Univerza *v Ljubljani*
Fakulteta *za gradbeništvo in geodezijo*

Učni načrti

Magistrski študijski program druge stopnje

STAVBARSTVO (MA)

Course Syllabi

2nd Cycle Master Study

BUILDINGS (MA)

Velja od 2020/2021 | Valid from 2020/2021

Veljavni študijski program na dan 29.1.2020 | Valid study programme at January 29, 2020

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UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	**DIFERENCIALNE ENAČBE IN GEOMETRIJA**
Course title:	**DIFFERENTIAL EQUATIONS AND GEOMETRY**

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Stavbarstvo, druga stopnja, magistrski	Ni členitve (študijski program)	1. letnik	Zimski

Univerzitetna koda predmeta/University course code:	1737

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
60	0	0	30	0	90	6

Nosilec predmeta/Lecturer:	Ganna Kudryavtseva
Vrsta predmeta/Course type:	obvezni strokovni/obligatory professional

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Opravljen izpit iz predmetov Matematika I in Matematika II oz. iz drugih predmetov s primerljivo vsebino.	Passed exams in Mathematics I and Mathematics II, or other courses with comparable content.

Vsebina:	Content (Syllabus outline):
• Navadne diferencialne enačbe: LDE n-tega reda, linearni sistemi, robni problemi, Fourierove vrste, numerično reševanje. • Parcialne diferencialne enačbe: toplotna in valovna enačba, začetni in robni problemi, Lapaceova transformacija, numerično reševanje. • Vektorji v prostoru in operacije z njimi. • Linearne in afine preslikave, matrike. • Krivulje v ravnini in prostoru: parametrizacija, aproksimacija, Bezierove krivulje, B-zlepki. • Ploskve: gladka elementarna ploskev, parametrizacija, odsekoma gladka ploskev,	• Ordinary differential equations: LDE of order n, linear systems, boundary value problems, Fourier series, numerical methods. • Partial differential equations: heat and wave equations, initial and boundary value problems, Laplace transformation, numerical methods. • Vectors in space and operations with them. • Linear and affine transformations, matrices. • Curves in plane and space: parameterisation, approximation, Bezier curves, B-splines. • Surfaces: elementary smooth surfaces, parameterisation, piecewise smooth surfaces,

premonosne ploskve, rotacijske ploskve, aproksimacija, Bezierove ploskve, dvodimenzionalni kubični B-zlepki.	ruled surfaces, surfaces of revolution, approximations, Bezier surfaces, twodimensional cubic B-splines.

Temeljna literatura in viri/Readings:

Braun, M. (1993). *Differential Equations and Their Applications*, Springer-Verlag.

Farin, G. 2002. Curves and surfaces for CAGD. Morgan – Kaufmann.

Kappraff, J. 1991. Connections – the geometric bridge between art and science. World scientific.

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

Cilji in kompetence:	**Objectives and competences:**
Cilji: • Omogočiti razumevanje matematičnega aparata, ki ga uporabljajo strokovni predmeti. • Predstaviti različne oblike diferencialnih enačb in metode za njihovo reševanje. • Zagotoviti solidno razumevanje osnov geometrije. • Seznaniti z uporabo računalniških orodij za numerično reševanje diferencialnih enačb in za geometrijsko oblikovanje. • Vpeljati v samostojno in timsko projektno orientirano delo. Pridobljene kompetence: • Zmožnost prepoznavanja diferencialne enačbe in izbire ustreznega orodja za iskanje rešitev. • Sposobnost rešitve nekaterih netrivialnih geometrijskih problemov s kombiniranjem znanja matematike in računalništva. • Pridobitev ustrezne literature/podpore.	Objectives: • To enable understaning of mathmatical tools used by engineering courses. • To present different forms of differential equations and methods for solving them. • To ensure solid understanding of basics of geometry. • To get acquainted with the application of computer software for numerical solving of differential equatons and for geometric design. • To introduce project based working, individually as well as in a team. Gained competences: • To be capable to recognize the differential equation and to choose the appropraite tools for seeking the solutions. • To be able to combine mathematical and computational knowledge in order to solve some nontrivial problems in geometry. • Skills in acquirement of the appropriate literature.

Predvideni študijski rezultati:	**Intended learning outcomes:**
• Uporaba diferencialnih enačb pri modeliranju inženirskih problemov. • Poglobljeno razumevanje geometrije v prostoru. • Obvladovanje matematičnega aparata do stopnje, ko se lahko suvereno uporablja zmogljiv računalniški program. • Sposobnost kritične presoje dobljenih računalniških rezultatov.	• Application of differential equations for modelling of problems in engineering. • In-depth understanding of the geometry in three dimensions. • Mastering theoretical knowledge to be able to use an efficient computational tool • Capability of a critical judgement of the obtained numerical results.

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

Predavanja, seminarske naloge, laboratorijske vaje, domače naloge.	Lectures, tutorials, consultations, internet.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Računske naloge in sprotno delo	70,00 %	Exercises and homework
Izpit (teoretičen del)	30,00 %	Exam (theoretical part)

Reference nosilca/Lecturer's references:

G. Kudryavtseva, M. Premuš, M. Škapin Rugelj, Matematika 1, Rešitve kolokvijev in izpitov. Univerzitetni učbenik z rešenimi nalogami, 189 strani, tiskarna Birografika Bori, 2019.

G. Kudryavtseva, Two-sided expansions of monoids, Internat. J. Algebra Comput., 29 (8), 2019, 1467-1498.

G. Kudryavtseva, Free skew Boolean intersection algebras and set partitions, Order, 35 (1), 2018, 1-22.

G. Kudryavtseva. M.V. Lawson, A perspective on non-commutative frame theory, Adv. Math., 311, 2017, 378-468.

M. Dokuchaev, V. V. Kirichenko, G. Kudryavtseva, M. Plakhotnyk, The max-plus algebra of exponent matrices of tiled orders, J. Algebra, 490, 2017, 1-20.

G. Kudryavtseva, P. Škraba, The principal bundles over an inverse semigroup, Semigroup Forum, 94, 2017, 674-695.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	**DNEVNA SVETLOBA**
Course title:	**DAYLIGHT**

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Stavbarstvo, druga stopnja, magistrski	Ni členitve (študijski program)	1. letnik	Zimski

Univerzitetna koda predmeta/University course code:	1259

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	0	0	60	0	90	6

Nosilec predmeta/Lecturer:	Mitja Košir
Vrsta predmeta/Course type:	obvezni strokovni/obligatory professional

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

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

Vsebina:	Content (Syllabus outline):
Predavanja: Prostorske konstituante za bioklimatsko oblikovanje stavb (geografske in podnebne razmere lokacije). Človek (upoštevanje psiho-fizioloških potreb človeka pri oblikovanju bivalnega in delovnega okolja). Stavba (notranji prostor in ovoj). Konfiguracija vplivnih faktorjev (dnevna svetloba, osončenje). Metode za izračun in preverjanje osončenja in dnevnega osvetljevanja. Komponente: stekla, zasteklitve, sečila, nadzorni sistemi. Elementi odprtin: horizontalni in vertikalni sistemi. Strategije	Lectures: Bioclimatic building design within defined space constituents (location, geography, climatic conditions), human (psycho-physiological human needs and the design of living and working environment), building (indoor environment, building envelope systems). Configuration of influential factors (daylight, insolation). Methods for the calculation and verification of insolation and daylight illuminance. Components: glass, glazing, shading devices, control systems. Elements of transparent constructional complexes: horizontal and vertical systems. Strategies for the design of

oblikovanja bivalnega in delovnega okolja s pomočjo dnevne in sončne svetlobe. Vaje: Seminarske vaje (uporaba znanja na konkretnem primeru v stavbi, oblikovanje koncepta, faktorska analiza, optimizacija sistema (sinteza)). Laboratorijske vaje (simulacije odziva stavbe in prostora s pomočjo programske opreme).	living and working environment on the basis of insolation and daylight illuminance. Tutorial: Application of theoretical knowledge in a particular building case, concept design, factor analysis, system optimization (synthesis), simulation of the whole building and individual space with appropriate computer software.

Temeljna literatura in viri/Readings:

Brandi, U. 2006. Lighting design: principles, implementation, case studies. Basel, Birkhäuser.

Szokolay, S.V. 2014. Introduction to architectural science: the basis of sustainable design. 3rd edn.

New York, NY, Routledge.

Muneer, T., Gueymard, C., Kambezidis, H. 2004. Solar radiation and daylight models. 2nd edn. Burlington, Elsevier.

McMullan, R. 2007. Environmental science in building. New York, Palgrave Macmillan.

Littlefair, P.J. 1995. Site layout planning for daylight and sunlight, A guide to god practice. Construction Research Communications ltd.

Crisinel, M. ed. 2007. Glass & interactive building envelopes, COST C13. IOS Press.

Študijsko gradivo dostopno na: e-učilnici UL FGG

Cilji in kompetence:	**Objectives and competences:**
Cilji: • Izboljšanje kakovosti grajenega okolja. • Zmanjševanje negativnih vplivov na zunanje okolje. • Učinkovita izraba virov. • Pridobivanje znanja, tehničnih spretnosti in oblikovanje inovacijske sposobnosti za dvig kakovosti projektov. Pridobljene kompetence: • Obvlada prenos sistema zunanje okolje-ovoj-notranje okolje-človek v konceptualizacijo realne stavbe (navezovanje na ostale gradbeno-fizikalne vplive). • Razume značilnosti in delovanje sistemov transparentnih delov stavbnega ovoja in njihovih realizacij. • Pozna izhodišča kontrolnih sistemov in njihovo vlogo pri optimizaciji delovanja odprtin. • Sposoben je zasnovati in optimizirati sistem svetlobnih odprtin na stavbnem ovoju.	Objectives: • The main objectives of the course are to improve the quality of the built environment. • To minimize negative impacts on the environment. • Efficient use of natural resources. • To acquire knowledge and technical skills for improving the quality of building projects. Gained competences: • Mastering the transfer of the analysed system: outdoor environment-building envelope-indoor environment-human (in the framework of real building case; linking daylight design to other fields of building physics). • Understanding the main characteristics and functioning of transparent constructional complexes and their implementation. • Getting familiar with the basics of control systems and their role in the optimization of transparent constructional complexes functioning.

• Sposoben je uporabljati računske metode in programsko opremo za področje dnevnega osvetljevanja in osončenja. • Sposoben je kritično oceniti in interpretirati pridobljene podatke (rezultate). • Obvlada veljavno zakonodajo za področje dnevnega osvetljevanja in osončenja stavb.	• Ability to design and optimize a proposed system of transparent constructional complexes. • Ability to use calculation methods and computer software for daylight illuminance and building insolation analyses. • Critical evaluation and interpretation of results. • Getting familiar with current legislation from the field of daylight illuminance and insolation of buildings.

Predvideni študijski rezultati:	**Intended learning outcomes:**
• Razumevanje delovanja transparentnih delov stavbnega ovoja, zasnova in analiza vplivov direktnega osončenja in zajema dnevne svetlobe v stavbi, sposobnost ocene odziva stavbe na osončenje in dnevno svetlobo. • Uporaba računskih metod in programske opreme za analizo obravnavanih elementov svetlobnega in (posredno) toplotnega odziva stavbe oziroma prostora. • Sposobnost samostojne ocene položaja in vloge obravnavnih elementov v sistemu okolje/človek/stavba. • Identifikacija medsebojnih povezav. • Spretnosti uporabe domače in tuje literature in drugih virov, zbiranja in interpretiranja podatkov, identifikacija. • Reševanje problemov, kritična analiza, sinteza, delo v skupini.	• Understanding the functioning of transparent constructional complexes, design and analysis of the effects of insolation and daylight in the buildings, ability to assess the building response to the insolation and daylight. • Application of calculation methods and computer software simulations to analyse the evaluated elements with regard to daylighting and indirectly also to thermal response of a building and its active spaces. • Ability to evaluate the status and the role of the analysed elements in the system: environment/human/building, identification of interconnections. • Skills for review of relevant literature sources and other references (national, international), data collecting and interpreting, problem identification, problem solving, critical analysis, synthesis, group work.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, seminarske in laboratorijske vaje.	Lectures, tutorial, laboratory work.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
pisni izpit	30,00 %	Written exam
Ocena izdelka vaj	70,00 %	Tutorial and laboratory work

Reference nosilca/Lecturer's references:

KOŠIR, Mitja, IGLIČ, Nataša, KUNIČ, Roman. Optimisation of heating, cooling and lighting energy performance of modular buildings in respect to locations climatic specifics. Renewable energy, ISSN 0960-1481. [Print ed.], 2018, letn. 129, dec., str. 527-539, ilustr., doi: 10.1016/j.renene.2018.06.026.

ERŽEN, Jure, KOŠIR, Mitja. Dinamične metrike za oceno dnevne osvetljenosti in njihova uporaba pri analizi učilnic v slovenskih osnovnih šolah = Dynamic daylighting metrics and its application for the evaluation of classrooms in Slovenian primary schools. Gradbeni vestnik, ISSN 0017-2774, feb. 2016, letn. 65, str. 41-53.

KOŠIR, Mitja, KRAINER, Aleš, DOVJAK, Mateja, KRISTL, Živa. Automatically controlled daylighting for visual and nonvisual effects. Lighting research & technology, ISSN 1477-1535. [Print ed.], 2011, letn. 43, št. 4, str. 439-455.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	**PROJEKTIRANJE NOSILNIH KONSTRUKCIJ STAVB I**
Course title:	**DESIGN OF BUILDING STRUCTURES I**

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Stavbarstvo, druga stopnja, magistrski	Ni členitve (študijski program)	1. letnik	Zimski

Univerzitetna koda predmeta/University course code:	1776

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
50		50	50		150	10

Nosilec predmeta/Lecturer:	Boštjan Pulko, Matjaž Dolšek, Sebastjan Bratina
Vrsta predmeta/Course type:	Obvezni strokovni/obligatory professional

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Obveznih pogojev ni, vendar je delo študenta pri predmetu zelo oteženo, če nima osnovnega znanja statike, geotehnike, potresnega inženirstva in dimenzioniranja armiranobetonski elementov.	There are no mandatory prerequisites, however the work of the student will be very difficult without the basic knowledge of statics, geotechnics, earthquake engineering, and dimensioning of reinforced concrete structural elements.

Vsebina:	**Content (Syllabus outline):**
Predavanja: Predavanja potekajo v več delih: Dolšek: Potresnoodporno projektiranje stavb; Bratina: Projektiranje betonskih stavb; Pulko: Geotehnično projektiranje.	Lectures: Lectures are composed of three basic parts/courses: Dolšek: Earthquake resistant design of buildings; Bratina: Design of Concrete Buildings; Pulko: Geotechnical Design. Earthquake-resistant design of buildings:

Potresnoodporno projektiranje stavb: Uvod v projektiranje stavb na potresnih območjih, zasnova in osnovna načela za potresnoodporno projektiranje stavb, osnove projektne potresne obtežbe, Osnovne metode potresne analize stavb (dinamična in modalna analiza), Zagotavljanje duktilnosti in principe načrtovanja nosilnosti potresno odpornih stavb, teoretične osnove programske opreme za analizo in dimenzioniranje stavb. Projektiranje betonskih stavb: Načela snovanja in projektiranja masivnih konstrukcij; pregled osnovnih skupin elementov nosilnih konstrukcij masivnih stavb s pripadajočimi značilnostmi glede nosilnosti in deformabilnosti ter konstrukcijskih posebnosti; ključna merila za smotrno izbiro tipa konstrukcijskega sistema; projektna obtežba; prevedba nosilnega sistema konstrukcije v ustrezen računski model; dimenzioniranje karakterističnih elementov armiranobetonske nosilne konstrukcije na mejna stanja; konstruiranje armature in detajlov. Geotehnično projektiranje: Osnovne zahteve pri temeljenju stavb. Plitvo in globoko temeljenje objektov. Osnovni postopki projektiranja temeljev ob upoštevanju interakcije med temeljnimi tlemi in objektom. Vaje in seminar: Pri posameznih temah se najprej izdela nekaj preprostih domačih nalog, ki podajo oziroma utrdijo znanja iz konstruiranja. Nato sledi seminarska naloga, ki obsega analizo in dimenzioniranje tipične armiranobetonske stavbe.	Introduction into design of building structures against seismic actions, conceptual design and basic principles of earthquake-resistant buildings, basis of design seismic action, basic methods of seismic analysis of buildings (response history and spectrum analysis), Ductility and capacity design for earthquake-resistant structures, theoretical background for the introduced computer programs. Design of reinforced concrete buildings: Principles of the design of concrete structures; Overview of basic groups of structural members for concrete buildings, related properties regarding ultimate resistance and deformability as well as structural specifics; key criteria for effective selection of the type of structural system; design loads of concrete structures; translation of load-bearing system of a structure into appropriate computational model; design of the characteristics elements of reinforced concrete load-bearing structure to the limit states; design and detailing of reinforcement. Geotechnical design: Basic requirements for the foundation design. Shallow and deep foundations of structures. Basic methods for the foundation design based on soil-structure interaction. Tutorials and seminar: Some simple tutorials will be made to enhance the knowledge related to specific topics of analysis and design of building structures. Then follow seminar work that includes analysis and dimensioning of typical reinforced concrete building.

Temeljna literatura in viri/Readings:

IZS 2009. Priročnik za projektiranje gradbenih konstrukcij po Evrokod standardih (ur. Beg, D., Pogačnik, A), poglavja 0: Evrokod 0 – Osnove projektiranja (110 str.), poglavje 2: Evrokod 2 - Projektiranje betonskih konstrukcij (137 str.), poglavje 7: Evrokod 7 – Geotehnično projektiranje (110 str.), poglavje 8: Evrokod 8 – Projektiranje potresnoodpornih konstrukcij (219 str.). EASY (Earthquake Engineering Slide Information System), IKPIR FGG, CD ali www.ikpir.fgg.uni- lj.si/EASY.

Cilji in kompetence:	**Objectives and competences:**
Cilji: • Razložiti in naučiti standardne postopke za potresno analizo in principe za zagotavljanje mehanske odpornosti in stabilnosti konstrukcij stavb iz različnih materialov (betona, jekla, lesa, zidov). • Razložiti in naučiti postopke za zagotavljanje mehanske odpornosti in stabilnosti armiranobetonskih stavb. • Razložiti in naučiti standardne postopke za zagotavljanje mehanske odpornosti in stabilnosti temeljev. Pridobljene kompetence: • Poznavanje in razumevanje odziva stavb na potresne in druge vplive ter s tem povezane zasnove konstrukcijskega sistema. • Razumevanje mehanizmov prenosa obtežbe preko konstrukcijskih sklopov v temeljna tla in osnovnih principov zagotavljanja potresne odpornosti konstrukcij stavb. • Sposobnost uporabe računskih metod in programske opreme za projektiranje nosilnih konstrukcij stavb in njihovih temeljev. • Poznavanje sodobnih IT podprtih orodij v projektiranju.	Objectives: • To explain and teach the procedures for analysis and concepts for ensuring earthquake-resistance of building structures made of different materials (concrete, steel, timber, masonry). • To explain and teach the procedures for ensuring mechanical resistance and stability of reinforced concrete buildings. • To explain and teach standard procedures for ensuring the mechanical resistance and stability of foundations. Gained competences: • The knowledge and understanding of response of building structures on seismic and other actions and related optimal selection of structural system. • The competence of understanding the load transfer through the structure into the foundation soil. • The competence of understanding the basic factors contributing to earthquake resistance of structures. • The ability to use computer software in the design of structural systems of buildings. • The ability to use the IT supported tools in design.

Predvideni študijski rezultati:	**Intended learning outcomes:**
• Razumevanje delovanja konstrukcijskih sklopov in konstrukcije kot celote ter prenosa obtežbe v temeljna tla. • Znanje določitve optimalnega sistema temeljenja. • Razumevanje dejavnikov za zagotavljanje duktilnosti in nosilnosti potresno odpornih konstrukcij in znanje oblikovanja ustreznih konstrukcijskih detajlov. • Sposobnost uporabe računskih metod in programske opreme za projektiranje nosilnih konstrukcij stavb in njihovih temeljev. • Sposobnost identifikacije in kvantifikacije kritičnih obtežb. • Kompetentna uporaba evropskih standardov za projektiranje potresnoodpornih konstrukcij, armiranobetonskih stavb in temeljev v skladu s standardom Evrokod. • Identifikacija in reševanje problemov, kritična analiza, argumentirana izbira med več možnostmi, sinteza, delo v skupini.	• Understanding the role of the structure and its subassemblies in the transfer of loads into the foundation soil. • The knowledge, how to choose a suitable foundation system. • Understanding of the key factors contributing to the ductility and strength of earthquake resistant structures. • The knowledge to choose and produce suitable structural details. • The use of the design methods and computer software for structural systems (including foundations). • The knowledge to identify and quantify critical loads on structures. • The knowledge of the competent use of the European standards (Eurocode) for the earthquake-resistant design of structures, for design of reinforced concrete structures and foundations.

	• Transferable skills include: identification and solving of problems; critical assessment and analysis; argued choice between several options; ability of the synthesis; and working in a group.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanje, vaje in seminarska naloga. Predmet temelji na sodobnih metodah poučevanja, kot so projektno učenje, timsko delo in individualno delo med učiteljem in študentom, poučevanje s poudarkom na interesu študentov.	Lectures, tutorials and seminar. The course is based on up-to-date teaching methods – project based learning, team work and individual work between teacher and student, student centred teaching and just-in-time lectures.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Individualno delo (vaje, seminar) med letom	50,00 %	Individual work during the course
Izpit (računski in teoretičen del)	50,00 %	Exam (computational and theoretical part)

Reference nosilca/Lecturer's references:

LAZAR SINKOVIĆ, Nuša, BROZOVIČ, Marko, DOLŠEK, Matjaž. Risk-based seismic design for collapse safety. Earthquake engineering & structural dynamics, ISSN 0098-8847. [Print ed.], [in press] 2016, letn. XX, št. X, str. 1-21.

ŽIŽMOND, Jure, DOLŠEK, Matjaž. Evaluation of factors influencing the earthquake-resistant design of reinforced concrete frames according to Eurocode 8. Structure and infrastructure engineering, ISSN 1573-2479, 2015, letn. 12, št. 10, str. 1326-1341.

DOLŠEK, Matjaž, LAZAR SINKOVIĆ, Nuša, ŽIŽMOND, Jure. IM-based and EDP-based decision models for the verification of the seismic collapse safety of buildings. Earthquake engineering & structural dynamics, ISSN 0098-8847. [Print ed.], dec. 2017, letn. 46, št. 15, str. 2665-2682, ilustr., doi: 10.1002/eqe.2923.

MARKOVIČ, Mojca, KRAUBERGER, Nana, SAJE, Miran, PLANINC, Igor, BRATINA, Sebastjan. Non-linear analysis of pre-tensioned concrete planar beams. Engineering structures, ISSN 0141-0296. [Print ed.], jan. 2013, letn. 46, str. 279-293.

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.

BAJC, Urška, BRATINA, Sebastjan, SAJE, Miran, PLANINC, Igor. Nelinearna analiza razpokane armiranobetonske natezne palice - primerjava numeričnih metod = Nonlinear analysis of cracked tensile reinforced concrete bar - comparison of numerical methods. Gradbeni vestnik, ISSN 0017-2774, maj 2013, letn. 62, str. 105-116.

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 : Journal of the international consortium on landslides, ISSN 1612-510X. [Print ed.], 2014, letn. 11, št. 1, str. 81-91.

PULKO, Boštjan. Primerjava metod za statično analizo temeljnih plošč = Comparision of methods for static analysis of mat foundations. Gradbeni vestnik : glasilo Zveze društev gradbenih inženirjev in tehnikov Slovenije, ISSN 0017-2774. [Tiskana izd.], sep. 2012, letn. 61, št. 9, str. 198-205.

PULKO, Boštjan, KILAR, Vojko, LOGAR, Janko. Geotechnical design of the reconstruction of the Bloudek jumping hill in Planica = Conception geotechnique de la reconstruction du tremplin de saut a ski Bloudek a Planica. V: Geotechnical engineering for infrastructure and development : conference proceedings, 13-17 september 2015, Edinburgh. Edinburgh: British Geotechnical Association. 2015, str. 4161-4166.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	**POŽAR**
Course title:	**FIRE**

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Stavbarstvo, druga stopnja, magistrski	Ni členitve (študijski program)	1. letnik	Zimski

Univerzitetna koda predmeta/University course code:	1470

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	0	0	60	0	90	6

Nosilec predmeta/Lecturer:	Tomaž Hozjan
Vrsta predmeta/Course type:	Obvezni strokovni /Obligatory professional

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

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

Vsebina:	Content (Syllabus outline):
Predavanja: Splošno o požarnem inženirstvu. Pregled osnovnih pojmov. Evropski standardi in predpisi. Požarna obtežba. Modeli standardnih in realnih požarov. Ukrepi aktivne požarne zaščite. Evakuacijske poti, sistemi za javljanje in gašenje. Ukrepi pasivne požarne zaščite. Vpliv visoke temperature na lastnosti materialov. Temperaturno polje konstrukcije. Računsko ugotavljanje požarne odpornosti lesenih, armiranobetonskih in jeklenih nosilnih konstrukcij.	Lectures: Introduction to fire engineering. Overview of basic concepts. European standards and regulations. Fire load. Models of standard and real fires. Measures of active fire protection. Evacuation routes, fire detection and fire fighting. Measures of passive fire protection. Influence of high temperatures on material behavior. Determination of temperature field in a structure. Computing determination of the fire resistance of timber, reinforced concrete and steel structures.

Vaje: Računsko reševanje osnovnih nalog, obisk požarnega laboratorija, izdelava požarnega elaborata za enostaven objekt.	Tutorial: Laboratory exercises (solving of basic tasks, visit of the fire laboratory). Seminar exercises (design of fire study for a simple building).

Temeljna literatura in viri/Readings:

Buchanan, A. H. 2005. Structural design for fire safety. John Wiley & sons ltd. Wald F. et al. 2004. Vypočet požarni odolnosti stavebnih konstrukci, Tehniška univerza v Pragi. Direktiva o gradbenih proizvodih, CPD 89/106, Bistvena zahteva št.2 “Požarna varnost”. Evrokod EN 1991-1-2 in požarni deli Evrokodov za lesene, armiranobetonske in jeklene konstrukcije. Učno gradivo v spletni učilnici.

Cilji in kompetence:	**Objectives and competences:**
Cilji: • Nadgraditi osnovno znanje stavbarstva in konstrukterstva z načeli projektiranja požarno varnih stavb. • Podati osnovne ugotovitve o nastanku, razvoju in poteku požarov v zgradbah in naravnem okolju. • Seznaniti študente z modeli požarne obtežbe skladno z Evrokodom EN 1991-1-2 in z ukrepi aktivne in pasivne požarne zaščite. • Privzgojiti občutek za pomen ukrepov požarne zaščite v luči socioloških, naselitvenih, ekonomskih in drugih faktorjev. • Povezati znanja iz drugih predmetov s požarnimi problemi. • Vpeljati osnovna načela požarno varnega projektiranja lesenih, armiranobetonskih in jeklenih konstrukcij. Pridobljene kompetence: • Sposobnost ocene požarne ogroženosti objekta ter načrtovanja ukrepov požarne zaščite. • Sposobnost izbire primernega modela požarne obtežbe. Sposobnost uporabe poenostavljenih računskih metod za oceno požarne odpornosti enostavnih nosilnih konstrukcij. • Sposobnost izdelave požarnega elaborata za preproste objekte.	Objectives: • To upgrade the basic knowledge of architecture and design with principles of fire- resistant buildings. • To provide the basic knowledge on the growth, development and progress of fires in buildings and natural environment. • To familiarize students with models of fire load in accordance with EN 1991-1-2 standard and measures of active and passive fire protection. • To obtain a sense of the importance of fire. • Safety measures in the light of sociological, urban, economic and other factors. • To relate knowledge from other courses with • Fire problems. • To introduce the basic principles of fire safety design of timber, reinforced concrete and steel structures. Gained competences: • Ability to perform the fire safety assessment of a building and design fire protection measures • Ability of selecting an appropriate fire load model. Ability to use the simplified calculation methods for the assessment of fire resistance of simple load-bearing structures. • Ability to design fire study for simple objects.

Predvideni študijski rezultati:	**Intended learning outcomes:**
• Razumevanje pomena požarnega inženirstva. Razumevanje fizikalnih osnov nastanka in	• Understanding the importance of fire safety engineering. Understanding the physical basis of

razvoja požara ter vpliva visokih temperatur na materiale in konstrukcije. • Znanje osnovnih metod in ukrepov aktivne in pasivne požarne zaščite. • Uporaba pridobljenega znanja pri pripravi magistrskega dela in pri samostojnem ali skupinskem reševanju požarnih problemov na delovnem mestu v praksi. • Povezava pridobljenega znanja z različnih področij naravoslovja in tehnike s problemi požarnega inženirstva. Kritično ovrednotenje računskih modelov in poenostavitev v okviru standardov in predpisov. • Uporaba domače in tuje literature ter evropskih standardov in predpisov s področja požarnega inženirstva. Pridobivanje podatkov s svetovnega spleta, uporaba domačih in tujih baz podatkov. • Izdelava in uporaba preprostih računalniških orodij za reševanje požarnih problemov. • Uporaba razpoložljive programske opreme.	the growth and evolution of fire and influence of high temperatures on materials and structures. • Knowledge of basic methods and measures of • Active and passive fire protection. • Using the knowledge gained at this course in the preparation of the master thesis and when solving practical fire issue problems individually or in a group in practice. • Link of the acquired knowledge from different fields of science and technology with the problems of fire engineering. Critical evaluation of computational models and simplification in the context of standards and regulations. • Use of a domestic and foreign literature and European standards and regulations in the field of fire engineering. • Obtaining information from the World Wide Web, use of domestic and foreign databases. Development and use of simple computational tools for solving fire problems. • Use of the available software.

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

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Ustni izpit	50,00 %	Oral exam
Samostojno izdelana naloga	50,00 %	Seminar work

Reference nosilca/Lecturer's references:

KOLŠEK, Jerneja, PLANINC, Igor, SAJE, Miran, HOZJAN, Tomaž. The fire analysis of a steel- concrete side-plated beam. Finite elements in analysis and design, ISSN 0168-874X. [Print ed.], okt. 2013, letn. 74, str. 93-110, ilustr., doi: 10.1016/j.finel.2013.06.001.

HOZJAN, Tomaž, SAJE, Miran, SRPČIČ, Stane, PLANINC, Igor. Fire analysis of steel-concrete composite beam with interlayer slip. Computers & Structures, ISSN 0045-7949. [Print ed.], 2011, letn. 89, št. 1-2, str. 189-200, doi:10.1016/j.compstruc.2010.09.004.

HOZJAN, Tomaž, PLANINC, Igor, SAJE, Miran, SRPČIČ, Stane. Buckling of an axially restrained steel column under fire loading. International journal of structural stability and dynamics, ISSN 0219-4554, 2011, letn. 11, št. 3, str. 451-472, doi:10.1142/SO219455411004245

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	**PRAKTIČNO USPOSABLJANJE**
Course title:	**PRACTICAL TRAINING**

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Stavbarstvo, druga stopnja, magistrski	Ni členitve (študijski program)	1. letnik	Zimski

Univerzitetna koda predmeta/University course code:	1262

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
6	0	0	0	80	34	4

Nosilec predmeta/Lecturer:	Andreja Istenič Starčič
Vrsta predmeta/Course type:	Obvezni strokovni/Obligatory professional

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

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

Vsebina:	Content (Syllabus outline):
Študent se seznani in opravlja delo, ki ga opravlja diplomant tega študija v praksi. Predvsem: se seznani z organizacijsko strukturo in tehnologijo gradbenega podjetja, se seznani s predpisi o varstvu pri delu in njihovi izvedbi v praksi, de seznani se z aktualnim dogajanjem v gradbenem podjetju, spozna menedžerski vidik dela v podjetju, dela na terenu – aktualnem gradbišču, oziroma v pisarni - samostojno opravi dela na aktualnem projektu pod vodstvom mentorja, razvija uporabo znanstvenoraziskovalnih metod v širšem spektru problemov v stroki, razvija kritične refleksije, socialne in komunikacijske zmožnosti za vodenje	Student is introduced to the performance of work done by graduate in practice. Especially, students are: aware of the organizational structure and technology of building companies, familiar with the regulations about safety at work and their implementation in practice, familiar with current developments in a construction company, introduced to executive aspect of work when undertaking field work - current site, or in office - self- performed work on current project under the guidance of a mentor; they develop the use of scientific research methods in a broad spectrum of problems in the profession, develop critical

skupinskega dela, pokaže iniciativnost in samostojnost pri vodenju najzahtevnejših delovnih sistemov pod nadzorom mentorja.	reflection, social and communication skills for teamwork management, show initiative and independence in the management of most complex work systems under the supervision of mentor.

Temeljna literatura in viri/Readings:

Viri so izbrani v sodelovanju z mentorjem praktičnega usposabljanja glede na vsebine, ki so predpisane in z njimi razpolaga organizacija, ki izvaja praktično usposabljanje. /

Resources are selected in collaboration with the supervisor of practical training in relation to the contents prescribed and disposed of by the organization conducting the practical training.

Interna in druga gradiva v delovni organizaciji.

Smernice za praktično usposabljanje na Univerzi v Ljubljani. 2007. Ljubljana, UL. 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.

Cilji in kompetence:	**Objectives and competences:**
Cilji: • Študent v okviru praktičnega usposabljanja spozna operativno delo v ciljnih poklicih in organizacijsko strukturo subjektov na področju gradbeništva. • Praksa, izvedena med izobraževalnim procesom, ima tudi motivacijski cilj ter namen. • 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: • Obvladovanje uporabe in prenosa teoretičnih znanj, ki jih študent pridobi med študijem pri predavanjih, vajah ter seminarjih, v inženirsko prakso. • Sposobnost za povezovanje teorije in dela v praksi.	Objectives: • In the context of practical training student learns about operational work in targeted occupations and organizational structure of entities in the construction field. • The practice during the educational process has also motivational goal and purpose. • Students learn about the elements of career planning and development and processes related to career development. • Student is facilitated to do self-evaluation of competences and factors that support the processes of professional identification in relation to academic environment and working environments. • Students learn about the characteristics of workplace learning and the characteristics of working environments and the characteristics of observation of workflows. Gained competences: • Control of the application and transfer of theoretical knowledge acquired while studying in academic environment (lectures, tutorials and seminars) to engineering practice. Ability to integrate theory and practical work.

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

• Študent pridobi praktična znanja in izkušnje na področju nalog in storitev gradbene stroke. • Pridobljena znanja mu koristijo pri izdelavi magistrskega dela. • Študent se po opravljeni praksi lažje in hitreje uvaja v delo po končanem študiju, razume različne gradbene subjekte in njihovo vlogo v družbi. • Študent se na podlagi sinteze pridobljenih znanj tekom študija lahko sooči z aktualnimi delovnimi nalogami oz. uporabi aktualna znanja in pripomočke pri izpolnjevanju nalog, ki jih opravlja organizacija, v kateri poteka praktično usposabljanje. • Pridobljena znanja in spretnosti pripomorejo h kakovostnejšemu razumevanje vsebin posameznih predmetov v študijskem procesu, tudi pri izdelavi magistrskega dela, kakor tudi kasneje pri uvajanju na prvo delovno mesto. 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.	• Students will acquire practical knowledge and experience in the field of tasks and services of the construction field. • Obtained knowledge will be useful in the preparation of master thesis. • During the practice students are more efficiently introduced to the work needed after completing their studies, understand various construction entities and their role in society. • Synthesis of knowledge acquired during the study may be confronted with the actual work and tasks through the application of core knowledge and tools in fulfilling the tasks carried out by the organization in which the practical training takes place. • Knowledge and skills to help achieve higher quality of comprehension of the content of individual courses in the study process, also in the writing of master thesis, as well as later in the introduction to the first employment. • Student is able to evaluate work against the objectives and targets achieved. Professional work is reflected on the basis of the information collected. Students develop competences for career planning and self-assessment of knowledge 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 keep a diary and portfolio of practices.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Dnevnik prakse	40,00 %	Diary of practical work
Portfolio	30,00 %	Portfolio
Ustni zagovor	30,00 %	Oral presentation

Reference nosilca/Lecturer's references:

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

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, ilustr.

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:	**PROJEKTIRANJE NOSILNIH KONSTRUKCIJ STAVB II**
Course title:	**DESIGN OF BUILDING STRUCTURES II**

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Stavbarstvo, druga stopnja, magistrski	Ni členitve (študijski program)	1. letnik	Letni

Univerzitetna koda predmeta/University course code:	1777

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

Nosilec predmeta/Lecturer:	Drago Saje, Primož Može
Vrsta predmeta/Course type:	obvezni strokovni/obligatory professional

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Obveznih pogojev ni, vendar je delo študentov zelo oteženo, če nimajo osnovnega znanja statike, trdnosti in dimenzioniranja jeklenih ter lesenih elementov.	There are no mandatory prerequisites however the work of the student will be very difficult without the basic knowledge how to calculate internal forces and how to proportion the steel elements.

Vsebina:	**Content (Syllabus outline):**
Predavanja: Predavanja potekajo v dveh delih: Može: Projektiranje jeklenih stavb; Saje: Projektiranje lesenih in zidanih stavb; Projektiranje jeklenih stavb:	Lectures: Lectures are composed of two basic parts/courses: Može: Design of Steel Buildings; Saje: Design of Timber and Masonry Buildings; Design of Steel Buildings:

Posebnosti zasnove jeklenih stavb (zasnove konstrukcijskih sistemov za prenos vertikalne in horizontalne obtežbe, zasnove stropov, načini zagotavljanje stabilnosti elementov in sistemov), Globalna analiza jeklenih okvirjev (metode, začetne nepopolnosti, modeliranje, dimenzioniranje elementov, presoja rezultatov), Posebnosti potresnoodpornega projektiranja jeklenih stavb (zasnova, duktilnost, ukrepi za zagotavljanje potresne odpornosti jeklenih stavb).	Characteristics of the design of steel buildings (design of structural systems for the transfer of vertical and horizontal loads, the design of floor structural systems, ensuring stability of elements and systems), Global analysis of steel frames (methods, initial imperfections, modeling, design of elements, assessment of results), Particularities of earthquake design of steel buildings (design, ductility , measures to ensure earthquake resistance of steel buildings).
Projektiranje lesenih in zidanih stavb: Posebnosti zasnove lesenih in zidanih stavb (zasnove konstrukcijskih sistemov za prenos vertikalne in horizontalne obtežbe, zasnove strehe, stropov, načini zagotavljanja stabilnosti elementov in sistemov). Analiza in dimenzioniranje nosilnih elementov stavbe (ostrešje, stropovi, stopnice, stebri, stene, temelji).	Design of Timber and Masonry buildings: Characteristics of the design of timber and masonry buildings (design of structural systems for the transfer of vertical and horizontal loads, the design of roof structural system, the design of floor structural systems, ensuring stability of elements and systems), Analysis and design of load-bearing elements of the building (roof, floors, stairs, columns, walls, foundations).
Vaje in seminar: Pri posameznih temah se najprej izdela nekaj preprostih domačih nalog, ki podajo oziroma utrdijo znanja iz konstruiranja. Sledi seminarska naloga, ki obsega analizo in dimenzioniranje tipične jeklene eno-etažne stavbe (industrijska) in lesene/zidane stavbe, kjer študent obdela glavne konstrukcijske sisteme.	Tutorials and seminar: Some simple tutorials will be made to enhance the knowledge related to specific topics of analysis and design of building structures. Then follow seminar work, which includes analysis and design of typical one-storey steel building (industrial) and timber/masonry building, where the student processes the main construction systems.

Temeljna literatura in viri/Readings:

D. Beg, A. Pogačnik. 2009. Priročnik za projektiranje gradbenih konstrukcij po evrokod standardih.

Ljubljana, IZS.

ESDEP - The European Steel Design Education Programme, spletna učilnica UL FGG.

Luís Simões da Silva, Rui Simões, Helena Gervásio. 2016. Design of Steel Structures: Eurocode 3: Design of Steel Structures, Part 1-1 – General Rules and Rules for Buildings. ECCS – European Convention for Constructional Steelwork

Thelanderson, S., Larsen, H.J. (urednika). 2003. Timber Engineering. John Wiley & Sons Inc.

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

• Razložiti in naučiti standardne postopke za zagotavljanje mehanske odpornosti in stabilnosti jeklenih, lesenih in zidanih konstrukcij stavb iz različnih materialov. Pridobljene kompetence: • Poznavanje prednosti uporabe posameznih konstrukcijskih materialov, oziroma njihove kombinacije pri izbiri optimalne zasnove konstrukcijskega sistema. • Razumevanje mehanizmov prenosa obtežbe preko konstrukcijskih sklopov v temeljna tla in osnovnih principov zagotavljanja potresne odpornosti konstrukcij stavb. • Sposobnost uporabe računskih metod in programske opreme za projektiranje nosilnih konstrukcij stavb in njihovih temeljev. • Poznavanje sodobnih IT podprtih orodij v projektiranju.	• To present, explain and teach the procedures providing mechanical resistance and stability of building structures made of steel, timber or masonry. Gained competences: • The ability to choose the “optimum” structural system considering the advantages of different materials and their combinations. • The competence of understanding the load transfer through the structure into the foundation soil. • The competence of understanding the basic factors contributing to earthquake resistance of structures. • The ability to use computer software in the design of structural systems of buildings. • The ability to use the IT supported tools in design.

Predvideni študijski rezultati:	**Intended learning outcomes:**
• Razumevanje delovanja konstrukcijskih sklopov in konstrukcije kot celote ter prenosa obtežbe v temeljna tla. • Razumevanje dejavnikov za zagotavljanje duktilnosti in nosilnosti potresno odpornih konstrukcij in znanje oblikovanja ustreznih konstrukcijskih detajlov. • Sposobnost uporabe računskih metod in programske opreme za projektiranje nosilnih konstrukcij stavb in njihovih temeljev. • Sposobnost identifikacije in kvantifikacije kritičnih obtežb. • Kompetentna uporaba evropskih standardov za projektiranje konstrukcij Eurokod. • Identifikacija in reševanje problemov, kritična analiza, argumentirana izbira med več možnostmi, sinteza, delo v skupini.	• Understanding the role of the structure and its subassemblies in the transfer of loads into the foundation soil. • Understanding of the key factors contributing to the ductility and strength of earthquake resistant structures. • The knowledge to choose and produce suitable structural details. • The use of the design methods and computer software for structural systems (including foundations). • The knowledge to identify and quantify critical loads on structures. • The knowledge of the competent use of the European standards for the design of structures – Eurocodes. • Identification and solving of problems; critical assessment and analysis; argued choice between several options; ability of the synthesis; and working in a group.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predmet temelji na več sodobnih metodah poučevanja, kot so projektno učenje, delo v skupini, poučevanje s poudarkom na interesu študentov in podajanje vsebin v času, ko so potrebne za delo.	The course is based on several up-to-date teaching methods – project based learning, team work, student centred teaching and just-in-time lectures.

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

Sprotno delo: delo na seminarski nalogi in domačih nalogah	50,00 %	Course work and home-works
Zagovor izdelanih nalog	50,00 %	Presentation and argumentation of the project work.
Študentje, ki pri tem ne uspejo, imajo možnost poprave v obliki (pisnega) izpita		Unsuccessful students have an additional option in the form of a written exam.

Reference nosilca/Lecturer's references:

MOŽE, Primož, BEG, Darko. A complete study of bearing stress in single bolt connections. Journal of Constructional Steel Research, ISSN 0143-974X. [Print ed.], apr. 2014, letn. 95, str. 126-140, ilustr.

MOŽE, Primož, CAJOT, Luis-Guy, SINUR, Franc, REJEC, Klemen, BEG, Darko. Residual stress distribution of large steel equal leg angles. Engineering structures, ISSN 0141-0296. [Print ed.], 2014, letn. 71, št. jul., str. 35-47.

ČERMELJ, Blaž, SINUR, Franc, MOŽE, Primož, BEG, Darko. Ciklično obnašanje varjenih ojačanih spojev prečka-steber, eksperimentalni testi = Cyclic behaviour of welded stiffened beam-to-column joints, experimental tests. Gradbeni vestnik : glasilo Zveze društev gradbenih inženirjev in tehnikov Slovenije, ISSN 0017-2774. [Tiskana izd.], maj 2015, letn. 64, str. 114-122, ilustr.

LOPATIČ, Jože, SAJE, Drago, SAJE, Franc. Creep of timber structures. International journal for engineering modelling, ISSN 1330-1365, 2005, vol. 18, no. 1/2, str. 1-10.

SAJE, Drago, BANDELJ, Branko, ŠUŠTERŠIČ, Jakob, LOPATIČ, Jože, SAJE, Franc. Shrinkage of polypropylene fibre reinforced high performance concrete. Journal of materials in civil engineering, ISSN 0899-1561, 2011, vol. 23, iss. 7, str. 941-952.

SAJE, Drago, SAJE, Franc. Sanacija cerkve v Šentjurju na Dolenjskem. V: SAJE, Franc (ur.), LOPATIČ, Jože (ur.). Zbornik 18. zborovanja gradbenih konstruktorjev Slovenije, Bled,

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	**KONSTRUKCIJSKA GRADBENA FIZIKA**
Course title:	**STRUCTURAL BUILDING PHYSICS**

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Stavbarstvo, druga stopnja, magistrski	Ni členitve (študijski program)	1. letnik	Letni

Univerzitetna koda predmeta/University course code:	1258

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
60	0	60	60	0	180	12

Nosilec predmeta/Lecturer:	Zvonko Jagličić
Vrsta predmeta/Course type:	obvezni strokovni/obligatory professional

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

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

Vsebina:	Content (Syllabus outline):
Predavanja: Difuzijska enačba, robni pogoji in odzivni dinamični parametri ovojnega sklopa zgradb. Podrobna analiza toplotnih mostov in konvekcija. Prenos toplote s sevanjem med posameznimi segmenti ovojnega sklopa in sevalne karakteristike materialov (absorptivnost, emisivnost in sipanje). Kondenzacija in transport vlage ter njen vpliv na termodinamske karakteristike ovojnega sklopa zgradbe. Vidna svetloba, svetlobni tok ter razširjanje, odboj in absorpcija svetlobe na posameznih elementih ovojnega sklopa. Zvok v zaprtih prostorih, hrup in	Lectures: Diffusion equation, boundary and initial conditions, and dynamical response parameters of building envelope. Detailed analysis of thermal bridges and Convection. Thermal radiation heat transfer between structural components of building envelope and radiation characteristics of the corresponding materials (absorptivity, emissivity, and scattering cross-sections). Condensation, moisture transport and its influence on thermodynamic properties of the building envelope. Light, radiation flux, propagation, reflection and

kontrola hrupa, merilni instrumenti in merilne metode v akustiki in analizi hrupa. Vaje: Računska analiza izbranih primerov iz prakse s pomočjo analitičnih metod. Uporaba računalniških programov za reševanje problemov iz prakse.	absorption of light on various surfaces of structural components forming the building envelope. Sound in enclosed spaces, noise and noise control, measuring equipment and measurement techniques in acoustics and noise analysis. Exercises: Solving practical engineering problems using analytical methods. Application of computer programs to solve problems encountered in engineering practice

Temeljna literatura in viri/Readings:

Kladnik, R. 1983. Nestacionarni temperaturni pojavi v ovojnem sklopu zgradbe, FAGG. Luikov, A.V. 1975. Heat and mass transfer in capillary porous bodies. Oxford, Pergamon. Biess, D.A., Hansen, C.H. 2003. Engineering Noise Control, Theory and Practice, 3rd edition. Spon Press. Siegel, R., Howell, J.R. 1972. Thermal Radiation Heat Transfer. McGraw-Hill. Peternelj, J., Jagličić, Z. 2014. Osnove gradbene fizike. UL, FGG.

Cilji in kompetence:	**Objectives and competences:**
Cilji: • Nadgraditi osnovno znanje nestacionarne termodinamike, zvočnih pojavov in svetlobnih pojavov z znanjem, ki je specifično za te pojave v grajenem okolju. • Podati poglobljeno znanje prenosa toplote z prevajanjem, konvekcijo in sevanjem, ter zvočnih in svetlobnih pojavov v gradbeništvu. • Podati matematične metode reševanja difuzijske in valovne enačbe z upoštevanjem robnih pogojev karakterističnih za zgradbe in druge gradbene objekte. • Podati pregled računalniških orodij primernih za numerično reševanje konkretnih problemov. Pridobljene kompetence: • Sposobnost fizikalno-matematične formulacije praktičnih problemov na teh področjih. • Pravilna izbira matematičnega orodja.	Objectives: • To expand knowledge and acquire new skills in applications of non-stationary thermodynamics, acoustics and photometry specific to buildings and urban environment. In particular this includes: • In-depth analysis of heat transfer via conduction, convection and radiation. • Sound and light effects in buildings and civil engineering in general. • Mathematical methods used for the solution of diffusion and wave equations subject to particular initial and boundary conditions. • Overview of available computer programs to solve the above problems. Gained competences: • Ability to formulate engineering problems using appropriate physical and mathematical methods in order to obtain quantitative results.

Predvideni študijski rezultati:	**Intended learning outcomes:**
• Pridobljeno poglobljeno znanje o prenosu toplote, vlage in zvoku ter hrupu v zaprtih prostorih.	• In-depth knowledge of heat and moisture transport across structural components in buildings, sound effects and noise in enclosures.

• Razumevanje matematičnih metod za opis in analizo fizikalnih procesov povezanih s toplotnimi in zvočnimi pojavi v zgradbah. • Osvojene računske spretnosti za analitično in numerično reševanje konkretnih problemov. • Doseženo znanje uporabljajo pri izdelavi diplomskega dela oz. v inženirski praksi. • Dobro razumevanje toplotnih in akustičnih pojavov v zgradbah je osnova za varčno rabo energije in primerno izbiro materialov za konstrukcijske sklope. • Sposobnost fizikalno-matematične formulacije procesov v ovojnem sklopu zgradbe. • Sposobnost izbire primernega matematičnega orodja za analizo praktičnih problemov.	• Understanding of physical processes involved in these phenomena and ability to use appropriate mathematical methods used for their analysis. • Application of the above skills in actual solving of practical problems or for writing research proposals. • Good understanding of heat and acoustic phenomena leads to economic use of energy in buildings and, in addition, to proper choice of materials for structural components. • Ability of exact physical and mathematical formulation of processes taking place in the building envelope. Selection of appropriate mathematical methods and tools for the analysis of practical problems.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, računski zgledi na vajah in uporaba prosto dostopnih računalniških programov za izračun prenosa toplote in vlage skozi konstrukcijske sklope.	Lectures and problem solving classes Application of a freely available computer programs designed for solving heat and moisture transport problems.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Ustni zagovor domačih nalog	70,00 %	Oral defence of home assignments
Pisni izpit	30,00 %	Written exam

Reference nosilca/Lecturer's references:

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

COTIČ, Patricia, JAGLIČIĆ, Zvonko, BOSILJKOV, Vlatko. Validation of non-destructive characterization of the structure and seismic damage propagation of plaster and texture in multi- leaf stone masonry walls of cultural-artistic value. Journal of cultural heritage, 2013, 12 str.

JAGLIČIĆ, Zvonko, PAJIĆ, Damir, TRONTELJ, Zvonko, DOLINŠEK, Janez, JAGODIČ, Marko. Magnetic memory effect in multiferroic. Appl. phys. lett., 2013, vol. 102, no. 24, str. 242410-1-242410-4

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	**INFORMACIJSKO MODELIRANJE STAVB**
Course title:	**BUILDING INFORMATION MODELLING**

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Stavbarstvo, druga stopnja, magistrski	Ni členitve (študijski program)	1. letnik	Letni

Univerzitetna koda predmeta/University course code:	1260

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	0	0	30	0	60	4

Nosilec predmeta/Lecturer:	Tomo Cerovšek
Vrsta predmeta/Course type:	obvezni strokovni/obligatory professional

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

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

Vsebina:	Content (Syllabus outline):
Predavanja: Uvod v informacijsko modeliranje stavb (BIM). Metode planiranja uporabe in uvajanja BIM 03. Metode sodelovalnega dela in upravljanja BIM. Metode modeliranja konstruktivnih in nekonstruktivnih elementov stavb za različne potrebe po fazah projekta. Metode modelne analize za trajnostno projektiranje. Metode modeliranja sistemov stavb. Zagotavljanje kakovosti ter odpravljanje ovir pri uporabi BIM ter pregled aspektnih modelov ter ogrodij BIM. OpenBIM in protokoli za izmenjavo BIM 09. Standardizacija BIM	Lectures: Introduction to building information model. BIM execution planning and implementation. BIM collaboration and management. Methods of modelling load-bearing and non-load bearing elements. BIM for Sustainable Design. Methods of modelling Building Systems. QA procedures in BIM and overview of BIM aspect and framework models. OpenBIM protocols for exchange of BIM. Standardization: BS 1192, IFC, CIS, IFD10. Advanced BIM parameterization techniques.

pri projektih PAS, IFC, CIS2. Napredne tehnike parametrizacije BIM. Vaje: BIM (Building information model) Informacijsko modeliranje stavb: konstrukcijski elementi, sestavi, izvlečki za potrebe različnih analiz. Izdelava študij izvedljivosti in analiza variant izvedbe na osnovi informacijskih modelov stavb. Izdelava parametričnih modelov in analiza Green Bim, študije na osnovi informacijskih modelov stavb (za preverbo količin, analizo materialov, energetsko analizo).	Tutorial: Development of BIM, structural and non- structural elements, composites, schedules. Development of design alternatives and 3D coordination based on BIM. Development of parametrical models and libraries, and analysis of Green BIM and various applications of BIM Uses.

Temeljna literatura in viri/Readings:

Eastman, C.M. 2008. BIM Handbook, A Guid to Building Information Modelling. Boca Raton, CRC.

Krygiel E., Bnies, B. 2008. Green BIM, Practice Integrated Sustainable Design with BIM. John Wiley & Sons, Inc.

Levy, F. 2012. BIM in small-scale sustainable design. John Wiley & Sons, Inc.

Učno gradivo v spletni učilnici.

Cilji in kompetence:	**Objectives and competences:**
Cilji: • Pojasniti osnovne koncepte informacijskega modeliranja stavb. • Pripraviti študente na uvajanje in uporabo informacijskih modelov stavb. • Pripraviti študente na analize informacijskih modelov za trajnostno gradnjo stavb. Pridobljene kompetence: • Izdelati shemo informacijskih modelov stavb. • Izdelati konkreten informacijski model in pridobiti ustrezne podatke. • Uporaba informacijskih modelov stavb za vizualizacijo, dokumentacijo in analize. • Analitično obravnavati izmenjavo informacijskih modelov in vlogo pri komunikaciji. • Sposobnost sodelovanja z deležniki v projektu, ki temelji na informacijskih modelih stavb.	Objectives: • Student shall understand major concept relevant for building information modelling. • Student shall be capable to independently plan and implement BIM on small scale projects. • Student shall be capable to perform sustainable design and analysis based on BIM. Gained competences: • Understand and develop small BIM schema. • Independently develop and evolve BIM and gain appropriate data. • Understand and plan various BIM uses, including visualization, documentation, analysis. • Analytically observe the exchange BIM models and their role in project communication. • Capability to collaborate with different project stakeholders using BIM technologies.

Predvideni študijski rezultati:	**Intended learning outcomes:**
• Poznavanje teoretičnih osnov in standardov za BIM. • Poznavanje zahtev in postopkov za trajnostno projektiranje z BIM. • Razumevanja pomena in potenciala BIM.	• Theoretical background and standards for BIM. • Special requirements and procedures for sustainable design supported by BIM. • Importance and potential of BIM.

• Razumevanje kritičnih vsebin in elementov pri implementaciji BIM. • Sposobnost planiranja uporabe in implementacije BIM. • Sposobnost kritične presoje uvajanja BIM glede na zrelost sodelujočih in konkreten projekt. • Sposobnost analizirati in odpraviti ovire za interoperabilnost BIM. Izdelki študentov: • delni informacijski modeli stavb s standardno, • določenimi elementi, • analize za trajnostno projektiranje na osnovi BIM, • integriran projekt BIM z vsemi bistveni elementi in izmenjavami modelnih vsebin.	• Critical digital content and elements for successful implementation of BIM. • Planning and implementation of BIM. • BIM assessments in terms of capability and capacity for implementation on a BIM project. • Analysis of interoperability issues and the related barriers. Students shall produce: • partial BIM models with standards elements and BIM libraries, • analysis for sustainable design based on BIM, • integrated BIM project with all essential load-bearing and non-load-bearing elements.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja sledijo problemsko naravnanemu delu na konkretnem projektu. Vsebine so delno posredovane v obliki multimedijskih gradiv.	Learning is supported by online learning content of management systems with interactive content. Student work is individual as well as in groups.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Sprotno delo: oddaja nalog	50,00 %	Course work and home-works
Pisni teoretični izpit	30,00 %	Written theoretical exam
Projekt	20,00 %	BIM Project

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, ISSN 1474-0346, 2011, letn. 25, št. 2, str. 224-244, ilustr., doi: 10.1016/j.aei.2010.06.003.

CEROVŠEK, Tomo, ZUPANČIČ-STROJAN, Tadeja, KILAR, Vojko. Framework for model-based competency management for design in physical and virtual worlds. Journal of information technology in construction, ISSN 1874-4753, 2010, vol. 15, str. 1-22, ilustr. http://www.itcon.org/2010/1.

CEROVŠEK, Tomo. BIM lifecycle // BIM FM. V: ANTÓNIO RUIVO, Meireles (ur.). 1st BIM International Conference : BIM Forum Portugal, 20. -21. 6. 2013. Porto: S. n., 2013, str. 1-57,ilustr.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	**NAPREDNI MATERIALI**
Course title:	**ADVANCED MATERIALS**

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Stavbarstvo, druga stopnja, magistrski	Ni členitve (študijski program)	2. letnik	Zimski

Univerzitetna koda predmeta/University course code:	1469

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	0	0	60	0	90	6

Nosilec predmeta/Lecturer:	Mateja Dovja
Vrsta predmeta/Course type:	obvezni strokovni/obligatory professional

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

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

Vsebina:	Content (Syllabus outline):
Predavanja: Korelacija med kemijsko strukturo in lastnostmi. Polimerni materiali s povišano temperaturno obstojnostjo in obstojnostjo na UV sevanje. Zaščita polimernih materialov pred pregrevanje: termotropne in termokromne prevleke, premazi z nizko termično emisivnostjo. Premazi s spremenljivo absorbpcijo, ”hladne” barve, radiacijsko hlajenje. Premazi in nanokompozitne prevleke z večfunkcionalnimi lastnostmi (antisoiling, self-cleaning), ”Trde” nanokompozitne prevleke. Uporaba pri sanaciji stavb in za varovanje kulturne dediščine. Optično prepustni polimerni materiali	Lectures: The correlation between chemical structure and properties. Polymer materials with a high thermal stability and resistance to UV radiation. Protection against overheating of polymeric materials: thermotropic and thermochromic coatings, coatings with low thermal emissivity. Coatings with changeable absorption, "cold" colors, radiant cooling. Coatings and nanocomposite coatings with multifunctional properties (antisoiling, self-cleaning), "Hard" nanocomposite coatings. Use the rehabilitation of buildings and for the protection of cultural heritage. Optical permeable polymeric

(PTFE, Mylar). Zaščita kovin proti koroziji z nanokompoziti (korozijski procesi, meritve propadanja, spektroskopija, itd). Hranilniki toplote (PCM). Pregled testnih metod za ugotavljanje obstojnosti materialov (pospešeni testi staranja). Ozelenjene strehe. Ogljični odtis, potencial globalnega segrevanja. Temeljenje na toplotni izolaciji. Patologija v gradbeništvu. Fotovoltaika, fototermika. Prezračevalni kolektorji. Vaje: Pregled eksperimentalnih postopkov za opredeljevanje lastnosti materialov. Spoznavanje procesov priprave nanokompozitnih prevlek in priprava premazov.	materials (PTFE, Mylar). Protection against corrosion of metal nanocomposites (corrosion processes of decay measurements, spectroscopy, etc.). The storage tanks (PCM). Overview of test methods for determining the stability of the materials (accelerated aging tests). Green roofs. Carbon footprint, global warming potential (GWP). Foundations on thermal insulations. Construction pathology. Photovoltaic, Photothermics. Ventilated panels. Tutorial: Review of experimental procedures defining properties of materials. Understanding the process of preparation of nanocomposite coatings and coating preparation.

Temeljna literatura in viri/Readings:

Addington, M., Schodek, D, 2005. Smart Materials and New Technologies, Elsevier.

Orel, B., Šurca Vuk, A., Slemenik Perše, L. 2008. Sončni sprejemniki za pridobivanje sončne toplote: učno gradivo. Ljubljana: Kemijski inštitut.

Granqvist, C. G. (urednik). 1991. Materials science for solar energy conversion systems. Pergamon Press.

Peternelj, J., Jagličić, Z. 2014. Osnove gradbene fizike. UL, FGG.

Študijsko gradivo dostopno na: e-učilnici UL FGG

Raziskovalni laboratoriji in infrastrukturna centra. Dostopno na: http://www.ki.si/raziskovalne-enote/l02-laboratorij-zaspektroskopijo-materialov/.

Cilji in kompetence:	**Objectives and competences:**
Cilji: • Nadgraditi osnovno znanje o naprednih materialih uporabnih za doseganje toplotno-optičnih učinkov v stavbah. • Podati pregled njihovih fizikalno-kemijskih lastnosti v povezavi z strukturo materialov. • Nadgraditi znanje o njihovi uporabi z namenom načrtovanja večfunkcionalnih rešitev. • Podati pregled možnih rešitev v modernih stavbah. Pridobljene kompetence: • Sposobnost koncipiranja toplotno-optičnih rešitev za gradbeništvo na osnovi naprednih materialov.	Objectives: • Upgrade basic knowledge of advanced materials which are useful for achieve thermal-optical effects in buildings. • To give an overview of physical-chemical properties in relation to the structure of materials. • Upgrade knowledge about their use in order to design multifunctional solution. • To give an overview of possible solutions in modern buildings. Gained competences: • Ability of conception of thermo-optical solutions for construction on the basis of advanced materials.

• Sposobnost razpoznavanja prednosti naprednih materialov na osnovi njihovih fizikalno-kemijskih lastnosti.	• Ability understanding of the benefits of advanced materials based on their physical - chemical properties.

Predvideni študijski rezultati:	**Intended learning outcomes:**
• Razumevanje delovanja transparentnih delov stavbnega ovoja, zasnova in analiza vplivov direktnega osončenja in zajema dnevne svetlobe v stavbi, sposobnost ocene odziva stavbe na osončenje in dnevno svetlobo. • Uporaba računskih metod in programske opreme za analizo obravnavanih elementov svetlobnega in (posredno) toplotnega odziva stavbe oziroma prostora. • Sposobnost samostojne ocene položaja in vloge obravnavnih elementov v sistemu okolje/človek/stavba in identifikacija medsebojnih povezav. • Spretnosti uporabe domače in tuje literature in drugih virov, zbiranja in interpretiranja podatkov, identifikacija. • Reševanje problemov, kritična analiza, sinteza, delo v skupini.	• Understanding the functioning of transparent constructional complexes, design and analysis of the effects of insolation and daylight in the buildings, ability to assess the building response to the insolation and daylight. • Application of calculation methods and computer software simulations for analyse of evaluated daylight and (indirectly) also thermal response of the buildings and surroundings. • Ability to independently evaluate the status and the role of the analysed elements in the system: environment/human/building, and identification of mutual interconnections. • Skills for review of relevant literature sources and other references (national, international), collecting and interpreting the data, problem identification. • Problem solving, critical analysis, synthesis, group work.

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

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Seminarske in laboratorijske vaje	70,00 %	Tutorial and laboratory work
Ustni izpit	30,00 %	Oral exam

Reference nosilca/Lecturer's references:

DOVJAK, Mateja, KUKEC, Andreja. Creating healthy and sustainable buildings: an assessment of health risk factors. Cham: Springer Open, cop. 2019. XVIII, 160 str.

DOVJAK, Mateja, MARKELJ, Jernej, KUNIČ, Roman. Embodied global warming potential of different thermal insulation materials for industrial products. *Journal of Engineering and Applied Sciences*, 2018, letn. 13, št. 6, str. 2242-2249.

DOVJAK, Mateja, SHUKUYA, Masanori, KRAINER, Aleš. Connective thinking on building envelope - Human body exergy analysis. *International journal of heat and mass transfer*, ISSN 0017-9310, 2015, vol. 90, str. 1015-1025.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	**UČINKOVITA RABA ENERGIJE**
Course title:	**EFFICIENT ENERGY USE**

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Stavbarstvo, druga stopnja, magistrski	Ni členitve (študijski program)	2. letnik	Zimski

Univerzitetna koda predmeta/University course code:	1471

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
45	0	0	90	0	135	9

Nosilec predmeta/Lecturer:	Mitja Košir
Vrsta predmeta/Course type:	obvezni strokovni/obligatory professional

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

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

Vsebina:	Content (Syllabus outline):
Predavanja: Metodologije za izračunavanje integrirane energijske učinkovitosti stavb: postopki, dimenzioniranje toplotne izolacije: stavba, konstrukcijski sklopi. Uporaba minimalnih zahtev glede energijske učinkovitosti novih in prenovljenih stavb. Energetska certifikacija stavb. Toplotni mostovi. Zaščita stavb pred pregrevanjem. Strategije in ukrepi za energetsko učinkovitost: stavba in konstrukcijski sklopi. Načini uporabe sončne energije v stavbah. Direktiva o energetski učinkovitosti stavb. Pravilnik o učinkoviti rabi energije v stavbah.	Lectures: Methodology for the calculation of integrated energy performance of buildings: methods, sizing of thermal insulation on the level of building and individual constructional complexes. Requirements regarding minimum energy performance for new and renovated buildings. Energy certification of buildings. Thermal bridges. Overheating protection of buildings. Strategies and measures for energy efficiency: building and constructional complexes. Solar energy utilization in buildings. Directive on the

Vaje: Računske metode za stacionarno in dinamično toplotno analizo konstrukcijskih sklopov in stavb. Individualne primerjalne analize toplotnega odziva na izbranih stavbah, z uporabo izbrane programske opreme.	energy performance of buildings. Regulations on energy efficiency in buildings. Tutorial: Tutorial: computational methods for stationary and dynamic thermal analysis of structural components and buildings. Laboratory work: analysis of thermal response of an individually selected building, using appropriate software.

Temeljna literatura in viri/Readings:

Szokolay, S.V. 2014. Introduction to architectural science: the basis of sustainable design. 3rd edn.

New York, NY, Routledge.DeKay, M., Brown, G. Z. 2014. Sun, wind & light. Hoboken, Wiley.

Košir, M., 2019. Climate Adaptability of Buildings: Bioclimatic Design in the Light of Climate Change, ISBN 978-3-030-18455-1, Springer.

La Roche, P. 2017. Carbon-neutral architectural design, ISBN 978-1-4987-1429-7, Taylor & Francis.

Lechner, N. 2014. Heating, cooling, lighting : sustainable design methods for architects. New York, John Wiley & Sons.

Athienitis, A. K. 2015. Modeling, design, and optimization of net-zero energy buildings. Berlin, Ernst & Sohn.

Schittich, C. (urednik.). 2003. Solar Architecture: Strategies, Visions, Concepts. Birkhauser.

Področna zakonodaja.

Študijsko gradivo dostopno na: e-učilnici UL FGG.

Cilji in kompetence:	**Objectives and competences:**
Cilji: • Regulacija porabe toplotne energije za ogrevanje. • Regulacija porabe toplotne energije za hlajenje. • Upoštevanje vplivov oblike stavbe, orientacije in geometrije na porabo energije. • Vpliv strukture zunanjega ovoja na varčno rabo energije. • Izkoriščanjem obnovljivih virov energije v grajenem okolju. Pridobljene kompetence: • Obvladanje projektiranja in dimenzioniranja toplotne zaščite in zaščite pred pregrevanjem. • Sposobnost uporabe predpisov in standardov s tega področja.	Objectives: • The objective of the course is to regulate heating energy consumption. • The objective of the course is to regulate cooling energy consumption. • The influence of building shape, orientation, geometry and envelope structure on the energy consumption is studied. • Final objective is to enable efficient energy use and utilization of renewable energy sources in the built environment. Gained competences: • Students will master the design process with regard to thermal protection and protection of overheating of buildings. • They will be able to use relevant rules and standards.

• Sposobnost uporabe ustrezne programske opreme za optimizacijo na ravni stavbe in njenega ovoja.	• They will be able to use as appropriate software tools for the optimization of energy performance of the entire building as well as its components.

Predvideni študijski rezultati:	**Intended learning outcomes:**
• Sposobnost identifikacije vplivnih faktorjev, ki oblikujejo toplotni odziv stavbe in njenih konstrukcijskih sklopov z uporabo sodobnih metod načrtovanja, dimenzioniranja, izbora tehnologij in materialov. Razumevanje povezav med njimi in stopnje njihovih pomembnosti. • Učinkovita koordinacija razpoložljivih materialov in tehnologij v stavbi, ki vplivajo na porabo toplotne energije. • Sposobnost samostojne ocene položaja in vloge obravnavnih elementov v sistemu okolje/človek/stavba in identifikacija medsebojnih povezav. Spretnosti uporabe domače in tuje literature in drugih virov. • Zbiranja in interpretiranja podatkov. • Identifikacija in reševanje problemov, kritična analiza, sinteza, delo v skupini.	• Ability to identify influential factors that shape the thermal response of the building and its constructional complexes using modern methods of design, dimensioning, choice of technologies and materials. • Understanding the links between them and their relative level of importance. • Effective coordination between available materials and technologies in the building, which affect the use of heating energy. • Ability to assess the situation and the role of individual elements in the environment / man / building system, as well as identification of interrelations. • Ability to use national and international relevant literature and other sources. • Collecting and interpreting data. • Identification of problems and their solving, critical analysis, synthesis, group work.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, laboratorijske vaje in seminarske vaje. Projektni pristop.	Lectures, laboratory exercises and seminar exercises. Project oriented approach.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Ocena izdelka vaj	70,00 %	Project executed during tutorial and lab work
Pisni izpit	30,00 %	Written exam

Reference nosilca/Lecturer's references:

PAJEK, Luka, KOŠIR, Mitja. Implications of present and upcoming changes in bioclimatic potential for energy performance of residential buildings. Building and environment, ISSN 0360-1323. [Print ed.], jan. 2018, letn. 127, str. 157-172, ilustr., doi: 10.1016/j.buildenv.2017.10.040. [COBISS.SI-ID 8205665]

KOŠIR, Mitja, IGLIČ, Nataša, KUNIČ, Roman. Optimisation of heating, cooling and lighting energy performance of modular buildings in respect to locations climatic specifics. Renewable energy, ISSN 0960-1481. [Print ed.], 2018, letn. 129, dec., str. 527-539, ilustr., doi: 10.1016/j.renene.2018.06.026. [COBISS.SI-ID 8491361]

HUDOBIVNIK, Blaž, PAJEK, Luka, KUNIČ, Roman, KOŠIR, Mitja. FEM thermal performance analysis of multi-layer external walls during typical summer conditions considering high intensity passive cooling. Applied energy, ISSN 0306-2619, sept. 2016, letn. 178, str. 363-375, ilustr., doi: 10.1016/j.apenergy.2016.06.036. [COBISS.SI-ID 7505505]

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	**BIVALNO OKOLJE**
Course title:	**LIVING ENVIRONMENT**

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Stavbarstvo, druga stopnja, magistrski	Ni členitve (študijski program)	2. letnik	Zimski

Univerzitetna koda predmeta/University course code:	1345

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
45	0	0	90	0	135	9

Nosilec predmeta/Lecturer:	Mateja Dovjak
Vrsta predmeta/Course type:	obvezni strokovni/obligatory professional

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

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

Vsebina:	Content (Syllabus outline):
Predavanja: Fizični prostor, ergonomija, fiziologija človeka. Viri: geomorgologija, značilnosti podnebij, človek. Toplotno okolje: občutena temperatura, metabolizem, faktor obleke, adaptacija. Svetlobno okolje: vizualno udobje. Kvaliteta zraka: fiziološki minimum, emisije. Vlaga v stavbi, hrup, geneza bivalnega okolja, razvoj tehnologij, koncept bioklimatske orientacije. Zdrava stavba (SBS), primeri dobre prakse, aktualni primeri.	Lectures: Physical active space, ergonomics, human physiology. Sources: geomorphology, climate type characteristics, human wellbeing. Thermal environment: thermal comfort, operative temperature, metabolic rate, effective clothing insulation, process of adaptation. Visual environment: visual comfort. Air quality: physiological minimum, pollutant emissions. Dampness related problems, noise issues, genesis of bioclimatic environment, technology development,

Vaje: Uporaba znanja na konkretnem primeru v stavbi, oblikovanje koncepta, faktorska analiza, optimizacija sistema (sinteza). Simulacije odziva stavbe in prostora s pomočjo programske opreme.	concept of bioclimatic orientation. Healthy building (SBS), examples of best practice. Tutorial: Application of knowledge on a case of a specific building, concept design, factor analysis, system optimization (synthesis). Simulation of building response /active space response with computer software.

Temeljna literatura in viri/Readings:

McMullan, R. 2007. Environmental science in building. New York, Palgrave Macmillan.

Liddament, M.V. 1996. A guide to energy efficient ventilation, AIC-TN vent guide.

Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive (89/106/EEC).

e-učilnica Katedre za stavbe in konstrukcijske elemente na spletu: http://kske.fgg.uni-lj.si

Cilji in kompetence:	**Objectives and competences:**
Cilji: • Izboljšanje kakovosti grajenega okolja. • Zmanjševanje negativnih vplivov na zunanje okolje. • Učinkovita izraba virov. • Zagotavljanje zdravega notranjega okolja za prebivalce. Pridobljene kompetence: • Pozna faktorje, ki vplivajo na bivalno in delovno okolje. • Razume procese delovanja posameznih vplivnih faktorjev in njihovo interaktivnost. • Sposoben je uporabljati računske metode in programsko opremo za področje oblikovanja notranjega okolja. • Obvlada prenos sistema zunanje okolje-ovoj-notranje okolje človek v konceptualizacijo realne stavbe (navezovanje na ostale gradbeno-fizikalne vplive).	Objectives: • The main objectives of the course are to improve the quality of the built environment • Minimization of negative impacts on the environment. • Efficient use of natural resources. • Providing healthy indoor environment for building occupants. Gained competences: • Student is familiar with influencing factors inside living and working environment. • He understands the interactive impacts of defined influencing factors. • He is able to use calculation methods and computer software for the design of healthy and comfort indoor environment. • He masters the transfer between analysed systems: “outdoor environment- building envelope-indoor environment-human wellbeing” (in the framework of conceptualization of specific building case; link to other parameters of building physics).

Predvideni študijski rezultati:	**Intended learning outcomes:**
• Razumevanje delovanja posameznih vplivnih faktorjev notranjega okolja na počutje in zdravje	• Understanding the functioning of the influencing factors of the internal environment

uporabnikov, sposobnost ocene odziva stavbe in uporabnikov na uporabljene ukrepe. • Uporaba računskih metod in programske opreme za analizo obravnavanih elementov kvalitete notranjega okolja. • Sposobnost samostojne ocene položaja in vloge obravnavnih elementov v sistemu okolje/človek/stavba. • Identifikacija medsebojnih povezav v sistemu okolje/človek/stavba. • Spretnosti uporabe domače in tuje literature in drugih virov. • Zbiranja in interpretiranja podatkov. • Identifikacija in reševanje problemov, kritična analiza, sinteza, delo v skupini.	on user health and comfort, the ability to evaluate the building and user response on the implemented measures. • Application of calculation methods and computer software to analyse the evaluated elements of the indoor environmental quality. • Ability to evaluate the status and role of analysed elements in the system "environment/human/building". • Identification of connections in the system "environment/human/building". • Skills for the review of relevant literature sources and other references (national, international). • Collecting and interpreting the data. • Problem identification, problem solving, critical analysis, synthesis, team work.

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

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Ocena izdelka vaj	70,00 %	Seminar and laboratory work.
Pisni izpit	30,00 %	Written exam

Reference nosilca/Lecturer's references:

DOVJAK, Mateja, KUKEC, Andreja, KRISTL, Živa, KOŠIR, Mitja, BILBAN, Marjan, SHUKUYA, Masanori, KRAINER, Aleš. Integral control of health hazards in hospital environment. Indoor + built environment, ISSN 1420-326X, okt. 2013, letn. 22, št. 5, str. 776-795, ilustr.

KOŠIR, Mitja, KRAINER, Aleš, DOVJAK, Mateja, KRISTL, Živa. Automatically controlled daylighting for visual and nonvisual effects. Lighting research & technology, ISSN 1477-1535. [Print ed.], 2011, letn. 43, št. 4, str. 439-455, ilustr.

KOŠIR, Mitja, KRAINER, Aleš, DOVJAK, Mateja, PERDAN, Rudi, KRISTL, Živa. Alternative to the Conventional Heating and Cooling Systems in Public Buildings. Strojniški vestnik, ISSN 0039-2480, 2010, letn. 56, št. 9, str. 575-283, ilustr.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	**AVTOMATSKO VODENJE SISTEMOV**
Course title:	**AUTOMATIC MANAGEMENT OF SYSTEMS**

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Stavbarstvo, druga stopnja, magistrski	Ni členitve (študijski program)	2. letnik	Letni

Univerzitetna koda predmeta/University course code:	1346

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
45	0	0	45	0	90	6

Nosilec predmeta/Lecturer:	Igor Škrjanc, Vito Logar
Vrsta predmeta/Course type:	obvezni strokovni/obligatory professional

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

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

Vsebina:	Content (Syllabus outline):
Predavanja: Sistemi: sistemski pristop, osnovni pojmi o sistemih, sistemski pristop pri načrtovanju vodenja. Modeliranje in simulacija: vrste modelov in načini modeliranja, ciklični postopek, vrednotenje in verifikacija, osnovni zapisi (dif. enačbe, prenosne funkcije in bločni diagrami). Objektno orientirano modeliranje, osnove simulacije, metode simulacije. Orodja: Matlab-Simulink, Dymola-Modelica. Modeliranje in simulacija toplotnih in svetlobnih tokov v zgradbi. Avtomatsko vodenje sistemov: inženirski pristop z bločnimi diagrami in tehnološkimi shemami. Osnovni pojmi (krmiljenje, regulacija,	Lectures: Systems: systems approach, basic concepts, systems approach in control design. Modelling and simulation: types of models and modelling methods, cyclic procedures, validation and verification, basic forms (differential equations, transfer functions and block diagrams). Object oriented modelling, basics of simulation, methods of simulation. Tools: Matlab-Simulink, Dymola-Modelica. Modelling and simulation of heat and light processes in buildings. Automatic control: engineering approach with block diagrams and process schemes, basic concepts (open-loop and closed-loop control, disturbance

sledenje, odpravljanje motenj, učinki povratne zanke na ustaljeno stanje, stabilnost). Osnovne regulacijske strukture: stopenjski, PID, mehki regulator, avtomatsko vodenje toplotnih in svetlobnih tokov v zgradbi. Vaje: Laboratorijske vaje: delo s pomočjo modelersko simulacijskih paketov: Matlab-Simulink in Dymola-Modelica. Izvedba avtomatskega vodenja na modelnih laboratorijskih napravah. Seminar: vsak študent samostojno izdela seminarsko nalogo pod mentorstvom učitelja ali asistenta.	reduction, closed-loop effects on steady state, stability). Basic control structures: step control, PID control fuzzy control, automatic control of heat and light in buildings. Tutorial: Laboratory work: work using modelling/simulation software: Matlab-Simulink and Dymola-Modelica. Application of automatic control on different laboratory plants. Tutorial: each student is required to conduct an individual seminar work under teacher's or assistant's supervision.

Temeljna literatura in viri/Readings:

Škrjanc, I. 2012. Avtomatsko vodenje sistemov. UL, FE. (skripta v pripravi) Zupančič, B. 1996. Zvezni regulacijski sistemi 1. del, 3. Izdaja. UL, FE. Zupančič, B., Karba, R., Matko, D. 1995. simulacija dinamičnih sistemov, 1.izdaja. UL, FE. Karba, R. 1999. Modeliranje procesov, 1. Izdaja. UL, FE. Oblak, R., Škrjanc, I. 2005. Matlab s simulinkom : priročnik za laboratorijske vaje, 1. izdaja. UL FE.

Cilji in kompetence:	**Objectives and competences:**
Cilji: • Prikaz področja avtomatike na zanimiv način preko številnih primerov. • Seznanitev s celovitostjo življenjskega cikla sistemov vodenja. • Poudarek na sistemskem pristopu. Pridobljene kompetence: • Osvojitev osnovnih metod modeliranja in simulacije sistemov. • Osvojitev osnovnih metod avtomatskega vodenja s poudarkom na regulacijskih metodah. • Seznanitev s celovitostjo obravnavanih postopkov s pomočjo primerov iz gradbeništva.	Objectives: • Introduction to the field of automatic control using interesting case examples. • Introduction to control life-cycles. • Emphasis on systems approach. Gained competences: • Mastering basic methods of system modelling and simulation. • Mastering basic principles of automatic control with emphasis on control methods. • Introduction to the integrity of presented procedures using examples from civil engineering.

Predvideni študijski rezultati:	**Intended learning outcomes:**
• Osnovna znanja iz modeliranja, simulacij in avtomatskega vodenja pretežno zveznih dinamičnih procesov, kot so procesi ogrevanja in osvetljevanja v zgradbah. • Znanja bodo pridobljena in demonstrirana ob številnih primerih, kar bo poudarilo uporabnostno komponento.	• Basic knowledge in modelling, simulation and automatic control of mainly continuous dynamic processes, such as heating and lighting processes in buildings. • The assessment and demonstration of the knowledge will be based on various case

• Poglobljeno razmišljanje s pomočjo sistemskega pristopa, ki je vodilo pri obravnavi, omogoča uporabo obravnavanih pristopov na podoben način tudi pri drugačnih problemih. • Sistemski pristop pri reševanju problemov. Modeliranje in simulacija bosta podana na način, ki bo demonstriran pretežno s problemi v gradbeništvu, vendar bo uporabnost dosti širša. • Metode vodenja bodo prav tako širše uporabne. Spoznana računalniška orodja za modeliranje, simulacijo in vodenje bodo gotovo uporabna tudi pri drugih predmetih.	examples, emphasising its usability and applicability. • Concepts of in-depth thinking based on systems approach, allowing the use of the presented concepts in similar manner also on other areas. • Systems approach to problem solving. The methods of modelling and simulation will be presented using different examples from civil engineering, but with broader applicability. • Similarly, the presented methods of systems control are also useful in a wider field of application. Presented software tools for modelling, simulation and control are useful for different lectures as well.

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

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Seminarsko in laboratorijsko delo	70,00 %	Seminar and laboratory work
Pisni izpit	30,00 %	Written exam

Reference nosilca/Lecturer's references:

EULER-ROLLE, Nikolaus, ŠKRJANC, Igor, HAMETNER, Christoph, JAKUBEK, Stefan. Automated generation of feedforward control using feedback linearization of local model networks. Engineering applications of artificial intelligence, ISSN 0952-1976. [Print ed.], Apr. 2016, vol. 50, str. 320-330.

ŠKRJANC, Igor, ŠUBIC, Barbara. Control of indoor CO[sup]2 concentration based on a process model. Automation in construction, ISSN 0926-5805. [Print ed.], Jun. 2014, vol. 42, str. 122-126.

TOMAŽIČ, Simon, LOGAR, Vito, KRISTL, Živa, KRAINER, Aleš, ŠKRJANC, Igor, KOŠIR, Mitja. Indoor-environment simulator for control design purposes. Building and environment, Dec. 2013, vol. 70, str. 60-72.

DOVŽAN, Dejan, LOGAR, Vito, ŠKRJANC, Igor. Implementation of an evolving fuzzy model (eFuMo) in a monitoring system for a waste-water treatment process. IEEE transactions on fuzzy systems, Oct. 2015, vol. 23, no. 5, str. 1761-1776.

LOGAR, Vito, FATHI, Amirhossein, ŠKRJANC, Igor. A computational model for heat transfer coefficient estimation in electric arc furnace. Steel research international, ISSN 1611-3683, 2015, vol. 86, str. 1-9.

LOGAR, Vito, KRISTL, Živa, ŠKRJANC, Igor. Using a fuzzy black-box model to estimate the indoor illuminance in buildings. Energy and buildings, Feb. 2014, vol. 70, str. 343-351.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	**VREDNOTENJE TRAJNOSTI STAVB**
Course title:	**BUILDING SUSTAINABILITY ASSESSMENT**

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Stavbarstvo, druga stopnja, magistrski	Ni členitve (študijski program)	2. letnik	Letni

Univerzitetna koda predmeta/University course code:	1760

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	0	0	30	0	60	4

Nosilec predmeta/Lecturer:	Mitja Košir
Vrsta predmeta/Course type:	Obvezni strokovni /Obligatory professional

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

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

Vsebina:	Content (Syllabus outline):
Cilj predmeta je seznaniti študente s principi okoljskega in trajnostnega inženirskega načrtovanja, oblikovanja in sistemskega pristopa k reševanju problemov in obvladovanju iterativnih postopkov razvoja od abstraktne zamisli do konkretne rešitve konstrukcijskih sklopov, kot tudi stavb kot celote, in obratno. Pri predmetu študent spozna postopke vrednotenja trajnostne gradnje, okoljskega vrednotenja stavbe kot celote, pravilne izbire gradiv in posledično sestavljanje konstrukcijskih sklopov in naprav, spozna dejavnike tveganja, napačne izbire gradiv ali neustrezne kombinacije materialov v poljubnem	The aim of the course is to acquaint students with principles of environmental and sustainable engineering planning, design and systematic approach to problem solving and management of iterative development processes from abstract ideas to concrete solutions of structural components, as well as the buildings as a whole, and vice versa. The students learn about the processes of evaluating sustainable construction, environmental evaluation of the building as a whole, the correct selection of materials and the resulting assembly of structural assemblies and devices, learn about risk factors, the wrong choice of materials or inappropriate

konstrukcijskem sklopu ali stavbi. Pri tem pa upošteva vse parametre celovitega načrtovanja in zahteve za inženirsko načrtovanje stavb. V sklopu laboratorijskih vaj študenti opravljajo izračune z ustrezno računalniško opremo. Predavanja: • Argumenti ekonomičnosti • Argumenti vpliva na okolje • Študija možnosti in izvršljivosti • EKO minimalizem • Vsebovana energija • CO2 ekvivalent • Trajnostnost • Kakovost • Življenjska doba • Trajnost materialov • Določevanje življenjske dobe, določevanje trajnosti • Lokacija stavbe in transporti do mesta vgradnje • Izbira okoljsko primernih gradiv in koncipiranje razvoja ustreznih konstrukcijskih sklopov in celotnih stavb, • Pregled testnih metod za ugotavljanje obstojnosti materialov (pospešeni testi staranja) • Ogljični odtis, potencial globalnega segrevanja	combinations of materials in any structural elements. Taking into account all the parameters of a comprehensive design and engineering requirements for the design of buildings. As a part of laboratory exercises students perform calculations using appropriate computer software. Lectures: • Arguments economy • Arguments impact on the environment • Study possibilities and enforceability • ECO minimalism • The energy content • CO2 equivalent • Sustainability • Quality • Life span • Durability of materials • Determination of service life determination of sustainability • Location of the building and transportation to the installation location • Choosing environmentally preferable materials, and devising the development of advanced structural components, • Review of test methods for determining the durability of materials (accelerated aging tests) • Carbon footprint, global warming potential

Temeljna literatura in viri/Readings:

Pacheco F., Eco Efficient Construction and Building Materials, Life Cycle Assesment (LCA, Eco Labelling and Case Studies, Woodhead Publishing, 2014

Leffers, M.R., Sustainable Construciton and Design – Pearson Education Prentice Hall, 2010

Mequignon M., H. Ait Haddou, Lifetime Environmental Impact of Buildings, Springer, 2014

El Khouli S., John V., Zeumer M., Sustainable construction techniques : from structural design to interior fit-out : assessing and improving the environmental impact of buildings, Institut für internationale Architektur-Dokumentation, 2015

- König H., Kohler N., Kreißig J., Lützkendorf T., A life cycle approach to buildings : principles, calculations, design tools, Institut für internationale Architektur-Dokumentation¸, 2010
  Študijsko gradivo dostopno na: e-učilnici UL FGG.

Cilji in kompetence:	**Objectives and competences:**
Cilji: • Nadgraditi osnovno znanje o izbiri materialov, konstrukcijskih sklopov, kot tudi stavb kot celote v pogledu trajnostne gradnje, zmanjševanju vpliva na okolje in analizi v celotnem življenjskem ciklusu stavb in drugih objektov, • Nadgraditi znanje z metodami, teoretičnimi in praktičnimi rešitvami, z namenom okoljsko	Objectives: • To upgrade the basic knowledge about choice of materials, structural assemblies, as well as the buildings as a whole in the context of sustainable construction, reducing the impact on the environment and analysis throughout the life cycle of buildings and other structures.

samovzdržnega načrtovanja, s čim manjšim vplivom na okolje. • Podati pregled naprednih metod in načinov ugotavljanja in dokazovanja vplivov na okolje, tako v procesu proizvodnje (pridobivanja surovin, predelave, proizvodnje, same vgradnje gradiv in gradnje objektov, vključno z vsemi transporti), uporabe (potrebne energije za • vzdrževanje stavbe, obnove, sanacije in druga popravila) in konca uporabe (odstranjevanje in dekompozicija objektov, možnost ponovne uporabe, recikliranja in deponiranja). Pridobljene kompetence: • Sposobnost izbire gradiv v procesu načrtovanja objektov s ciljem čim manjšega vpliva na okolje, ob istočasnem upoštevanju vplivov v celotnem življenjskem ciklusu stavb in drugih objektov, • Nadgraditi vsa do sedaj pridobljena znanja s področja stavbarstva z znanji okoljsko vzdržne gradnje in uporabe objektov v celotni življenjski dobi, • Sposobnost razpoznavanja prednosti okoljske gradnje in uporabe objektov.	• To upgrade the knowledge of methods, theoretical and practical solutions in order to sustainable environmental planning, with minimum impact on the environment. • To give an overview of advanced methods and ways of identifying and proving the impact on the environment, both in the production process (extraction, processing, production, installation of materials and construction of buildings as a whole, including all transports) and use (energy required for building maintenance, renovation, rehabilitation and other repairs) and end use (remove and decomposition of objects and its parts, re-use, recycling). Acquired competences: • Ability to choose materials in the design process of buildings with a view to minimize the impact on the environment, taking into account all impacts throughout the lifecycle of buildings and other structures, • Upgrade all acquired knowledge in the field of architecture with the skills of environmentally sustainable construction and use of buildings throughout its lifetime, • Ability to recognize environmental benefits of the construction and use of buildings.

Predvideni študijski rezultati:	**Intended learning outcomes:**
• Sposobnost koncipiranja rešitev v pogledu varovanja okolja in zniževanja vplivov na okolje. • Študent s svojim znanjem in izkušnjami postane konkurenčen na trgu strokovnega, raziskovalno - razvojnega in znanstvenega področja, s poudarkom na grajenem okolju.	• Ability to create a solution in view of protecting the environment and reducing environmental impacts on the environment. • Students got knowledge and experience to become competitive in the professional market, research - development and scientific fields, with a focus on the built environment.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, seminarske naloge, laboratorijske vaje, domače naloge.	Lectures, tutorials, consultations, homework.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Seminarske naloge in sprotno delo	70,00 %	Exercises and homework
Izpit (teoretičen del)	30,00 %	Exam (theoretical part)

Reference nosilca/Lecturer's references:

PAJEK, Luka, HUDOBIVNIK, Blaž, KUNIČ, Roman, KOŠIR, Mitja. Improving thermal response of lightweight timber building envelopes during cooling season in three European locations. Journal of cleaner production. [Print ed.]. jul. 2017, letn. 156, str. 939-952, ISSN 0959-6526. DOI: 10.1016/j.jclepro.2017.04.098.

KOŠIR, Mitja, IGLIČ, Nataša, KUNIČ, Roman. Optimisation of heating, cooling and lighting energy performance of modular buildings in respect to locations climatic specifics. Renewable energy. [Print ed.]. 2018, letn. 129, dec., str. 527-539, ISSN 0960-1481. DOI: 10.1016/j.renene.2018.06.026.

TÖRÖK, Teja, KOŠIR, Mitja, DOVJAK, Mateja. Celovito ocenjevanje trajnostnih vidikov gradnje na primeru enodružinske hiše = Holistic assessment of sustainability aspects on a case of single family detached house. Gradbeni vestnik : glasilo Zveze društev gradbenih inženirjev in tehnikov Slovenije. [Tiskana izd.]. nov. 2016, letn. 65, str. 234-252, ISSN 0017-2774.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	**PAMETNA HIŠA**
Course title:	**SMART HOUSE**

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Stavbarstvo, druga stopnja, magistrski	Ni členitve (študijski program)	2. letnik	Letni

Univerzitetna koda predmeta/University course code:	1347

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	0	0	30	0	60	4

Nosilec predmeta/Lecturer:	Mitja Košir
Vrsta predmeta/Course type:	Obvezni strokovni/Obligatory professional

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

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

Vsebina:	Content (Syllabus outline):
Predavanja: Geneza odnosa koncept – tehnologija. Interaktivnost vplivov na lokaciji. Sheme sistema pametne hiše: okolja, sistemi vedenja, stopnje vodenja, implementacija. Vloga individualnosti: zdravje, udobje, učinkovitost pri načrtovanju. Interaktivnost in povezanost prostora in časa s povezavo tega načela z informacijsko tehnologijo. Vpliv kulture in tehnologije, fiziologije in energije ter nove informacijske tehnologije na učinkovitost. Topologija komunikacij. Pametni proizvodi, podsistemi in avtomatizirano bivalno okolje. Vpliv dinamične odprtine in fasadni sistemi. Regulacija	Lectures: Relation between concept and technology. Interactivity of various influence factors on the building location. Schemes of smart house systems: environment, systems of user behaviour, regulation, implementation. Role of individuality in the process of design: health, comfort, efficiency. Space and time interactivity in the built environment and its integration with information technology. Impact of culture and technology, physiology, energy use issues and new information technology on the system performance. Topology of communications. Smart products, subsystems and automated living

dnevne/umetne svetlobe. Pregled in kritična predstavitev aktualnih primerov. Laboratorijske vaje: Načrtovanje zasnove stavb na osnovi izhodišč dinamičnega odziva na zunanje spremembe. Individualne simulacije in primerjalne analize izbranih primerov stavb iz vaj.	environment. Influence of dynamically regulated façade envelope. Daylight/artificial light control. Review and critical presentation of real life examples. Tutorial: Tutorial: strategies for the design of residential buildings on the basis of dynamic response to outdoor conditions. Laboratory work: individual simulations and comparative analysis of the selected practical examples.

Temeljna literatura in viri/Readings:

Addington, M., Schodek, D. 2005. Smart Materials and Technologies. Elsevier, Architectural Press. (izbrana poglavja)

IEA (International Energy Agency). 1999. Solar Energy Houses, Strategies, Technologies, Examples, James&James.

Lee, E., Selkowitz, S., Bazjanac, V., Inkarojrit, V., Kohler, C. 2002. High-performance commercial building facades. Lawrence Berkley National Laboratory.

Krainer, A. 1993. Toward smart buildings, (Building science and environment-conscious design, Module 1: Design principles, 7). London: European Commission.

European Committee for Standardisation. 2012. EN 15232: Energy Performance of Buildings—Impact of Building Automation, Controls and Building Management, 2nd edition. Brussels, European Committee for Standardisation.

Študijsko gradivo dostopno na: e-učilnici UL FGG

Cilji in kompetence:	**Objectives and competences:**
Cilji: • Izboljšanje kakovosti bivalnega in delovnega okolja z razumno uporabo novih tehnologij in minimalno porabo energije za delovanje sistema. • Optimalna komunikacija z drugimi strokami in enakopravno sodelovanje s svojimi kompetencami z njimi. • Vodenja sistemov načrtovanja in gradnje, kjer se bo v praksi pojavil skupaj z arhitektom. Pridobljene kompetence: • Obvladanje osnovnih principov inženirskega načrtovanja. • Obvladanje postopka sistemske in faktorske analize.	Objectives: • The main objectives of the course are to improve the quality of the living and working environment with the rational use of new technologies and minimal use of energy for system operation. • Optimal communication with other experts with equal participation in their own field of competences. • Being able to design the framework of control systems of buildings. • Working in coordination with architect. Gained competences: • Mastering the basic principles of engineering design, mastering the processes of system analysis and factor analysis.

• Sposobnost uporabe različnih orodij za analizo in načrtovanje stavb. • Sposobnost uporabe literature in kritične presoje produktov razvoja stroke. • Sposobnost upoštevati tekočo zakonodajo in standarde.	• Ability to use calculation methods and computer software in the process of building design. • Ability to use relevant literature with critical evaluation of available products. • Getting familiar with current legislation from relevant filed.

Predvideni študijski rezultati:	**Intended learning outcomes:**
• Sposobnost identifikacije vplivnih faktorjev, ki oblikujejo dinamično in sonaravno bivalno okolje z razumno uporabo razpoložljivih tehnologij. Razumevanje povezav med njimi in stopnje njihovih pomembnosti. • Učinkovita koordinacija različnih strokovnih področij, ki se pojavljajo pri načrtovanju in gradnji stavb in aktivno sodelovanju na delu, ki ga pokrivajo gradbeniške intervencije. • Sposobnost samostojne ocene položaja in vloge obravnavnih elementov v sistemu okolje/človek/stavba in identifikacija medsebojnih povezav. • Spretnosti uporabe domače in tuje literature in drugih virov. • Zbiranja in interpretiranja podatkov. • Identifikacija in reševanje problemov, kritična analiza, sinteza, delo v skupini.	• Ability to identify the influencing factors for the design of dynamic and sustainable living environment with rational use of new technologies. Understanding the interconnections among them and the level of individual importance. • Efficient coordination of various fields influencing the design of buildings and construction, active participation in implementation of interventions. • Ability to evaluate the status and the role of elements in the “environment/human/building” system, identification of interconnections between them. • Skills for review of relevant literature sources and other references (national, international). • Collecting and interpreting the data. • Identification and solving of problems, critical analysis, synthesis, group work.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, laboratorijske vaje in seminarske vaje. Projektni pristop.	Lectures, laboratory exercises and seminar exercises. Project oriented approach.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Laboratorijsko delo (projektno delo)	70,00 %	Laboratory work (project work)
Pisni izpit	30,00 %	Written exam

Reference nosilca/Lecturer's references:

KOŠIR, Mitja. Adaptive building envelope - an integral approach to indoor environment control in buildings : chapter 6. V: PONCE CRUZ, Pedro (ur.). Automation and control trends. Rijeka: InTech. 2016, str. 121-148, ilustr., doi: 10.5772/64951.

TOMAŽIČ, Simon, LOGAR, Vito, KRISTL, Živa, KRAINER, Aleš, ŠKRJANC, Igor, KOŠIR, Mitja. Indoor-environment simulator for control design purposes. Building and environment, ISSN 0360-1323. [Print ed.], Dec. 2013, vol. 70, str. 60-72, ilust.

KOŠIR, Mitja, KRAINER, Aleš, KRISTL, Živa. Integral control sistem of indoor environment in continuously occupied spaces. Automation in construction, ISSN 0926-5805. [Print ed.], 2012, letn. 21, št. 1, str. 199-209, ilustr.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	**MAGISTRSKI SEMINAR**
Course title:	**MASTER SEMINAR**

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Stavbarstvo, druga stopnja, magistrski	Ni členitve (študijski program)	2. letnik	Letni

Univerzitetna koda predmeta/University course code:	1761

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
0	30	0	0	60	90	6

Nosilec predmeta/Lecturer:	Mateja Dovjak
Vrsta predmeta/Course type:	Obvezni strokovni/Obligatory professional

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

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

Vsebina:	Content (Syllabus outline):
Študenti pri Magistrskem seminarju v uvodnem delu poslušajo serijo predavanj s področja znanstveno raziskovalnega in strokovnega dela (hipoteza, eksperimentalno delo, modeliranje, ponovljivost eksperimentov …), zbiranja podatkov in literature ter raziskovalne etike in intelektualne lastnine. Predstavljeni so pristopi k oblikovanju teme magistrske naloge, iskanja literature ter priprave in oblikovanja znanstveno-tehničnega teksta. Skozi redna individualna srečanja z mentorji in somentorji ter vodjo seminarja študenti izoblikujejo	Students at the Masters seminar attend a series of lectures on the subject of scientific research and professional work presentation (hypothesis, experimental work, modelling, repeatability of experiments,...), data and literature search and preparation as well as research ethics and intellectual property. The basic approaches for writing and conceptualization of master's thesis topic, search for literature and the preparation and design of scientific and technical texts are presented.

temo magistrske naloge (druge oblike študija v obsegu 60 h). V času trajanja seminarja pripravijo dispozicijo naloge, ki jo javno predstavijo in zagovarjajo ob koncu semestra.	Through regular individual meetings with supervisors, co-supervisors and the leader of the seminar, students develop their own master thesis topic (other forms of study in the extent of 60 h). During the seminar they prepare master thesis disposition, which is publicly presented and defended at the end of the semester.

Temeljna literatura in viri/Readings:

Evans, D., Gruba, P. 2002. How to Write a Better Thesis, Second edition. Melbourne University Press.

Young, M. 2002. The technical writer's handbook – Writing with style and clarity. University Science Books.

Montgomery, D. C., Runger, G. C. 2007. Applied Statistics and Probability for Engineers. John Wiley & Sons.

Koler-Povh T., Turk G. 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

Članki v strokovnih in znanstveno raziskovalnih revijah ter znanstvene monografije, ki jih študentje potrebujejo pri pisanju svojega magistrskega dela.

Cilji in kompetence:	**Objectives and competences:**
Cilji • Predstavitev lastnega dela. • Priprava izhodišč za samostojno izdelavo obsežnejšega strokovnega dela. • Definiranje ciljev in načina doseganja le-teh. • Kritična opredelitev do dela drugih. Pridobljene kompetence • Sposobnost samostojnega raziskovalnega in načrtovalskega dela. • Sposobnost izdelave in predstavitve dispozicije magistrskega dela. • Pridobitev ustrezne literature/podpore.	Objectives: • Presentation of executed work. • Preparation of starting points for the execution of individual professional work. • Definition of goals and method for theirs execution. • Critical assessments of other students work. Gained competences: • Ability for independent research and design. • Ability to make and present a master thesis disposition. • Acquirement of the appropriate literature.

Predvideni študijski rezultati:	**Intended learning outcomes:**
• Sposobnost predstavitve disertacije lastnega magistrskega dela in razumevanje dela drugih študentov. • Priprava učinkovite in razumljive predstavitve strokovnih vsebin. • Metodologija učinkovite komunikacije (pisna in ustna). • Oblikovanje fokusa raziskovalnega in strokovnega dela. • Zasnova strukture magistrskega dela (hipoteza, metode, pregled literature). • Iskanje relevantne literature.	• Ability to present and defend the disposition of master thesis and the ability to understand work of other students. • Preparation of an effective and comprehensive presentation of professional content. • The methodology of effective communication (written and oral). • Creation of research focus in the framework of the professional work. • Conception of the master thesis structure (hypothesis, methods, literature review). • Finding relevant literature.

Metode poučevanja in učenja:	Learning and teaching methods:
Predavanja vodje seminarja ali drugih pedagogov, raziskovalno delo, individualni sestanki z mentorjem, somentorjem in vodjo seminarja, predstavitve dispozicije magistrskega dela s strani študentov.	Lectures by the seminar organizer or by other lecturers, individual meetings with supervisors, co-supervisors and the leader of the seminar, student's presentation of master thesis disposition.

Načini ocenjevanja:	Delež/Weight	Assessment:
Aktivna udeležba na seminarju	40,00 %	Active participation in seminar work
Priprava in javna predstavitev teme in zasnove magistrskega dela (dispozicija)	60,00 %	Preparation and public presentation of the master thesis concept (disposition)

Reference nosilca/Lecturer's references:

DOVJAK, Mateja, KUKEC, Andreja. Prevention and control of sick building syndrome (SBS). Part 2, Design of a preventive and control strategy to lower the occurrence of SBS. Sanitarno inženirstvo, dec. 2014, no. 1, vol. 8, str. 41- 55.

DOVJAK, Mateja, KUKEC, Andreja, KRISTL, Živa, KOŠIR, Mitja, BILBAN, Marjan, SHUKUYA, Masanori, KRAINER, Aleš. Integral control of health hazards in hospital environment. Indoor + built environment, okt. 2013, letn. 22, št. 5, str. 776-795.

KACJAN ŽGAJNAR, Katarina, GALIČIČ, An, ZORAN, Urška, PAJEK, Luka, DOVJAK, Mateja. Analysis of sanitary-technical and hygienic conditions of Slovenian kindergartens and proposed measures. Sanitarno inženirstvo, dec. 2013, no. 1, vol. 7, str. 4-20.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	**MAGISTRSKO DELO**
Course title:	**MASTER THESIS**

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Stavbarstvo, druga stopnja, magistrski	Ni členitve (študijski program)	2. letnik	Letni

Univerzitetna koda predmeta/University course code:	1348

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

Nosilec predmeta/Lecturer:	
Vrsta predmeta/Course type:	Obvezni strokovni/Obligatory professional

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Opravljen Magisterski seminar, odobrena tema in mentor s strani Študijskega odbora Oddelka za gradbeništvo skladno s Pravilnikom o študiju na I. in II. stopnji.	Passed Master seminar, approved topic and supervisor by the Study Board of the Department of Civil Engineering according to the Rules of 1st and 2nd cycle studies.

Vsebina:	**Content (Syllabus outline):**
Magistrsko delo se izdela pod mentorstvom izbranega učitelja. Izhodišče za izdelavo magistrskega dela je opravljen Magistski seminar v kontekstu katerega se pripravi dispozicija magistrske naloge. Delo se javno predstavi ob zaključku študija. Vsebovati mora: • Uvod • Delovno hipotezo • Pregled virov • Material in metode	Master thesis shall be made under the supervision of a selected teacher. Disposition of master thesis executed in the Master seminar course is the basis for the preparation of master thesis. The work is presented in public at the end of the study. It must include: • Introduction • The working hypothesis • Overview of sources • Material and methods

• Rezultate • Razpravo • Povzetek Praviloma se v magistrskem delu obravnavajo praktični problemi s področja stavbarstva (predvsem na področju bistvenih zahtev št. 3, 4, 5 in 6) ter podajajo rešitve, do katerih pridejo s pomočjo študija in izsledkov lastnega raziskovalnega dela.	• Results • Discussion • Summary The thesis will ordinarily deal with practical problems from the area of buildings (mainly in the area of essential demands No. 3, 4, 5 and 6) that provide further solutions which come out from the study and from the results of students' own work.

Temeljna literatura in viri/Readings:

Literatura s področja vsebine diplomskega 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 creating higher part of the Faculty of Civil and Geodetic Engineering and citation of sources.

Cilji in kompetence:	**Objectives and competences:**
Cilji: • Uporabiti pridobljena znanja v poglobljenem študiju na temi magistrskega dela. • 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. Pridobljene kompetence: • Sposobnost samostojnega načrtovalskega in raziskovalnega dela. • Sposobnost izdelave celovite in zaključene projektne in/ali raziskovalne naloge. • Z javno predstavitvijo magistrskega dela pridobiti komunikacijske spretnosti in sposobnosti.	Objectives: • To use the knowledge gained by in-depth 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. Gained competences: • Ability to independent research and design. • Ability to produce report about the executed design and/or research task. • With public presentation student obtains communication skills and abilities.

Predvideni študijski rezultati:	**Intended learning outcomes:**
• Pridobi znanja na vseh fazah, ki so del samostojnega reševanja konkretnih problemov in nalog na področju stavbarstva, sodelovanja in tudi skupinskega dela v okviru različnih subjektov na področju stavbarstva. • Razume stavbarstvo kot interdisciplinarno panogo, vezano na ostale naravoslovne in tehniške vede in na okolje. • Uporaba doseženega znanja v inženirski praksi.	• Students acquire knowledge in all phases, which are part of a real problem and tasks in buildings, as well as cooperation and teamwork within various entities in the area of buildings. • They understand the interdisciplinary of this area. • They learn how to use the theoretical knowledge in engineering practice. • Use of theoretical knowledge in practice.

Metode poučevanja in učenja:	Learning and teaching methods:
Samostojno delo, konzultacije	Independent work, consultations

Načini ocenjevanja:	Delež/Weight	Assessment:
Magistrska naloga	50,00 %	Master thesis
Javna predstavitev in zagovor	50,00 %	Public presentation and defence

Reference nosilca/Lecturer's references:

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	**TEHNOLOGIJA INSTALACIJ**
Course title:	**TECHNOLOGY OF INSTALLATIONS**

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Stavbarstvo, druga stopnja, magistrski	Ni členitve (študijski program)		Letni, Zimski

Univerzitetna koda predmeta/University course code:	1263

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

Nosilec predmeta/Lecturer:	Vincenc Butala
Vrsta predmeta/Course type:	Izbirni strokovni/Elective professional

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

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

Vsebina:	Content (Syllabus outline):
Uvod v vsebine, namen predmeta in program, kompetence. Notranje okolje v stavbah. Modeliranje notranjega okolja. Koncepti učinkovitih ter inovativnih sistemov za bivanje in delo uporabnika prostora, ter drugih namembnosti prostorov. Odziv uporabnika prostora na občutene parametre notranjega okolja – študija funkcij in modelov. Napredne tehnologije in sistemi za OPK in pripravo tople vode. Osnove regulacije in krmiljenja OPK sistemov za doseganje zahtevanih (želenih) parametrov v notranjih prostorih stavb. Osnove meritev in monitoring OPK sistemov. Reševanje	Lectures: Introduction to topics, aims of the course and program, competences. Indoor environment in buildings. Indoor environment modelling. Concepts of efficient and innovative systems for occupant's living and working environment, and for other purposes of spaces. Occupant's response to the perceptible indoor environment parameters – studies of functions and models. Advanced technologies and systems for HVAC and hot water preparation. Fundamentals of regulation and feedback control of HVAC systems to achieve the required (desired) parameters in indoor spaces of

problemov in osnovna načela projektiranja ter ocenjevanje kakovosti OPK sistemov. Vaje: Teoretične vaje (uporaba različnih modelov za analizo notranjega okolja, računanje posameznih parametrov notranjega okolja). Laboratorijske vaje (spoznavanje z merilno opremo, meritev neposrednega notranjega okolja, demonstracijske vaje na laboratorijskem modelu klimatske naprave) Seminarski izdelek: Študent bo izbral vsebino, v smeri katere želi poglobiti svoje znanje. V sodelovanju z učiteljem bo izdelal seminar.	buildings. Fundamentals of measurements and HVAC monitoring. Problem solving, planning fundamentals, and quality assessment of the HVAC systems. Tutorial: Theoretical exercises (use of different models for the analysis of indoor environment, calculating different parameters of indoor thermal environment). Laboratory work (learning about measuring equipment, direct measurement of indoor environment parameters, demonstration exercises on a laboratory model of air-conditioner). Seminar work: Students will choose the work task depending on individual requests to deepen their knowledge. In collaboration with teachers they will create seminar work.

Temeljna literatura in viri/Readings:

ASHRAE. 2007. ASHRAE Handbook: HVAC Application. Atlanta.

Mundt, E. et al. 2004. Ventilation effectiveness, REHVA Guidebook 2. Brussels.

Handbuch der Klimatechnik, Verlag C.F. Muller GmbH, Karlsruhe, 1989.

Wargocki, P. et al. 2006. Indoor climate and productivity in offices, REHVA Guidebook 6. Brussels.
Bilateral project. Thermal energy storage. Dostopno na: http://www.fs.uni-lj.si/los.

Cilji in kompetence:	**Objectives and competences:**
Cilji: • Podati osnove razumevanja in poznavanja notranjega okolja stavb (toplotno okolje, kakovost zraka) v korelaciji z uporabnikom prostora in strojnimi instalacijami. • Podati osnove povezave prostorske umeščenosti uporabnika prostora – človeka (npr. delovno okolje) z vrednotenjem notranjega okolja na podlagi osnovnih tehničnih zakonitosti in strojnimi instalacijami. • Podati osnovne tehnologije in osnove (sistemov) ogrevanja, prezračevanja in klimatizacije (hlajenja) (OPK) ter sistemov za pripravo tople vode. • Podati teoretične osnove regulacije OPK sistemov. Pridobljene kompetence: • Pridobljena znanja bodo omogočila, da bo študent: • Sposoben oceniti in osnovno načrtovati delovno in bivalno notranje okolje (toplotno okolje,	Objectives: • The main objective of this course is to make student understand the fundamentals of indoor environment in buildings (thermal environment and air quality) in correlation with the occupants and engineering installations. • To explain the fundamental relations of the occupant's position in a room (e.g. working environment) with indoor environment evaluation considering the fundamental technical requirements and engineering installations. • To explain the basics of technologies and heating, ventilation and air-conditioning systems as well as the fundamentals of hot water systems. • To explain the theoretical fundamentals of the HVAC system regulation. Gained competences: • Ability to estimate and prepare basic design of working and living environment (thermal

kakovost zraka) s predvidenim tveganjem za ugodje in zdravje uporabnika prostora, • Sposoben osnovnega modeliranja parametrov notranjega okolja, • Sposoben prepoznati različne osnovne ogrevalne, prezračevalne in klimatske sisteme in sisteme za pripravo tople vode.	environment, air-quality) with foreseen risk for the occupant's comfort and health risk. • Ability of basic modelling of the indoor environment parameters. • Ability to identify different heating, ventilation and air-conditioning systems and hot water systems.

Predvideni študijski rezultati:	**Intended learning outcomes:**
• Sposobnost razumevanja notranjega okolja v korelaciji z uporabnikom prostora in s tem povezanega delovanja OPK sistemov. • Uporaba pridobljenih znanj pri osnovnih analizah ocenjevanja notranjega okolja in ustreznosti vgrajenih OPK v inženirski praksi. • Pridobljena znanja so izjemno potrebna pri gradbenem inženirstvu. • Sposobnost logičnega razmišljanja in ustrezen inženirski pristop, ki vodi v kakovostno gradbeno aplikacijo. • Uporaba ustrezne literature, zbiranje in interpretacija podatkov, delna kritična analiza. • Sposobnost upoštevanja dinamike procesov pri načrtovanju in uporabe računalniških programov.	• Ability to understanding the indoor environment in correlation with occupants and HVAC system operating. • Application of acquired knowledge at fundamental indoor environment analysis and assessments and suitability of built-in HVAC systems. • Ability to think logically and take appropriate engineering approach which leads to high-quality application. • Using corresponding literature, collecting and interpreting data, critical analysis. • Ability to take into consideration the processes of dynamics at the planning and use of computers programs.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, teoretične in laboratorijske vaje, samostojna izdelava individualnih nalog.	Lectures, theoretical and laboratory tutorial, individual work.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Seminar	20,00 %	Work
Laboratorijske vaje	30,00 %	Laboratory tutorial
Pisni izpit	50,00 %	Written exam

Reference nosilca/Lecturer's references:

MAZEJ, Mitja, BUTALA, Vincenc. Investigation in the characteristics of the personal ventilation using computational fluid dynamics. Indoor + built environment, ISSN 1420-326X, 2012, vol. 21, no. 6, str. 749-771, ilustr.

PREK, Matjaž, BUTALA, Vincenc. An enhanced thermal comfort model based on the exergy analysis approach. International journal of exergy, ISSN 1742-8297. [Print ed.], 2012, vol. 10, iss. 2, str. 190-208.

PREK, Matjaž, BUTALA, Vincenc. Principles of exergy analysis of human heat and mass exchange with the indoor environment. International journal of heat and mass transfer, ISSN 0017-9310. [Print ed.], Dec. 2010, vol. 53, iss. 25/26, str. 5806-5814.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	**INFORMACIJSKE IN KOMUNIKACIJSKE TEHNOLOGIJE V GRAJENEM OKOLJU**
Course title:	**INFORMATION AND COMMUNICATION TECHNOLOGIES IN BUILT ENVIRONMENT**

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Stavbarstvo, druga stopnja, magistrski	Ni členitve (študijski program)		Letni, Zimski

Univerzitetna koda predmeta/University course code:	1738

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
45	0	45	0	0	90	6

Nosilec predmeta/Lecturer:	Žiga Turk
Vrsta predmeta/Course type:	Izbirni strokovni /Elective professional

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

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

Vsebina:	Content (Syllabus outline):
Predavanja: Razvoj digitalne tehnologije je tisti faktor, ki najmočneje spreminja načine in vzorce dela v poklicih, ki oblikujejo grajeno okolje. Spremembe se dogajajo na štirih frontah. Prva je vedno večja računska moč, ki vodi k vedno bolj vernim simulacijam tako naravnih pojavov kot človeške inteligence. Računalniki zmagujejo v šahu, vozijo avtomobile, pišejo poročila o športnih dogodkih ... Zakaj ne bi v bodočnosti projektirali stavb? Druga so	The advances in digital technology are the factor that is most strongly changing kinds and types of work in occupations working on the built environment. Changes are occurring on four fronts. The first is the increasing computing power, leading to a more faithful simulation of natural phenomena and artificial intelligence. Computers are winning at chess, driving cars, writing reports on sporting events ... Why not design buildings? The second is increasingly structured information. Engineers no longer draw line drawings, but build content-rich

vedno bolje strukturirane informacije. Inženirji več ne rišejo črtnih risb, ampak gradijo vsebinsko bogate informacijske "BIM" modele in izdelujejo fotorealistične simulacije. Bo to omejilo ali razširilo ustvarjalnost? Tretja fronta je vedno boljše komuniciranje med ljudmi. Primeri tega so družabna omrežja in internet. Četrta fronta je prodor informacijske tehnologije v neračunalniško okolje skozi senzorje, kamere in podobno. Zaradi vsega tega se bistveno spreminja način projektiranja. Od lokalnega sodelovanja okrog risb prehajamo na globalno sodelovanje okrog digitalnih informacij. Cilj predavanj je posredovati teorije in koncepte, ki bodo osnova za vseživljensko učenje, ki bo potrebno o novih tehnologijah. Cilj vaj je posredovati praktično znanje pri uporabi programov in spletnih storitev za sodelovanje na računalniških platformah – torej za učinkovito komuniciranje, koordinacijo, ustvarjanje, izmenjavo in deljenje informacij. Vaje tečejo projektno v povezavi s katerim od strokovnih predmetov.	information "BIM" model and produce realistic simulations. Will this limit or augment creativity? The Third front is improved communication between people. Examples of this are the social networks and the Internet. The fourth front is the penetration of information technology in physical environment through sensors, cameras and the like. All this significantly changes the way we design. From local participation around drawings we are transitioning to a global collaboration around digital information. The aim of the lectures is to provide theories and concepts that will form the basis for lifelong learning, which will be on new technologies. The aim of the exercises is to provide practical knowledge in the use of programs and online services for collaboration on computing platforms - thus for effective communication, coordination, creation, exchange and dissemination of information. Exercises running the project in conjunction with one of the technical courses.

Temeljna literatura in viri/Readings:

Mitchell, William J., and Malcolm McCullough. Digital design media. John Wiley & Sons, 1995.

Zarli, A. et al. 2004. Building a Better Future, eBook, ICCI Consortium.

Deutsch, R. 2011. BIM and integrated design: Strategies for architectural practice. John Wiley & Sons.

Eastman, C. et al. 2011. BIM handbook: A guide to building information modeling for owners, managers, designers, engineers and contractors. John Wiley & Sons.

Raphael, B., Smith, I.F.C. 2003. Fundamentals of computer-aided engineering. John Wiley & Sons.

Turk Ž, Učno gradivo v spletni učilnici, posodobljeno letno.

Cilji in kompetence:	**Objectives and competences:**
Cilji: • Spoznati pomen računalniške tehnologije kot povezovalnega gradnika v gradbeni industrije in v procesih, ki v tej industriji potekajo. • Spoznati osnovno teoretično in tehnološko ozadje. • Poglobiti razumevanje o neposrednih in strateških vidikih informatizacije v gradbeništvu. • Postaviti okvir za gradbeno informatiko, ki ga v toku študija dopolnjujejo bolj specialni predmeti.	Objectives: • Understand the importance of information technology as an integrating element among the entities of the construction industry and its processes. • Learn about basic theoretical and technological backgrounds. • Deepen the understanding of the direct and strategic aspects of informatization in construction.

• Razumeti vlogo poklica »specialista-gradbenega-informatika« za gradbeno industrijo in karierne priložnosti. Pridobljene kompetence: • Sposobnost strateškega in kritičnega razmišljanja o uporabi informacijskih tehnologij v gradbeništvu. • Sposobnost uporabe praktičnih tehnoloških rešitev – lokalnih programov in storitev na internetu.	• Establish a conceptual framework of themes and topics of construction informatics, which will be expanded by other courses • Understand the importance of professions in which engineers specialize in IT knowledge and see it a career opportunity. Gained competences: • Ability of strategic and critical thinking about the use of information technology in construction. • Ability to use technological solutions, local software and services on the internet.

Predvideni študijski rezultati:	**Intended learning outcomes:**
• Vloga informatike v družbi nasploh in v gradbeništvu posebej. • Pregled nad temami gradbene informatike. • Strateški vidiki informatizacije na področju gradbeništva. • Razumevanje znanstvenih metod dela v gradbeni informatiki. • Raba ključnih orodij za delo in učenje na daljavo. • Uporaba znanstvenih metode pri informatizaciji procesov v gradbeništvu. • Kritična analiza uporabe IKT v gradbeništvu. • Sposobnost uporabiti metode znanstvenega dela v okviru gradbene informatike tudi na druga področja. • Sposobnost strateškega uvajanja informacijskih tehnologij v gospodarstvo. • Sposobnost organiziranja IKT podpore projektom. • Sposobnost postati informacijski manager projekta. • Sposobnost sodelovati v softverskih projektih.	• The role of information technology in society in general and in construction in particular. • Overview of the topics of construction informatics. • Strategic aspects of information in the field of construction. • Understanding of scientific methods in construction informatics. • Use of key tools for distance working and distance learning. • Use of key tools for the three kinds of integration (information-knowledge, process, communication). • Critical analysis of the use of ICT in construction • Ability of systematic analysis of the use of information technologies. • Ability to organize ICT project support. • Ability to become an IT manager (CIO) of a project, BIM manager of a project. • Ability to be involved in software development projects.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, obogatena z multimedijskimi vsebinami in demonstracijami. Projektno organizirane vaje, kjer se delo usmerja v enovit projektni rezultat. Samostojno delo doma s korekturami v šoli.	Lectures enriched with multimedia and demos. Project oriented exercises focused into a unified project result. Work at home with consultations

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Teoretično znanje na izpitu	40,00 %	Theoretical exam
Sodelovanje na vajah in predavanjih	20,00 %	Activity and collaboration
Projekt in izdelek	40,00 %	Project work quality

Reference nosilca/Lecturer's references:

MEŽA, Sebastjan, TURK, Žiga, DOLENC, Matevž. Component based engineering of a mobile BIM¬based augmented reality system. Automation in construction, ISSN 0926¬5805. [Print ed.], jun. 2014, letn. 42, št. X, str. 1¬12, ilustr. http://www.sciencedirect.com/science/article/pii/S0926580514000363, doi: http://dx.doi.org/10.1016/j.autcon.2014.02.011.

TODOROVIĆ, Miloš, TURK, Žiga. Upoštevanje trajnostnih kriterijev pri projektiranju z orodjem BIM = Designing using sustainability criteria with BIM tools. Gradbeni vestnik, ISSN 0017¬2774, okt. 2011, letn. 60, št. 10, str. 279¬284, ilustr.

KLINC, Robert, TURK, Žiga, DOLENC, Matevž. Engineering collaboration 2.0 : requirements and expectations. Journal of information technology in construction, ISSN 1874-4753, 2009, letn. 14, pos. št., str. 473-488, ilustr. Dostopno na: http://www.itcon.org/2009/31.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	**ŠPORTNA VZGOJA**
Course title:	**SPORTS EDUCATION**

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Stavbarstvo, druga stopnja, magistrski	Ni členitve (študijski program)		Letni, Zimski

Univerzitetna koda predmeta/University course code:	1256

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
5	0	40	0	0	45	3

Nosilec predmeta/Lecturer:	prof. dr. Branko Škof
Vrsta predmeta/Course type:	Izbirni splošni /Elective general

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Zdravstveni status, ki dovoljuje ustrezen telesni napor.	Health status, which allows appropriate physical exercise.

Vsebina:	Content (Syllabus outline):
Predavanja Splošni teoretični del vsebuje predavanja, ki so skupna vsem športnim programom in se izvajajo skupno za vse študente (osnove delovanja človekovega telesa, njegovega gibalnega, srčno žilnega in dihalnega sistema, psihomotorične in funkcionalne sposobnosti, športno-gibalna aktivnost kot preventivna in kurativna dejavnost za ohranjanje in utrjevanje zdravja, osnove zdravega prehranjevanja in regulacije telesne teže ter drugih medicinskih vidikov športa, metode preverjanja in	Lectures General theoretical part contains lectures, which are common to all sports programs made collectively for all students (basic function of the human body, movement of the body and cardiovascular system, psychomotor and functional abilities, prevention and curative activity for developing health, basic nutrition and healthy diet, regulation of body weight and other medical aspects of sports, checking methods and assessment of psychomotor and functional abilities).

ugotavljanja stanja psihomotoričnih in funkcionalnih sposobnosti). Specialni teoretični del je vezan na izbrano športno panogo (posebnosti športne panoge, njen vpliv na človeka, tehnika, taktika in pravila, osnove telesne in tehnično taktične priprave) in se izvaja skozi praktične vaje; Praktične vaje Študent izbira med ponujenimi športnimi panogami. Za vsako panogo se izvaja program učenja, izpopolnjevanja znanja in osnovnega treniranja. Poleg izbrane športne panoge bo študent moral opraviti 5 vodenih enodnevnih ali večdnevnih športnih aktivnosti v naravi, ter preizkus motoričnih in funkcionalnih sposobnosti.	Special theoretical part is linked to the selected sport (specificity of sport, human development through sport, technique, tactics and rules, fundamentals of physical and technical preparation) and is implemented through practical exercises; Practical work Students choose between the offered sport branches. For each sport have a program of learning and skill training. Students have to do: five guided multi-day sports activities in nature and aerobic endurance test.

Temeljna literatura in viri/Readings:

Škof, B. 2012. Does physical activity at a young age really mean a healthier adulthood and old age? Annales kinesiologiae, ISSN 2232-2620, 2012, vol. 3, no. 2, str. 149-166. Škof, B. 2010. Spravimo se v gibanje - za zdravje in srečo gre: kako do boljše telesne zmogljivosti slovenske mladine? Ljubljana, Fakulteta za šport UL, Inštitut za šport, 253 str. Škof, B. et at., 2007. Šport po meri otroka in mladostnika. Ljubljana, Fakulteta za šport UL, Inštitut za šport, 445 str. Berčič, H. et at. 2007. Šport v obdobju zrelosti. Fakulteta za šport UL, Inštitut za šport, 240 str. Škof, B., Zabukovec V., Boben, D., Cecič Erpič S., 2005. Pedagoško-sociološki vidiki športne vzgoje. Ljubljana, Fakulteta za šport UL, Inštitut za kineziologijo, 237 str.

Cilji in kompetence:	**Objectives and competences:**
Cilji • odpravljanje in preprečevanje posledic pomanjkanja gibanja oz. skrb za izboljšanje psihofizičnih sposobnosti, krepitev zdravja in ustvarjalno izrabo prostega časa. • ozaveščanje o vrednotah športa in preko tega vplivanje na oblikovanje pozitivnih stališč do športa in navajanje na zdrav način življenja • izpopolnjevanje znanja v izbrani športnih panogah • oblikovanje trajnega aktivnega odnosa do športa kot kompenzacijske dejavnosti k študiju in delu Kompetence • oblikovanje trajnega pozitivnega odnosa do športne dejavnosti in trajne skrbi za ohranjanje zdravja in delovnih sposobnosti,	Objectives • care for improving psychophysical abilities, health strength and creative use of free time • raising awareness about the values of sports, encouraging a positive attitude to sports and healthy way of lifestyle • perfecting knowledge in selected sports • encouraging positive attitude to sport as a compensatory activity to study and work Competences • formed positive attitude towards sports activities and permanent concern for the preservation of health and working ability. • rational incorporation of sports into lifestyle, • understand the concern for a healthy lifestyle through sports and physical activity,

• racionalno vgrajevanje športa v način življenja, • sposobnost samostojne skrbi za zdrav način življenja skozi športno-gibalno aktivnost, • pripravljenost in sposobnost samostojnega vključevanja v organizirane ali neorganizirane oblike športnega udejstvovanja v novih študijskih ali delovnih okoljih, • promocija in uveljavljanje fakultete in univerze.	• readiness and ability of self-depended inclusion in organized or non-organized forms of sports in the new study or work environments, • promotion and recognition of the Faculty and University.

Predvideni študijski rezultati:	**Intended learning outcomes:**
• razumevanje temeljnih pojmov in teorij delovanja človekovega gibalnega, srčno žilnega in dihalnega sistema ter njihovih najpogostejših patologij • oblikovanje razumskega in čustvenega odnosa do telesnega napora, poznavanje teorije aktivnega počitka in metod za regeneracijo telesa, poznavanje zdravega prehranjevanja in regulacije telesne teže. Izpopolnitev znanja izbranih športnih zvrsti • uporaba pridobljenih znanj in vedenj v vsakodnevnem življenju za kompenzacijo negativnih učinkov enostranskih obremenitev v času študija • skozi pridobljena znanja in vedenja zagotovitev večje kvalitete življenja in večje učinkovitosti pri študiju in delu • psihofizična pripravljenost organizma je pogoj za reševanje vsakodnevnih obveznosti in nalog.	• understanding the basic concepts and theories of human locomotion, cardiovascular and respiratory systems and their most frequent pathologies in relation to mental health • creation of rational and emotional attitude toward physical effort, knowledge of the theory of active rest and methods for body regeneration, knowledge of healthy diet and body weight regulation, • improvement of knowledge in selected sport. Use of acquired knowledge and skills in daily life to compensate daily stresses and negative effects of unilateral load during the study, • through the acquired knowledge and behaviour increased quality of life and increased efficiency of study and work are ensured, • good psychophysical preparedness is a condition to solve everyday duties and obligations.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Pouk se izvaja v pokritih športnih objektih in v naravi v obliki predavanj in vaj, skupinskih in individualnih konzultacij kontinuirano preko celega semestra, pa tudi v zgoščenih (kurznih) oblikah, vendar z enakim fondom ur, pri čemer se večji del teorije podaja skozi praktične vaje. Uporablja se naslednje učne oblike: frontalna, individualna, delo v manjših skupinah.	Activities are implemented in indoor sports facilities and the natural environment in the form of lectures and exercises, group and individual consultations through the whole semester as well as in concentrated forms, major part of theory is performed through practical exercises. Learning forms: frontal, individual, small group work.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Praktični izpit	80,00 %	Practical exam
Teoretični izpit	20,00 %	Theoretical exam

Reference nosilca/Lecturer's references:

AUERSPERGER, Irena, ŠKOF, Branko, LESKOŠEK, Bojan, KNAP, Bojan, JERIN, Aleš, LAINŠČAK, Mitja. Exerciseinduced changes in iron status and hepcidin response in female runners. PloS one, 2013, vol. 8, issue 3, tabele, graf. prikazi, [8 str.]

PLEVNIK, Matej, PIŠOT, Rado, ŠKOF, Branko. The effects of a six-month training programme on running endurance, morphological characheristics [!] and some aerobic ability parameters of adult women with different physical abilities = Vpliv šestmesečnega vadbenega programa na tekaško vzdržljivost, morfološke značilnosti in nekatere kazalce aerobne zmogljivosti odraslih žensk z različno začetno zmogljivostjo. Ann. Kin. (Koper, Tisk. Izd.), 2012, vol. 3, no. 2, str. 181-195.

AUERSPERGER, Irena, KNAP, Bojan, JERIN, Aleš, BLAGUS, Rok, LAINŠČAK, Mitja, SKITEK, Milan, ŠKOF, Branko. The effects of 8 weeks of endurance running on hepcidin concentrations, inflammatory parameters and iron status in female runners. Int. J. sport nutr. Exerc. Metab. (Print), 2012, vol. 22, issue 1, str. 55-63.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	**ZAPIRANJE SNOVNIH TOKOV PRI STAVBAH IN NASELJIH**
Course title:	**CLOSING MATERIAL CYCLES IN BUILDINGS AND AGGLOMERATIONS**

Študijski programi in stopnja	**Študijska smer**	**Letnik**	**Semestri**
Stavbarstvo, druga stopnja, magistrski	Ni členitve (študijski program)		Letni, Zimski

Univerzitetna koda predmeta/University course code:	1778

Predavanja	**Seminar**	**Vaje**	**Klinične vaje**	**Druge oblike študija**	**Samostojno delo**	**ECTS**
30	15		45		90	6

Nosilec predmeta/Lecturer:	Nataša Atanasova
Vrsta predmeta/Course type:	Izbirni strokovni/Elective

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Opravljen izpit Osnove zdravstvene hidrotehnike BA GR-UNI ali BA VOI oz. osvojena ustrezna primerljiva znanja. Ustreznost oziroma primerljivost znanj oceni nosilec oziroma izvajalec predmeta.	Finished course in Basics of sanitary engineering of the study programme BA GR-UNI or BA VOI or equivalent. The equvalnecy of student's prior knowledge is asses by the course lecturer.

Vsebina:	**Content (Syllabus outline):**
Predavanja: V okviru tega predmeta so prikazani najnovejši pristopi/koncepti za ravnanje z viri (voda-hrana-energija) v stavbah in na nivoju naselij.	**Lectures:** The lectures will present the latest concepts for resources (water-food-energy) management in buildings and neighbourhoods. 1. The need for change in water, food and energy management in cities. Impact of

1. Zakaj je potrebna sprememba pri ravnanju z vodo, hrano in energijo. Vpliv urbanega okolja/mest na stanje naravnih virov: metabolizem mest. 2. Prevladujoči koncepti ravnanja z naravnimi viri v mestih, lastnosti linearne (vodne) infrastrukture. 3. Značilnosti pitne in odpadne vode. Osnovni pojmi za vrednotenje masnih tokov: voda in hranila. 4. Zasnova decentralizacije urbane vodne infrastrukture: pomen, prednosti in težave. Paradigma rabe brez odpadkov. Integracija in povezava vodne in zelene infrastrukture. 5. Primerne tehnologije za obnovo in ponovno rabo virov: voda, hranila, energija v stavbah. 6.Primernost objektov za implementacijo 'zapiranja snovnih tokov'. Ločevanje na viru v stavbah: siva in črna voda. 7. Možnosti za ponovno rabo vode in hranil v stavbah: urbano kmetijstvo, zelene strehe in stene. 8. Celovite rešitve. **Seminar:** Študentje izberejo določen objekt (hiša, hotel, industrijsko poslopje) ali skupino objektov in naredijo zasnovo za zbiranje , obdelavo in ponovno rabo vode in/ali hranil in/ali energije oz. zasnovo, ki pelje k čimboljšem zapiranju snovnih tokov.	agglomerations/cities on resources: urban metabolism. 2. Conventional concepts for resources management in cities; characteristics of linear (water) infrastructure. 3. Characterisation of drinking and waste water. Basics for evaluation of mass flows: water and nutrients. 4. Decentralized concepts for urban water management: significance, benefits and obstacles. Zero waste paradigm. Integration of blue and green infrastructures. 5. Appropriate technologies for resources recovery and reuse: water, nutrients, energy in buildings. 6. Buildings: feasibility for implementation of closed-loop concepts. Source separation in buildings: grey and black water. Reuse options in buildings 7. Options for reuse of water and nutrients in buildings: urban farming, green roofs and walls. 8. Integrated solutions. **Seminary work:** Students select a building (a house, hotel, industrial complex) or a group of buildings and propose collection, treatment and reuse of water, nutrients and energy, i.e. a closed-loop concept for water management.

Temeljna literatura in viri/Readings:

Knjižni viri (izbrana poglavja):

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

Larsen, T. A., Kai M. Udert and Judit Lienert, Editors. Source Separation and Decentralization for Wastewater Management, 2013, IWA Publising.

World resources institute, 2011. World resources Report 2010-2011. ISBN 978-1-56973-774-3

Atanasova, N. in Griessler Bulc, T., 2018. Okoljske tehnologije, skripta v nastajanju.

Ramaswami, A., Milford, J.B., Small, M.J., 2005. Integrated environmental modelling : pollutant transport, fate and risk in the environment.

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

Costanza, R., Joergensen, S.E., 2002. Understanding and solving environmental problems in the 21st century - Toward a new, integrated hard problem science. Elsevier. ISBN: 0-08-044111-4.

Weber, W.J., Jr., 2001. Environmental systems and processes. Wiley Inter-science. ISBN 0-471-40518-3.

Cilji in kompetence:	Objectives and competences:
Cilji: Cilj predmeta je študentom dati dodatna znanja in spretnosti pri reševanju najbolj kompleksnih okoljskih problemov. **Kompetence:** Študent se nauči prepoznavati kdaj je primerno ravnanje z viri po principu zapiranja zank. Pozna koncepte in tehnologije, ki to omogočajo na nivoju stavbe in/ali naselja. Zna ovrednotiti take rešitve v širšem kontekstu.	**Goals:** Introduce students to additional knowledge and skills for solving complex environmental problems. **Competences:** Students will learn to estimate the applicability of closed-loop management of resources in a building and/or cities. They will learn how to design concepts and appropriate technologies for such solutions and be able to estimate impacts of closed-loop concepts in a wider context.

Predvideni študijski rezultati:	Intended learning outcomes:
Znanje in razumevanje: Razumevanje materialnih tokov (voda, hrana, energija) in uporaba konceptov in tehnologij za njihovo optimizacijo. **Prenosljive spretnosti:** Izvajanje projektov za učinkovito rabo virov po principu zapiranja snovnih tokov.	**Knowledge and understanding:** Understanding of material (water-food-energy) flows and concepts and technologies for closing the loop. **Skills:** Implementation of projects for closed-loop management of resources.

Metode poučevanja in učenja:	Learning and teaching methods:
Predavanja in uporaba pridobljenih znanj pri individualnih seminarskih vaj.	Lectures and use of knowledge in elaborating seminary work.

Načini ocenjevanja:	Delež/Weight	Assessment:
Način (pisni izpit, ustno izpraševanje, naloge, projekt):		Type (examination, oral, coursework, project):
Vaje	30,00 %	Exercises
Seminarska naloga	30,00 %	Project Report
Izpit	40,00 %	Exam

Reference nosilca/Lecturer's references:

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

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

ATANASOVA, Nataša, POCH ESPALLARGAS, Manel. REUCITY - Innovative technologies for resource oriented cities. Girona: Universitat de Girona, Laboratory of Chemical and Environmental Engineering, 2017. 27 str., ilustr. ISBN 978-84-9984-393-3. http://www.lequia.udg.edu/research/books/item/2514-reucity.html. [COBISS.SI-ID 8126305]