina:

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, pripravljalna dela, ureditev gradbišča;; 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.

Content (Syllabus outline):

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, 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.

Temeljni literatura in viri / Readings:

Rodošek, E. 1988. Osnove organizacije v gradbeništvu. Ljubljana, UL FGG.
Rodošek, E. 1984. Operativno planiranje. Ljubljana, UL FGG.
Pšunder, M. 2009. Operativno planiranje. Maribor, UM FG.

Cilji in kompetence:

Cilji
- Seznaniti študente z osnovami organizacijske vede kot izhodišče za uspešno delovanje gradbenega podjetja.
- Študentje se seznanijo 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, 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

Intended learning outcomes:

- The necessary declarative knowledge includes knowledge of a construction company 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;

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).	- 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).

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja in seminarske vaje.	Lectures and seminar tutorial.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Računski del izpita	**50 %**	Computational part of exam
Teoretični del izpita	**50 %**	Theoretical part of exam

Reference nosilca / Lecturer's references:

ŠIJANEC-ZAVRL, Marjana, ŽARNIĆ, Roko, ŠELIH, Jana. Multicriterial sustainability assessment of residential buildings. Ukio technol. ekon. vystym. (Spausd.). Print ed., 2009, letn. 15, št. 4, str. 612-630.
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.
ŠELIH, Jana. Environmental management systems and construction SMEs : a case study for Slovenia. J. civ. eng. manag.. Tiskana izdaja, 2007, letn. 13, št. 3, str. 217-226.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Temelji ekonomske analize
Course title:	Introduction to economic analysis

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Vodarstvo in okoljsko inženirstvo – prva stopnja UN		3	5
Water Science and Environmental Engineering – first cycle academic		3	5

Vrsta predmeta / Course type: Obvezni splošni / Obligatory general

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
45					45	3

Nosilec predmeta / Lecturer: Polona Domadenik

Jeziki / Languages:	
Predavanja / Lectures:	slovenski / Slovene
Vaje / Tutorial:	slovenski / Slovene

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

Vsebina:	**Content (Syllabus outline):**
Razmišljati kot ekonomist. Vloga ekonomske analize za inženirje Osnove ponudbe in povpraševanja Obnašanje potrošnika. Povpraševanje na področju vodnih storitev, upravljanje s povpraševanjem, stanje; oblikovanje ponudbe na področju vodnih storitev, regulacija trgov vodnih storitev. Osnove teorije proizvodnje in stroškov. Stroški vodnih storitev, teorija stroškov, omejenost virov, oblikovanje krivulje ponudbe na področju vodnih storitev. Časovna vrednost denarja, obresti in načelo ekvivalence – teorija analize stroškov in koristi Sedanja vrednost in notranja stopnja donosa. Primeri vrednotenj na področju upravljanja z vodami. (različna masovna vrednotenja, politične odločitve). Ocenjevanje stroškov za inženirje, ocenjevanje koristi, analiza stroškov in koristi.Investicijska dokumentacija, priprava investicijske dokumentacije, vrste investicijske dokumentacije, primeri, obravnava investicijske tveganji dokumentacije, upravljanje s	Thinking like economist. The role of economic analysis for engineers. Fundamentals of demand and supply. Consumer behavior. Demand for water services, water demand management, supply of water services, regulation of market for water services. Fundamentals of production and cost theories Costs of water services, cost theory, scarcity of resources, deriving supply curve in the field of water service. Time equivalent of money, interests and principle of equivalence – theory of cost and benefit analysis. Present value and internal rate of return. Examples of evaluation in the field of water management (different mass evaluation, political decisions). Cost evaluation for engineers, evaluation of benefits, analysis of costs and benefits Investment documentation, preparation of investment documentation, types of investment documentation, examples, treatment of investment documentation, risk management. How to choose the best project? C/B analysis,

tveganji. Kako izbrati najboljši projekt? C/B analiza, hierarhična odločitvena drevesa, podatkovni modeli, primeri. Tržne strukture – popolna konkurenca, monopol in oligopol. Ekonomska analiza javnega sektorja Osnove makroekonomije.	hierarchical decision trees, data models, cases Market structures – perfect competition, monopoly, oligopoly. Economic analysis of public sector. Fundamentals of macroeconomics.

Temeljni literatura in viri / Readings:

Prašnikar, J., Domadenik, P., Koman M. 2009. Mikroekonomija. Ljubljana: Gospodarski vestnik.
Newnan, D., Eschenbach, T., Lavelle, J. 2009. Engineering Economic Analysis, Oxford University Press.

Cilji in kompetence:	**Objectives and competences:**
Cilji - Seznaniti slušatelja z osnovnim ekonomskim analitičnim aparatom, ki omogoča razumevanje in razčlenitev realnih ekonomskih problemov. - Študent se bo v okviru predmeta seznanil z osnovno ekonomsko terminologijo, ki jo bo nadgradil s specifikami s področja vodarsko-komunalnega inženirstva. Pridobljene kompetence - Sposobnost pravilne presoje ekonomskih odločitev, - sposobnost razumevanja osnovnih ekonomskih pojavov na mikro in makroekonomskem nivoju, - sposobnost aplikacije ekonomskih konceptov na primerih vodarstva in komunalnega inženirstva. - Sposobnost kritične presoje.	Objectives - To acquaint student with the basic economic analytical framework that allows understanding of real economic problems. - Student will get familiar with the basic economic terminology, which will be upgraded to specifics in the field of water engineering. Gained competences - 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 engineering, - ability of critical assessment.

Predvideni študijski rezultati:	**Intended learning outcomes:**
- 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, - 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.	- 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, - 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 (v %) / Weight (in %)	Assessment:
Dva kolokvija	**67 %**	Two midterm tests
Pisni izpit	**33 %**	Final exam

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.
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.
DOMADENIK, Polona, PRAŠNIKAR, Janez, SVEJNAR, Jan. How to increase R&D in transition economies? : evidence from Slovenia. Rev. dev. econ. (Print), 2008, vol. 12, no. 1, str. 193-208.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Ceste in promet
Course title:	Roads and traffic

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Vodarstvo in okoljsko inženirstvo – prva stopnja UN		3	5
Water Science and Environmental Engineering – first cycle academic		3	5

Vrsta predmeta / Course type: Obvezni strokovni / Obligatory professional

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
45			45		90	6

Nosilec predmeta / Lecturer: Peter Lipar

Jeziki / Languages:	
Predavanja / Lectures:	slovenski / Slovene
Vaje / Tutorial:	slovenski / Slovene

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

Prerequisites:

Vsebina:

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.

Content (Syllabus outline):

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.

Temeljni 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:	**Objectives and competences:**
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 - 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:	**Intended learning outcomes:**
- 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.	- 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:	**Learning and teaching methods:**
Predavanja in uporaba pridobljenih znanj pri vajah in projektnem izdelku.	Lectures and application of acquired knowledge to adapt and project product.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Pisni in/ali ustni izpit	**50 %**	Written and / or oral examination
Vaje/projektni izdelek	**50 %**	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:	Osnove lesenih in jeklenih konstrukcij
Course title:	Introduction to timber and steel structures

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Vodarstvo in okoljsko inženirstvo – prva stopnja UN		3	5
Water Science and Environmental Engineering – first cycle academic		3	5

Vrsta predmeta / Course type: Obvezni strokovni / Obligatory professional

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30		30			60	4

Nosilec predmeta / Lecturer: Jože Lopatič, Jože Korelc

Jeziki / Languages:	**Predavanja / Lectures:**	slovenski / Slovene
	Vaje / Tutorial:	slovenski / Slovene

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

Opravljen izpit iz predmeta Osnove mehanike.

Prerequisites:

Passed exam from the course Introduction to Structural Mechanics.

Vsebina:

Lesene konstrukcije
Prednosti in slabosti lesenih konstrukcij. Fizikalne, mehanske in reološke lastnosti gradbenega lesa v odvisnosti od pogojev okolja. Merila za razvrščanje lesa v trdnostne razrede.Izhodišča za dimenzioniranje elementov lesenih konstrukcij. Mejna nosilnost in dimenzioniranje elementov lesenih konstrukcij iz masivnega lesa pri osni, osno-upogibni in strižni obremenitvi. Posebnosti računa in omejitve pomikov lesenih konstrukcij. Ukrepi za zaščito lesenih konstrukcij pred vplivi okolja in požarom. Temeljna pravila izvedbe priključkov in detajlov lesenih konstrukcij.
Jeklene konstrukcije: mehanske lastnosti jekla; tehnološki postopki obdelave jekla in standardne kvalitete jekla; koncepti projektiranja jeklenih konstrukcij; izdelava in montaža jeklenih konstrukcij; veljavni standardi in pravilniki za analizo in dimenzioniranje jeklenih konstrukcijskih elementov; protipožarna in protikorozijska zaščita

Content (Syllabus outline):

Timber structures
Advantages and disadvantages of timber structures. Physical, mechanical and rheological properties of structural timber in dependence of the environmental conditions; criteria for the classification of timber into strength classes. Bases for the design of wood structural elements.
Ultimate resistance and design of structural elements made of solid timber at axial, axial-bending and shear loading. Specifics of calculation and limitations of deflections of timber structures. Measures for the protection of timber structures against the impacts of environment and fire. Basic rules for the execution of joints and detailing of timber structures.
Steel structures: mechanical properties of steel.Technological procedures of steel processing and standard steel qualities.

jeklenih konstrukcij; vezna sredstva in spoji (zvari, vijaki, zakovice, čepi).	Concepts of design of steel structures. Manufacturing and assembly of steel structures. Valid standards and regulations for the analysis and design of steel structural elements. Protection of steel structures against fire and corrosion. Connecting elements and joints (welds, bolts, rivets, pins).

Temeljni literatura in viri / Readings:

Priročnik za projektiranje gradbenih konstrukcij, IZS, 2009 (Deli, ki se nanašajo na SIST EN 1990, SIST EN 1993-1-1, SIST EN 1995-1-1).
Kržič, F. 1994. Jeklene konstrukcije I. Ljubljana, UL FGG.
Beg, D. 1999. Projektiranje jeklenih konstrukcij po ENV 1993-1-1. Ljubljana, UL FGG.
Jackson, N., Dhir, R.K. (ur.) 1996. Civil Engineering Materials. Macmillan, str. 103-160.
Dobrila, P. 1997. Lesene konstrukcije - rešeni primeri z uporabo in razlago EC5. Maribor, UM FG, 133 str.
Lopatič, J. Študijsko gradivo za del, ki se nanaša na lesene konstrukcije (60 strani),
Standardi za gradbene konstrukcije Evrokod, Evrokod 3, Evrokod 5 (SIST EN 1990, SIST EN 1993-1-1, SIST EN 1995-1-1).
European Steel Design Education Programme (ESDEP). Dostopno na: www.fgg.uni-lj.si/kmk/.

Cilji in kompetence:	**Objectives and competences:**
Cilji predmeta - Pridobiti teoretična in praktična znanja, ki omogočajo projektiranje elementov enostavnih lesenih in jeklenih konstrukcij. Pridoblljene kompetence - Zna najti ustrezno konstrukcijsko rešitev v jekleni ali leseni izvedbi, - zna uporabiti splošna znanja mehanike in konstruiranja pri reševanju specifičnih problemov lesenih in jeklenih konstrukcij, - zna dimenzionirati elemente enostavnih lesenih in jeklenih konstrukcij.	Objectives - To acquire theoretical and practical knowledge that enables the design of elements of simple timber and steel structures. Gained competences - To know how to find adequate structural solution in steel or timber, - to know how to use general knowledge of mechanics and design to solve specific problems of timber and steel structures, - to know how to design elements of simple timber and steel structures.

Predvideni študijski rezultati:	**Intended learning outcomes:**
- Spozna mehanske lastnosti jekla in lesa in razume njihov vpliv na obnašanje konstrukcij v različnih pogojih obratovanja, - spozna osnove tehnoloških postopkov izdelave enostavnih jeklenih in lesenih konstrukcij, - spozna in razume obnašanje osnovnih konstrukcijskih elementov jeklenih in lesenih konstrukcij, - spozna praktične postopke in pripomočke za dimenzioniranje lesenih in jeklenih konstrukcij, - spozna in razume obnašanje veznih sredstev in spojev, - spozna standarde in pravilnike za analizo in	- To learn about mechanical properties of steel and timber and understands their behaviour in a structure in different serviceability conditions, - to learn the basic technological procedures for the construction of simple steel and timber structures, - to learn and understands the behaviour of basic structural elements of steel and timber 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 and regulations for the

dimenzioniranje jeklenih in lesenih konstrukcij, - obvlada postopke protipožarne zaščite jeklenih in lesenih konstrukcij ter protikorozijske zaščite jeklenih konstrukcijskih elementov.	analysis and design of steel and timber structures, - to know the procedures of fire protection for steel and timber structures and anti-corrosion protection of steel structural elements.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja in seminarske vaje v klasični učilnici.	Lectures and seminar tutorials in classical classroom.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Vaje	**20 %**	Tutorials
Računski del izpita (možno opraviti s kolokviji)	**40 %**	Computational part of exam (can be completed by mid-term exams)
Teoretični del izpita	**40 %**	Theoretical part of exam

Reference nosilca / Lecturer's references:

LOPATIČ, Jože, ČAS, Bojan. Vpliv podajnosti stika na obnašanje sestavljenih lesenih nosilcev, Zbornik 21. zborovanja gradbenih konstruktorjev Slovenije, Bled, 14. - 15. oktober 1999. Ljubljana: Slovensko društvo gradbenih konstruktorjev, 1999, str. 175-182.
ČAS, Bojan, LOPATIČ, Jože, SAJE, Miran, SCHNABL, Simon, PLANINC, Igor. Experimental and numerical analysis of composite wood beams : paper 199. Proceedings of the Tenth International Conference on Civil, Structural and Environmental Engineering Computing. Rome, Italy, 30 August-2 September 2005. Stirling [Scotland]: Civil-Comp Press, 2005.
PLANINC, Igor, SCHNABL, Simon, SAJE, Miran, LOPATIČ, Jože, ČAS, Bojan. Numerical and experimental analysis of timber composite beams with interlayer slip. Eng. Struct. [Print ed.], 2008, str. 1-11.
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.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Geotehnika
Course title:	Geotechnical engineering

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Vodarstvo in okoljsko inženirstvo – prva stopnja UN		3	5
Water Science and Environmental Engineering – first cycle academic		3	5

Vrsta predmeta / Course type: Obvezni strokovni / Obligatory professional

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
45	10		30	5	90	6

Nosilec predmeta / Lecturer: Janko Logar

Jeziki / Languages:	
Predavanja / Lectures:	slovenski / Slovene
Vaje / Tutorial:	slovenski / Slovene

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

Opravljeni izpiti iz predmetov Osnove mehanike, Mehanika tal in inženirska geologija.

Prerequisites:

Passed exams Introduction of Structural Mechanics, Soil mechanics and engineering geology.

Vsebina:

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

Content (Syllabus outline):

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

Temeljni 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:

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 and competences:

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:

- 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.

Intended learning outcomes:

- 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.

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 (v %) / Weight (in %)	**Assessment:**
računski (pisni) izpit (ali 2 kolokvija)	**45 %**	practical (written) exam (or two mid-term exams)
teoretični (ustni) izpit (ali 2kolokvija)	**45 %**	theoretical (oral) exam (or two mid-term exams)
Domače naloge	**10 %**	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:	Vodne gradnje
Course title:	Introduction to drainage engineering

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Vodarstvo in okoljsko inženirstvo – prva stopnja UN		3	5
Water Science and Environmental Engineering – first cycle academic		3	5

Vrsta predmeta / Course type:	Obvezni strokovni / Obligatory professional
Univerzitetna koda predmeta / University course code:	

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
40		15		5	60	4

Nosilec predmeta / Lecturer:	Matjaž Mikoš, Andrej Kryžanowski

Jeziki / Languages:	**Predavanja / Lectures:**	slovenski / Slovene
	Vaje / Tutorial:	slovenski / Slovene

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

Temeljni 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:

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 proctor,
- zna dimenzionirati take objekte po enostavnejših metodah ter oceniti njihovo stabilnost.

Objectives and competences:

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.

Predvideni študijski rezultati:

- 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.
- 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.

Intended learning outcomes:

- 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.
- 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.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, seminarske vaje, terensko delo.	Lectures, seminar tutorials, field work.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Način (pisni izpit, ustno izpraševanje, naloge, projekt):		Type (written examination, oral examination, coursework, project):
Seminarske vaje	**40 %**	Seminar tutorials
Terensko delo	**10 %**	Field work report
Pisni in/ali ustni izpit	**50 %**	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:	Temelji prostorskega načrtovanja
Course title:	Fundamentals of spatial planning

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Vodarstvo in okoljsko inženirstvo – prva stopnja UN		3	5
Water Science and Environmental Engineering – first cycle academic		3	5

Vrsta predmeta / Course type: Obvezni strokovni / Obligatory professional

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
45			60		105	7

Nosilec predmeta / Lecturer: Alma Zavodnik Lamovšek

Jeziki / Languages:		
	Predavanja / Lectures:	slovenski / Slovene
	Vaje / Tutorial:	slovenski / Slovene

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 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 poglabljanje vsebin	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 system, transport and other public infraworks, landscape (green systems). In conclusion succed synthesis in spatial planning. Seminar Seminar coursework to reinforce the topics covered

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.	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.

Temeljni 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 Tehnologies, Elsevier Science Ltd.

Cilji in kompetence:	**Objectives and competences:**
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, - 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,	Objectives - Ability to give comprehensive information about the meaning and contents of spatial planning at all levels, - 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

- 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.

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.

Predvideni študijski rezultati:

- Seznanitev s strokovno terminologijo in osnove razumevanja prostorskega načrtovanja v povezavi z osnovami geodezije,
- poznavanje 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,
- sposobnost obvladanja enostavnega prostorskega problema, sposobnost samostojne analize, sinteze in prezentacije praktičnega primera,
- sposobnost samostojnega dela ter dela v skupini.
- Študenti se navajajo na povezovanje izredno

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,
- 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,

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.).	necessary for the synthetic understanding of planning (geoinformatics, mapping, land development, sectoral issues, spatial restrictions and regimes, etc.)

Metode poučevanja in učenja:	**Learning and teaching methods:**
Sistematična predavanja, dialog, praktične vaje v računalniški učilnici, seminarske vaje za poglabljanje vsebin predavanj in terensko delo.	Systematic lectures, dialogue, tutorials in the computer classroom, seminar tutorials to reinforce the topics covered in lectures, field work.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Pisni izpit	**50 %**	Written examination
Vaje:		Tutorials:
- kolokvij	**15 %**	- midterm test
- projektna naloga	**30 %**	- project assignment
Terensko delo (udeležba)	**5 %**	Field work (attendance)

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 betonskih in zidanih konstrukcij
Course title:	Introduction to concrete and masonry structures

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Vodarstvo in okoljsko inženirstvo – prva stopnja UN		3	6
Water Science and Environmental Engineering – first cycle academic		3	6

Vrsta predmeta / Course type: Obvezni strokovni / Obligatory professional

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
45		45			90	6

Nosilec predmeta / Lecturer: Jože Lopatič, Sebastjan Bratina

Jeziki / Languages:	**Predavanja / Lectures:**	slovenski / Slovene
	Vaje / Tutorial:	slovenski / Slovene

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

Opravljen izpit iz predmeta Osnove mehanike.

Prerequisites:

Passed exam from the course Introduction to Structural Mechanics.

Vsebina:

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 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

Content (Syllabus outline):

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 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.

obremenitev. Izvedba potresnovarnih enostavnih zidanih konstrukcij.	

Temeljni 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:	**Objectives and competences:**
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 - Learn about mechanical and rheological propertis 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 defections 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 prerezov in elementov armiranobetonskih konstrukcij. - Razumevanje in poznavanje temeljnih načel za armiranje enostavnih betonskih konstrukcij. - Uporaba postopkov za praktično dimenzioniranje	- 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 priciples of reinforcing simple concrete structures. - Application of procedures for the practical design

prečnih prerezov in elementov armiranobetonskih in zidanih konstrukcij. - Uporaba osnovnih pravil za zagotavljanje potresne varnosti enostavnih zidanih konstrukcij.	of reinforced concrete and masonry structural members. - Application of basic rules to provide the earthquake resistant simple masonry structures.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja in seminarske vaje v klasični učilnici.	Lectures and seminar tutorials in classical classroom.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Vaje	**20 %**	Tutorials
Računski del izpita (možno opraviti s kolokviji)	**40 %**	Computational part of exam (can be completed by mid-term exams)
Teoretični del izpita	**40 %**	Theoretical part of exam

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 program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Vodarstvo in okoljsko inženirstvo – prva stopnja UN		3	6
Water Science and Environmental Engineering – first cycle academic		3	6

Vrsta predmeta / Course type: Obvezni strokovni / Obligatory professional

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
6				80	34	4

Nosilec predmeta / Lecturer: Andreja Istenič Starčič

Jeziki / Languages:		
	Predavanja / Lectures:	slovenski / Slovene
	Vaje / Tutorial:	slovenski / Slovene

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.

Temeljni 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.
- Lažje in hitrejše uvajanja v delo po končanem študiju, razumevanje različnih vodarskih

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.
- Efficient introduction after graduation,

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.	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.

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.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Dnevnik prakse	**40 %**	Diary of practical work,
Portfolio	**30 %**	Portfolio
Ustni zagovor	**30 %**	Oral presentation
Predmet se ocenjuje z "opravil" / "ni opravil".		The course is assessed with "passed" / "failed ".

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 program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Vodarstvo in okoljsko inženirstvo – prva stopnja UN		3	6
Water Science and Environmental Engineering – first cycle academic		3	6

Vrsta predmeta / Course type:	Obvezni strokovni / Obligatory professional
Univerzitetna koda predmeta / University course code:	

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
				75	75	5

Nosilec predmeta / Lecturer:	učitelj na študijskem programu / teacher at study programme

Jeziki / Languages:	**Predavanja / Lectures:**	slovenski / Slovene
	Vaje / Tutorial:	slovenski / Slovene

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 izdela pod mentorstvom izbranega učitelja. Delo se javno predstavi ob zaključku študija. Vsebovati mora: - Uvod - Delovno hipotezo - Pregled virov - Material in metode - 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.	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 - 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.

Temeljni 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

Literature from the field of the contents of the thesis.
Instructions for writing thesis and citating 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:

Mentorsko vodeno samostojno delo.

Learning and teaching methods:

Independent work under supervision.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Diplomska naloga	**50 %**	Written thesis
Zagovor	**50 %**	Presentation of the topic

Reference nosilca / Lecturer's references:

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Osnove statistike v vodarstvu
Course title:	Basic statistics in water science

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Vodarstvo in okoljsko inženirstvo – prva stopnja UN		2, 3	3, 6
Water Science and Environmental Engineering – first cycle academic		2, 3	3, 6

Vrsta predmeta / Course type: Izbirni strokovni / Elective professional

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30		30			60	4

Nosilec predmeta / Lecturer: Goran Turk, Dejan Zupan

Jeziki / Languages:	
Predavanja / Lectures:	slovenski / Slovene
Vaje / Tutorial:	slovenski / Slovene

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

Opravljena izpita Matematika I, Matematika II.

Prerequisites:

Passed exams from the courses Mathematics I and Mathematics II.

Vsebina:

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, 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

Content (Syllabus outline):

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 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.

(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.	

Temeljni 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:

Cilji
- Spoznati osnovne pojme verjetnostnega računa in najpogosteje uporabljene statistične metode v okoljskem gradbeništvu.

Pridobljene kompetence
- Pozna in uporablja osnovne pojme verjetnostnega računa,
- pozna in uporablja v gradbeništvu najpogosteje 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 and competences:

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.

Predvideni študijski rezultati:

- razume osnovne pojme verjetnostnega računa,
- pozna porazdelitvene zakone, pogosto uporabljane v gradbeništvu,
- 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

Intended learning outcomes:

- Knowledge and understanding
- Student understands the basic concepts of the theory of probability,
- to know basic statistical distributions commonly used in engineering, learns about the basic statistical methods, hypothesis testing, bivariate analysis, ANOVA,
- Student is able to choose the most suitable statistical method with respect to the problem and is able to perform the analysis,
- Understands the conclusions based on risk level,
- to be able to use Slovenian and foreign literature,

sposobnost predstavljanja rezultatov, - zna uporabljati pripravljena računalniška orodja in programe (Word, Excel, Mathematica).	- to be able to collect and analyze data, ability to represent data, - to be able to use different software (Word, Excel, 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 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.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Sprotno delo (oddane rešitve nalog)	**50 %**	Exercises during the semester
Ustni izpit	**50 %**	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 bucling 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 program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Vodarstvo in okoljsko inženirstvo – prva stopnja UN		2, 3	3, 6
Water Science and Environmental Engineering – first cycle academic		2, 3	3, 6

Vrsta predmeta / Course type:	Izbirni strokovni / Elective professional
Univerzitetna koda predmeta / University course code:	

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30		30			60	4

Nosilec predmeta / Lecturer:	Goran Turk, Dejan Zupan

Jeziki / Languages:	**Predavanja / Lectures:**	slovenski / Slovene
	Vaje / Tutorial:	slovenski / Slovene

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Opravljena izpita 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, krigiranje. Robustna statistika. Definicija mer robustnosti posameznih statistik, primerjava običajnih in robustnih statistik, aplikacija robustne statistike v linearni regresiji. Analiza variance, vzorčenje s ponavljanji in brez, posterione metode analize variance.	Basic Monte Carlo method, random variate/vector generation, generation of random fields, variance reduction methods. Spatial statistics, random fields and processes, variogram, covaraince function, kriging. Robust statistics, the definition of robustness measures of some basic statstics, comparison between common and robust statistics, application of robust statistics in linear regression. Analysis of variance, sampling with or without repetitions, post-anova methods.

Temeljni 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, Geostatisics, 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:	**Objectives and competences:**
Cilji - Spoznati različne statisitične 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 - 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:	**Intended learning outcomes:**
- spozna različne statistične metode, kot so intervali zaupanja, preizkušanje domnev, bivariatna analiza in analiza variance, posteriorne analize variance, - spozna osnove prostorske statistike in razume razliko in pomen prostorske statistike gled ena običajno statistiko, - spozna osnove robustne statistike in razume raliko med raobustno 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 literature, - spretnost zbiranja in obdelave podatkov ter sposobnost predstavljanja rezultatov, - zna uporabljati pripravljena računalniška orodja in programe (na primer Mathematica).	- Knowledge and understanding: - Student understands the basic concepts of the theory of probability, knows basic statistical distributions commonly used in geodesy; learns about the basic statistical methods, i.e. confidence intervals, hypothesis testing, bivariate analysis, ANOVA. - Student is able to choose the most suitable statistical methods with respect to the problem and is able to perform the analysis. - Understands the shortcomings and advantages of forming conclusions based on risk level. - learns about different statistical methods, i.e. confidence intervals, hypothesis testing, bivariate analysis, ANOVA, post-ANOVA, - learns the basics of spatial statistics and understands the relationship between common and spatial statistics, - learns the basics of 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 (v %) / Weight (in %)	**Assessment:**
Sprotno delo (oddane rešitve nalog)	**50 %**	Exercises during the semester
Ustni izpit	**50 %**	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 bucling 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:	Gradbene tehnologije v vodarstvu
Course title:	Construction technologies in water works

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Vodarstvo in okoljsko inženirstvo – prva stopnja UN		3	6
Water Science and Environmental Engineering – first cycle academic		3	6

Vrsta predmeta / Course type: Izbirni strokovni / Elective professional

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30		30			60	4

Nosilec predmeta / Lecturer: Andrej Kryžanowski

Jeziki / Languages:	
Predavanja / Lectures:	slovenski / Slovene
Vaje / Tutorial:	slovenski / Slovene

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 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	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, seismotectonic investigations); (3) foundation and hydraulic stability of structures – anti-filtration measures. Construction site organisation in the 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

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.	(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.

Temeljni 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:	**Objectives and competences:**
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, - sposobnost prepoznavanja materialov in tehnoloških postopkov priprave materialov pri gradnji vodnih zgradb.	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, - 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 (v %) / Weight (in %)	**Assessment:**
Vaje	**50 %**	Tutorials
Pisni izpit	**50 %**	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 program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Vodarstvo in okoljsko inženirstvo – prva stopnja UN		3	6
Water Science and Environmental Engineering – first cycle academic		3	6

Vrsta predmeta / Course type: Izbirni strokovni / Elective professional

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
45		30			75	5

Nosilec predmeta / Lecturer: Goran Turk, Marijan Žura

Jeziki / Languages:	
Predavanja / Lectures:	slovenski / Slovene
Vaje / Tutorial:	slovenski / Slovene

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

Opravljena izpita Matematika I, Matematika II, Statistične metode v gradbeništvu.

Prerequisites:

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

Vsebina:

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.

Content (Syllabus outline):

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.

Temeljni 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 introduces 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 deterministčnih 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

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 own 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 ...).

komunalnem inženirstvu). - 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. Druga polovica so vaje, ki jih opravimo v računalniški učilnici, v okviru katerih rešuje relativno preproste optimizacije upravljanja oziroma operacijskih raziskav.	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. 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 (v %) / Weight (in %)	**Assessment:**
Sprotno delo (oddane rešitve nalog)	**50 %**	Exercises during the semester
Ustni izpit	**50 %**	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:	Meritve v hidrologiji
Course title:	Hydrometry

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Vodarstvo in okoljsko inženirstvo – prva stopnja UN	-	3	6
Water Science and Environmental Engineering – first cycle academic		3	6

Vrsta predmeta / Course type	Izbirni strokovni / Elective professional
Univerzitetna koda predmeta / University course code:	

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30	**-**	**20**	**-**	**10**	**60**	**4**

Nosilec predmeta / Lecturer:	Matjaž Mikoš, Simon Rusjan

Jeziki / Languages:	**Predavanja / Lectures:**	**slovenski / Slovene**
	Vaje / Tutorial:	**slovenski / Slovene**

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Opravljena izpita 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 površinskega toka: prelivi in jezovi. Hidrološka mreža opazovalnic in merilnih postaj: monitoring. Analiza napake meritev in kontrola kakovosti; zapisovanje podatkov, prenos podatkov in	**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 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

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.	(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.

Temeljni 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.

Herschy, R.W. (ed.) (1998): Hydrometry: principles & practices. 2nd Ed. John Wiley & Sons, New York, 376 str.

Herschy, 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:	**Objectives and competences:**
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:** - Sposobnost izbire ustrezne merilne tehnike za določeni problem. - Pridobljena spretnost pri rokovanju in delu z merilnimi instrumenti.	**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:** - 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.

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 ter**e**nskih 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.

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).

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Način (pisni izpit, ustno izpraševanje, naloge, projekt):		Type (examination, oral, coursework, project):
Laboratorijske in seminarske vaje	**60 %**	Lab and class tutorials
Udeležba in poročilo s terenskega dela	**10 %**	Presence & Individual field work report
Pisni in/ali ustni izpit	**30 %**	Written and/or oral examination

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:	Hidroinformatika
Course title:	Hydroinformatics

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Vodarstvo in okoljsko inženirstvo – prva stopnja UN		3	6
Water Science and Environmental Engineering – first cycle academic		3	6

Vrsta predmeta / Course type: Izbirni strokovni / Elective professional

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
10	10		40		60	4

Nosilec predmeta / Lecturer: Franci Steinman

Jeziki / Languages:		
	Predavanja / Lectures:	slovenski / Slovene
	Vaje / Tutorial:	slovenski / Slovene

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

Osnovna znanja o opisnih in prostorskih podatkovnih bazah, pridobljena npr. pri gradbeni informatiki, pri predmetih o vodnih zgradbah ali o modeliranju z vodami povezanih procesov (tj. navezava na podatke za ekološko, hidrološko in hidravlično modeliranje).

Prerequisites:

Basic skills of descriptive and spatial databases, obtained for example at courses on construction informatics, engineering communication, hydraulic structures or gained from modeling of water-related processes (i.e. data collection for ecological, hydrological or hydraulic modeling).

Vsebina:

Predavanja
- Teoretične podlage hidroinformacijskih sistemov
- Pregled podatkov povezanih z upravljanjem voda (državni in občinski nivo)
- Prostorska upodobitev hidroinformacijskih sistemov (državni in občinski nivo)
- Priprava (poizvedovanje, povezovanje,… v bazah podatkov) za modeliranje vodnih sistemov
- Rudarjenje podatkov v modelih hidroinformacijskih sistemov za podporo odločanja v upravljanju voda

Vaje
- Poizvedovanje po podatkovnih bazah o rabi, urejanju ali varstvu voda
- Preslikave informacij med posameznimi oblikami zapisov
- Povezovanje, rudarjenje in sinteza podatkov za

Content (Syllabus outline):

Lectures
- Theoretical basis of hydro-information systems
- Review of data related to water management (state and municipal level)
- Spatial depiction of hydro-information systems (state and municipal level)
- Preparation of data sources (search, querying, linking, ... in databases) for water systems modeling
- Data mining on hydro-information systems to support decision-making in water management

Exercises
- Querying databases on water utilization, water engineering or water protection
- Transformations between the various forms of digital records
- Integration, data mining and synthesis for of a

pripravo podrobnejšega načrta upravljanja voda (pNUV) Seminar - Študent izdela poročilo, kjer z izborom in poizvedbo v obstoječih podatkovnih virih opiše hidroinformacijski model za podrobnejši načrt upravljanja voda glede na izbrano vodnogospodarsko tematiko.	detailed water management planning (pNUV) Project Report - Project Report should be done, where the selection and query in existing data sources are used for a water management planning of a particular topic.

Temeljni literatura in viri / Readings:

Peck A., Neuwirth C. and Simonovic P. S., 2014. Coupling System Dynamics with Geographic Information Systems: CCaR Project Report Water Resources Research Report no. 086, London, Ontario, Canada, 60 pages. ISBN: (print) 978-0-7714-3069-5; (online) 978-0-7714-3070-1.
KUMAR, Praveen et.al.: Hydroinformatics. Taylor & Francis Group, 2006. ISBN 0-8493-2894-2. (EN)
Breiting T., 2006, Techniken und Methoden der Hydroinformatik, Verlag: Inst. für Wasserbau, Univ. Stuttgart
ABBOTT, M. B. 1991 Hydroinformatics – Information Technology and the Aquatic Environment. Avebury Technical Aldershot, UK.

Cilji in kompetence:	**Objectives and competences:**
Cilji - Spoznati osnovne teoretične podlage hidroinformacijskih sistemov - Prepoznati uporabo podatkov, ki vstopajo v procese upravljanje voda na državnem in občinskem nivoju - Izboljšati prostorsko zaznavo podatkov o vodah in hidroinformacijskih sistemih na državnem in občinskem nivoju - Poiskati in uporabiti podatke za modeliranje hidroinformacijskih sistemov ter za modeliranje z vodami povezanih procesov - Spoznati rudarjenje podatkov v modelih hidroinformacijskih sistemov za podporo odločanja pri upravljanju voda Kompetence - Razumevanje podatkovnih struktur hidroinformacijskih sistemov - Uporabljati opisne in prostorske podatke hidroinformacijskih sistemov za podporo odločanja pri upravljanju voda	Objectives - Gaining basic theoretical background in hydro-informatics systems - Recognizing the needed data input in water governance at the state and municipal level - Improving the perception of water related spatial data and hydro-information systems at the state and municipal level - Finding and using data to make a concept of hydro-information systems or initiate a modeling of water-related processes - Gaining knowledge of data mining models in the hydro-information systems to support decision-making in water management Competences - Understanding data structures in hydro-information systems - Using descriptive and spatial information in the hydro-information systems to support decision-making in water management

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje - Pridobljeno poglobljeno znanje o hidroinformacijskih sistemih - Pridobljeno znanje o podatkovnih strukturah hidroinformacijskih sistemov - Pridobljeno znanje o uporabi podatkov hidroinformacijskih sistemov za podporo	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

odločanju pri upravljanju voda in za pripravo vhodnih informacij za modeliranje procesov na vodah ter za predstavitev rezultatov oz. vključitev v podatkovne strukture Prenosljive spretnosti - Sposobnost uporabe in kritične presoje podatkovnih struktur hidroinformacijskih sistemov na širšem področju upravljanja voda	management, for the input data collecting for water process modelling and the presentation or inclusion of results in the data storages. Transferable skills Ability to critical assess and apply of data structures in hydro-information systems for integrated water management

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 (Project Report).	Lectures, demonstrations and exercising on open-source software, skills synthesis within individual Project Report.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Način (pisni izpit, ustno izpraševanje, naloge, projekt):		
Seminarska naloga	**50 %**	Project Report
Pisni in/ali ustni izpit	**50 %**	Final oral or written exam

Reference nosilca / Lecturer's references:

TRATNIK, M., STEINMAN F., BATIČ S., PINTAR M. Evidence in stanje gospodarske javne infrastrukture, primer zadrževalnika Vogršček = Records and state of public infrastructure, the case of the Vogršček reservoir. *Geodetski vestnik*, ISSN 0351-0271. [Tiskana izd.], 2014, letn. 58, št. 1, str. 28-45, ilustr. http://geodetski-vestnik.com/cms/images/58/1/gv58-1_tratnik.pdf .

ENGI Z., TOTH G., STEINMAN F., BRAUN M. Historical morphological reconstruction of the Mura River (SW of the Carpathian Basin) by using GIS methods. *Zeitschrift für Geomorphologie*, ISSN 0372-8854, 2012, letn. 56, št. 2, str. 63-77, ilustr.

PREŠEREN T., STEINMAN F., PAPEŽ J. Contingency Planning Oriented Hazard Maps : new ideas and Lessons learned within the Monitor II project - Slovenian example. V: KOBOLTSCHNIG, Gernot (ur.), HÜBL, Johannes (ur.), BRAUN, Julia (ur.). *12th Congress INTERPRAEVENT 2012.*

STEINMAN F., BANOVEC P., GOSAR L.. Functional connected areas : sea and land uses interaction. V: IP, Wing-Huen (ur.). *Advances in geosciences : Vol. 4 : Hydrological science*. Hackensack, N.J.: World Scientific, cop. 2006, str. 285-290, ilustr.

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 program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Vodarstvo in okoljsko inženirstvo – prva stopnja UN		1–3	1–6
Water Science and Environmental Engineering – first cycle academic		1–3	1–6

Vrsta predmeta / Course type: Izbirni strokovni / Elective professional

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
60	30				90	6

Nosilec predmeta / Lecturer: Andrej Kryžanowski, Primož Banovec

Jeziki / Languages:	
Predavanja / Lectures:	slovenski / Slovene
Vaje / Tutorial:	slovenski / Slovene

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

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 nženirstva.

Prerequisites:

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:

Predavanja
Opredelitev 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) Evropske inštitucije 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

Content (Syllabus outline):

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 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.

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.	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 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.	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.

Temeljni 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 Trasforiniin 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 - 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, - prepoznavanj 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 primernega 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, - sposobnost razumevanja državnega in mednarodnega okolja v katerem sile zaščite in reševanja delujejo.	Objectives - 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, - 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.

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

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja in uporaba pridobljenih znanj pri izdelavi individualne seminarske naloge.	Lectures and use of the acquired knowledge for the elaboration of individual seminar work.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Način (pisni izpit, ustno izpraševanje, naloge, projekt):		Type (examination, oral, coursework, project):
Seminarska naloga	**50 %**	Seminar work
Pisni in/ali ustni izpit	**50 %**	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, ilustr.
KRYŽANOWSKI, Andrej, HUMAR, Nina. Dam safety practice in Slovenia. V: WINTER, Jan (ur.). Bezpieczenstwo zapor - nowe wyzwania. Warszawa: Instytut meteorologii i gospodarki wodnej panstwowy, 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.