MARDS
REFORMING PHD STUDIES

MARDS Doktorski Program „Doktorske studije u održivom razvoju"

Plan i Program

Curriculum Book

Working version 1.1 (ME)

Co-funded by the Erasmus+ Programme of the European Union

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MARDS Doktorski Program
„Doktorske studije u održivom razvoju"

- **Nivo programa:** Doktorski
- **Organizator:** Univerzitet Crne Gore
- **Partneri:** : University of Vienna, Austria, University of Maribor, Slovenia, University of Zagreb, Croatia, Matej Bel university, Slovakia, University of Donja Gorica, Montenegro
- **Oblast:** Prirodne i tehničke nauke u održivom razvoju. Prirodne i tehničke nauke u ekodizajnu.

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MARDS
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MARDS PhD Structura

1 obavezni predmet, sa liste dio A 10ECTS 2 izborna predmeta po modulima i predmetu interesovanja sa liste, dio B 20 ECTS	1 izborni multidisciplinarni predmet sa liste, DIO C 5 ECTS Početna istraživanja 20 ECTS Doktorski kolokvijum 5 ECTS	Izrada teze 80 ECTS Istraživački boravak min 1 mjesec 10 ECTS	Priprema i odbrana Doktorske Disertacije
30 ECTS	30 ECTS	90 ECTS	30 ECTS

I godina → II godina → III godina

Razlike u odnosu na standardni program

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SADRŽAJ KVALIFIKACIJE / ISHODI UČENJA

- **sposobnost za individualni istraživački rad na polju primjene prirodnih i tehničkih nauka u održivom razvoju.**
- **sposobnost upotrebe multidsciplinarnih, visoko-tehnoloških znanja u praksi i njihova integracija u cilju sticanja upotrebljivih znanja.**
- **sposobnost kreiranja visoko-tehnoloških i održivih rješenja u različitim sektorima kao što su: energija, čovjekova sredina, transport, poljoprivreda, medicina, informaciono komunikacione tehnologije, turizam, sektor usluga itd.**
- **prepoznavanje važnosti naučnog znanja za kreiranje sistema održivog razvoja.**
- **razumijevanje pojma „pametnih održivih tehnologija“ i sticanje znanja i vještina za realnu primjenu.**
- **razvoj istraživačkih i naučnih komunikacionih sposobnosti i vještina, posebno komunikacije u međunarodnaom okruženju.**
- **razumijevanje značaja cross-border i regionalne saradnje u oblasti upotrebljivih znanja i njihova primjena na dobrobit internacionalnih zajednica.**
- **stvaranje geenracije budućih edukatora, lidera i nosilaca razvoja koji imaju upotrebljivije kompetence za podršku transformacije lokalne i globalne zajednice prema društvu znanja**

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#	Predmet	Course	Professor	ECTS	Status	Nosilac	Dio
1	Metodologija naučno istraživačkog rada	Methodology of science and research work		10	obavezni	Univerzitet Crne Gore	A
2	Daljinsko istraživanje	Remote sensing	Prof. dr Dušan Gleich	10	izborni	Univerzitet u Mariboru	
3	Upravljanje zaštita elektroenergetskih sistema	Power System Control and Protection	Prof. dr Boštjan Polajžer	10	izborni	Univerzitet u Mariboru	
4	Komunikacija čovjek-računar u medijima	Human-Computer Interaction in the media	Matjaž Debevc	10	izborni	Univerzitet u Mariboru	
5	Intelegentna obrada podataka	Intelligent Data Analysis	Iztok Fister	10	izborni	Univerzitet u Mariboru	
6	Distributivni sistemi za smještanje podataka	Distributed data storage systems	Aida Kamišalić Latifić	10	izborni	Univerzitet u Mariboru	
7	Rudarjenje nestrukturalnih podataka i procesiranje u prirodnim jezicima	Mining unstructured data and natural language processing	Sašo Karakatič	10	izborni	Univerzitet u Mariboru	
8	Savremeni građevinski materijali	Contemporary building materials	Prof.dr Radomir Zejak	10	izborni	Gradjevinski fakultet Univerziteta Crne Gore	
9	Eksperimentalna analiza konstrukcija	Experimental analysis of structures	Prof. dr Biljana Šćepanović	10	izborni	Gradjevinski fakultet Univerziteta Crne Gore	
10	Upravljanje rizikom u građevinarstvu	Risk management in civil engineering	Prof.dr Miloš Knežević	10	izborni	Gradjevinski fakultet Univerziteta Crne Gore	
11	Energetska efikasnost zgrada	Energy efficiency of buildings	Prof.dr Radmila Sinđić Grebović	10	izborni	Gradjevinski fakultet Univerziteta Crne Gore	
12	Izabrana poglavlja iz električnih mašina	Selected topics in electrical machines	Prof. dr Gojko Joksimović	10	izborni	Elektrotehnicki fakultet Univerziteta Crne Gore	
13	IoT ekosistemi	IoT ecosystems	Prof. dr Nedjeljko Lekić	10	izborni	Elektrotehnicki fakultet Univerziteta Crne Gore	
14	EKSERGETSKE ANALIZE U HVAC INSTALACIJAMA	Power analyse in HVAC systems	Prof. dr Igor Vušanović	10	izborni	Masinski fakultet Univerziteta Crne Gore	
15	Kompleksi metala i njihova primjena	Metal complexes and their application	Prof. dr Željko Jaćimović, Prof. dr Nedeljko Latinović	10	izborni	Metalursko tehnoloski i Biotehnicki fakultet Univerziteta Crne Gore	B
16		Environmental chemistry	To be decided	10	izborni	Prirodnomatematicki fakultet Univerziteta Crne Gore	
17		Enviroment and ecology	To be decided	10	izborni	Prirodnomatematicki fakultet Univerziteta Crne Gore	
18		Ecology and biodiversity of aquatic ecosystems	To be decided	10	izborni	Prirodnomatematicki fakultet Univerziteta Crne Gore	
19		Biological processes in the environment - selected chapters	To be decided	10	izborni	Prirodnomatematicki fakultet Univerziteta Crne Gore	
20	Naučna komunikacija i pisanje	Science Communication and Writing	UDG	5	izborni	Univerzitet u Donjoj Gorici	
21	Napredno Preduzetnistvo	Advanced Entrepreneurship	UDG	5	izborni	Univerzitet u Donjoj Gorici	
22	Tehnološko preduzetništvo	Technological Entrepreneurship	Prof. dr Radovan Stojanovic	5	izborni	Elektrotehnicki fakultet Univerziteta Crne Gore	
23	Precizna poljoprivreda	Precision Agriculture	Prof. dr Radovan Stojanovic, Prof. dr Nedjeljko Latinovic	10	izborni	Elektrotehnicki i Biotehnicki fakultet Univerziteta Crne Gore	
24	Brodska alternativna goriva i pogoni	Ships' Alternative Fuels and Propulsion	Prof. dr Danilo Nikolic	10	izborni	Pomorski fakultet Univerziteta Crne Gore	
25	Održavanje zasnovano na pouzdanosti	Reliability-based maintenance	Prof. dr. Špiro Ivošević	10	izborni	Pomorski fakultet Univerziteta Crne Gore	
26	Modeliranje u Supply Chain Management-u	Modeling the Supply Chain	Prof. Dr. Branislav Dragovic	10	izborni	Pomorski fakultet Univerziteta Crne Gore	

27	Naučna komunikacija i pisanje	Science Communication and Writing	UDG	5	izborni	Univerzitet u Donjoj Gorici	C
28	Napredno Preduzetnistvo	Advanced Entrepreneurship	UDG	5	izborni	Univerzitet u Donjoj Gorici	
29	Tehnološko preduzetništvo	Technological Entrepreneurship	Prof. dr Radovan Stojanovic	5	izborni	Elektrotehnicki fakultet Univerziteta Crne Gore	

MEĐUNARODNA UPOREDIVOST

Predloženi program je u potpunosti uporediv i kompatibilan sa sličnim programima u Evropskoj Uniji, Americi, Japanu, Australiji...itd. Program je naročito popularan u razvijenim zemljama. Zemlje u razvoju ga moraju imati, ako žele da ostvare potrebnu sinergiju izmedju parcijalnoh znanja koja se stiču na različitim doktorskim programima i onih koja su potrebna za ostvarivanje realnog razvoja. Vršena je analiza više studijskih programa slične sadržine, uključujući Region, EU, Ameriku, Australiju i Japan.

- **Sustainability, Ph.D., Polytechnic University of Catalonia, Spain, University rank #300 (QS) Barcelona, Spain, https://www.phdportal.com/studies/68258/sustainability.html#content:description**
- **Eindhoven University of Technology (TU/e), University rank #102 (QS) Eindhoven, Netherlands, Smart Buildings and Cities, PDEng, https://www.phdportal.com/studies/156665/smart-buildings-and-cities.html#content:contents**
- **Sustainable Futures, Ph.D., University of Technology, Sydney, University rank #140 (QS) Sydney, Australia, https://www.phdportal.com/studies/290371/sustainable-futures.html**
- **Ecosystem Sustainability, Ph.D., Colorado State University, University rank #201 (ARWU) , Fort Collins, CO, United States**
- **PhD in Sustainability, Rochester Institute of Technology (RIT), USA, https://www.phdstudies.com/PhD-in-Sustainability/USA/Rochester-Institute-of-Technology-(RIT)/**
- **Official doctoral program in environmental science and technology, Universidade da Coruña, Spain, https://www.phdstudies.com/Official-Doctoral-Program-In-Environmental-Science-And-Technology/Spain/Universidade-da-Coru%C3%B1a/**
- **Doctoral program in appropriate technology and science for sustainable development, University of Tsukuba, Japan , http://www.global.tsukuba.ac.jp/departments/life-and-environmental/app-sus-tech-sci**
- **Jožef Stefan International Postgraduate School (IPS), ECOTECHNOLOGIES, Slovenia, https://www.mps.si/en/studij/bolonjski-studij-tretje-stopnje/ekotehnologije/**
- **PhD in Sustainable Energy and Technologies, The Free University of Bozen-Bolzano, Italy, University rank #401 (WUR) https://www.unibz.it/en/faculties/sciencetechnology/phd-sustainable-energy-technologie**

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USLOVI ZA UKLJUČIVANJE U PROGRAM

Ciljna grupa za upis na akademske doktorske studije su kandidati koji su završili master studije i stekli diplomu akademskih master studija iz odgovarajuće oblasti nauke, stepen MSc, i ostvarili najmanje 300 ECTS kredita.

Pravo upisa na akademske doktorske studije imaju kandidati sa završenim akademskim master studijama, stepen MSc, iz sledećih oblasti nauka:

1. Tehničke nauke

2. Biotehničke nauke

3. Prirodno-matematičke nauke

4. Multidisciplinarne nauke, kompatibilne sa predloženim programom

5. Biomedicinski inženjering.

5. Medicinske nauke

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MARDS
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Liste predmeta

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KATALOG PREDMETA / COURSE SYLLABUS	
Naziv predmeta:	Daljinsko istraživanje
Course title:	Remote sensing

Studijski program i stepen **Study programme and level**	**Studijski smjer** **Study field**	**Akademska godina** **Academic year**	**Semester** **Semester**
Doktorski program "Prirodne nauke i tehnologija za održivi razvoj", Modul Electrical and Computer Engineering 3.stepen PhD Program "Natural sciences and Technology for Sustainable Development", Module and ComputerEngineering, 3rd degree		1.	zimski, letnji Autumn, Spring

Vrsta predmeta / Course type	Izborni / Optional
Kod predmeta/ University course code:	

Predavanja **Lectures**	**Seminar** **Seminar**	**Tutorial** **Tutorial**	**Rad** **Work**	**Drugi oblici rada**	**Samostalni rad** **Individual work**	**ECTS**
30		30			120	**6**

Nosilac predmeta predmeta / Lecturer:	Dušan Gleich
Jeziki / Languages: **Predavanja / Lectures:**	slovenski / Slovene-English
Tutorial / Tutorial:	slovenski / Slovene –English

Uslovi za pohadjanje predmeta	**Prerequisites:**
Nema uslova	None.

Sadržaj predmeta:

- Daljinska istraživanja, pregled, kratka istorija.
- Elektromagnetno zračenje: opis zračenja, spektralna analiza elektromagnetnog zračenja.
- Interakcija sa atmosferom i površinom: pobačaj, razbijanje talasa.
- Daljinske senzorske platforme: aktivni i pasivni senzori za daljinsko istraživanje.
- Rezolucija daljinskih senzorskih platformi: prostorna rezolucija, spektralna rezolucija, radiometrijska rezolucija, vremenska rezolucija.
- Optički, radarski i lidarni sistemi za daljinsko očitavanje Zemlje: multispektralna akvizicija, termička akvizicija, sintetički radar, bočni radar, interakcija mikrotalasa sa zemljinom površinom, principi lidar, prenos podataka i obrada podataka, primanje podataka.
- Poboljšanje slike: izvori radio-metričkih i geometrijskih izobličenja, radio-metrička i geometrijska poboljšanja.
- Prikazivanje slika na daljinskom senzoru.

Content (Syllabus outline):

- Remote sensing definition and short history overview.
- Electromagnetic radiation: description of radiation, spectral analysis of electromagnetic radiation.
- Interaction with atmosphere and surface: abortion, wave breaking.
- Remote sensing platforms: active and passive sensors for remote sensing.
- Resolution of remote sensing platforms: spatial resolution, spectral resolution, radiometric resolution, time resolution.
- Optical, radar and lidar systems for remote sensing of the Earth: multispectral acquisition, thermal acquisition, synthetic aperture radar, side looking radar, interaction of microwaves with Earth surface, lidar principles, data transmission and data processing, data receiving.
- Image enhancement: sources of radio-metrical and geometrical distortions, radio-metric and geometric enhancement.
- Representation of remote sensing images.
- Image statistics: random variables, random vectors, parameter estimation, hypothesis testing, Bayes theorem and classification.
- Transformations: Fourier transform, wavelet transform, image compression, noise reduction, noise estimation.
- Supervised classification, maximum a posteriori, training data and learning, maximum likelihood, post-processing, Hyper-spectral analysis.
- Unsupervised learning: simple cost functions, K-Means,

• Statistika slike: slučajne promenljive, slučajni vektori, procena parametara, testiranje hipoteza, Bajesova teorema i klasifikacija. • Transformacije: Fourierova transformacija, talasna transformacija, kompresija slike, smanjenje buke, procena buke. • Nadzirana klasifikacija, maksimum a posteriori, podaci o obuci i učenju, najveća verovatnoća, naknadna obrada, hiperspektralna analiza. • Nenadzorovano učenje: jednostavne funkcije troškova, K-sredstva, Fuzzi K-sredstva. • Detekcija promena: algebarske metode, glavne komponente, poređenje posle klasifikacije, nenadzorovana klasifikacija promena. •	Fuzzy K-means. • Change detection: algebraic methods, principal components, post-classification comparison, unsupervised classification of changes.

Literatura/ Readings:

- K. Oštir, *Daljinsko zaznavanje*, založba ZRC, Ljubljana, 2006.
- M. J. Canty, Image *Analysis, Classification and Change Detection in Remote Sensing*, Taylor and Francis Group, New York, 2007.
- Q. Weng, *Remote Sensing of Impervious Surfaces*, CRC Press, Taylor and Francis Group, New York, 2008.
- J. A. Richards, X. Jia, *Remote Sensing Digital Image Analysis*, Springer Verlag, Berlin, 2006.
- M. Soumekh, *Synthetic Aperture Radar Signal Processing*, John Wiley & Sons, Toronto, 1999.

Ciljevi i kompetence:	**Objectives and competences:**
Cilj ovog predmeta je da studenti postdiplomskog studija razumeju osnove daljinskog osmatranja i obrade slike, koristiće stečena znanja u analizi i proceni fizičkih parametara u podacima daljinskog senzora.	The objective of this course is that postgraduate students will understand the basics of remote sensing and image processing, will use gained knowledge in the analysis and evaluation of physical parameters in the remote sensing data.

Očekivani rezultati učenja:	**Intended learning outcomes:**
<u>Znanje i razumijevanje:</u> Po završetku ovog predmeta student će moći • objasniti principe sistema daljinskog ispitivanja, • razumeti pojave posmatranog objekta pomoću podataka daljinskog senzora, • analizirati scenu u okviru podataka daljinskog senzora, • Ocenite fizičke parametre koristeći podatke daljinskog senzora. <u>Prenosive / ključne veštine i drugi atributi:</u> • Veštine komunikacije: odbrana usmenog laboratorijskog rada, način izražavanja na pismenom ispitu. • Upotreba informacione tehnologije: upotreba softverskih alata za daljinsko istraživanje. • Veštine računanja: obavljanje računarskih operacija u algoritmima za daljinsko istraživanje. • Rešavanje problema: dizajniranje i primena algoritama za daljinsko istraživanje.	<u>Knowledge and understanding:</u> On completion of this course the student will be able to • explain principles of remote sensing systems, • understand phenomena of observed object with remote sensing data, • analyse scene within remote sensing data, • Evaluate physical parameters using remote sensing data.

	Transferable/Key skills and other attributes: • *Communication skills:* oral lab work defence, manner of expression at written examination. • *Use of information technology:* use of remote sensing software tools. • *Calculation skills:* performing calculation operations in remote sensing algorithms. • *Problem solving:* designing and implementing remote sensing algorithms.

Metode učenja i podučavanja	**Learning and teaching methods:**
• predavanja, • projektno učenje, • eksperimentalni i laboratorijski rad	• lectures, • project based teaching, • experimental lab work

Načini ocenjivanja	Iznos (u %) / Weight (in %)	**Assessment:**
• odradjene laboratorijske vježbe • pismeni ispit • ostale aktivnosti (domaci...)	25 % 50 % 25 %	• completed lab work, • written examination • other activities (home works…).

Reference nosioca predmeta/Lecturer's references:

GLEICH, Dušan, SINGH, Jagmal, PLANINŠIČ, Peter. Parametric and nonparametric methods for SAR patch scene categorization. *IEEE journal of selected topics in applied earth observations and remote sensing*, ISSN 1939-1404, Date of publication: 15. oktober 2014, vol. , no. , str. 1-12, doi: 10.1109/JSTARS.2014.2352337. [COBISS.SI-ID 18252822], [JCR, SNIP, Scopus do 19. 11. 2014: št. citatov (TC): 0, čistih citatov (CI): 0, čistih citatov na avtorja (CIAu): 0, normirano št. čistih citatov (NC): 0]

GLEICH, Dušan, KSENEMAN, Matej, DATCU, Mihai. Despeckling of terraSAR-X data using second-generation wavelets. *IEEE geoscience and remote sensing letters*, ISSN 1545-598X. [Print ed.], jan. 2010, vol. 7, no. 1, str. 68-72, doi:10.1109/LGRS.2009.2020610. [COBISS.SI-ID 13422870], [JCR, SNIP, WoS do 19. 8. 2014: št. citatov (TC): 12, čistih citatov (CI): 11, čistih citatov na avtorja (CIAu): 3.67, normirano št. čistih citatov (NC): 9, Scopus do 6. 2. 2015: št. citatov (TC): 20, čistih citatov (CI): 18, čistih citatov na avtorja (CIAu): 6.00, normirano št. čistih citatov (NC): 15]
kategorija: 1A2 (Z, A1/2); uvrstitev: SCI, Scopus, MBP; tipologijo je verificiral OSICT

PLANINŠIČ, Peter, SINGH, Jagmal, GLEICH, Dušan. SAR image categorization using parametric and nonparametric approaches within a dual tree CWT. *IEEE geoscience and remote sensing letters*, ISSN 1545-598X. [Print ed.], Oct. 2014, vol. 11, no. 10, str. 1757-1761, doi: 10.1109/LGRS.2014.2308328. [COBISS.SI-ID 17758486], [JCR, SNIP, WoS do 14. 7. 2014: št. citatov (TC): 0, čistih citatov (CI): 0, čistih citatov na avtorja (CIAu): 0, normirano št. čistih citatov (NC): 0, Scopus do 9. 6. 2014: št. citatov (TC): 0, čistih citatov (CI): 0, čistih citatov na avtorja (CIAu): 0, normirano št. čistih citatov (NC): 0]
kategorija: 1A2 (Z, A1/2); uvrstitev: SCI, Scopus, MBP; tipologijo je verificiral OSICT
točke: 31.95, št. avtorjev: 3

MALAJNER, Marko, GLEICH, Dušan, PLANINŠIČ, Peter. Angle of arrival measurement using multiple static monopole antennas. *IEEE sensors journal*, ISSN 1530-437X. [Print ed.], Jun. 2015, vol. 15, iss. 6, str. 3328 - 3337, doi: 10.1109/JSEN.2014.2386537. [COBISS.SI-ID 18354198], [JCR, SNIP, WoS do 2. 8. 2016: št. citatov (TC): 2, čistih citatov (CI): 1, čistih citatov na avtorja (CIAu): 0.33, Scopus do 2. 11. 2016: št. citatov (TC): 2, čistih citatov (CI): 2, čistih citatov na avtorja (CIAu): 0.67]
kategorija: 1A2 (Z, A1/2); uvrstitev: SCI, Scopus, MBP; tipologijo je verificiral OSICT
točke: 33.18, št. avtorjev: 3

PEJOSKI, Slavche, KAFEDZISKI, Venceslav, GLEICH, Dušan. Compressed sensing MRI using discrete nonseparable shearlet transform and FISTA. *IEEE signal processing letters*, ISSN 1070-9908. [Print ed.], 2015, vol. 22, no. 10, str. 1566-1570. [COBISS.SI-ID 18778390], [JCR, SNIP, WoS do 2. 9. 2016: št. citatov (TC): 3, čistih citatov (CI): 3, čistih citatov na avtorja (CIAu): 1.00, Scopus do 2. 6. 2016: št. citatov (TC): 4, čistih citatov (CI): 4, čistih citatov na avtorja (CIAu): 1.33]

kategorija: 1A2 (Z, A1/2); uvrstitev: SCI, Scopus, MBP; tipologijo je verificiral OSICT
točke: 29.92, št. avtorjev: 3

Biografija nosioca predmeta (sa fotografijom opciono)/Lecturer's CV (with photo optionally):

Univerza v Mariboru

FERI

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Vodenje in zaščita elektroenergetskih sistemov
Subject Title:	Power System Control and Protection

Študijski program Study programme	Študijska smer Study option	Letnik Year	Semester Semester
Elektrotehnika Electrical Engineering		1	zimski, poletni Autumn, Spring

Univerzitetna koda predmeta / University subject code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samostojno delo Individual work	ECTS
30			30		120	**6**

Nosilec predmeta / Lecturer: Boštjan Polajžer

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

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

Ni pogojev.

Prerequisites:

None.

Vsebina:

- Modeliranje, analiza in načrtovanje sistemov vodenja in zaščite elektroenergetskih sistemov (EES): normalno obratovanje, motena stanja in havarije.
- Izbrane vsebine iz vodenja EES v okviru združenja ENTSO-E.
- Regulacija moči in frekvence: osnovni in napredni koncepti, primeri obratovanja, optimiranje rezerv.
- Zaščita rotacijskih strojev, močnostnih transformatorjev in prenosnih vodov: osnovni koncepti, selektivnost, zaščitne sheme, primeri nastavitev.
- Numerična zaščita: napredni zaščitni algoritmi, delovanje relejev, analiza okvar in sekundarno preizkušanje.
- Vplivi nekonvencionalnih elementov na vodenje in zaščito EES: vetrne in sončne elektrarne, enosmerne povezave, FACTS naprave, virtualni vodi, itd.
- Sistemske meritve, vodenje in zaščita v pametnih omrežjih.

Content (Syllabus outline):

- Modelling, analysis and design of power system control and protection systems: normal operation, alert states and incidents.
- Selected topics from the field of power system control within ENTSO-E union.
- Load-frequency control (LFC): basic and advanced concepts, operation examples, optimization of reserves.
- Protection for rotating machines, power transformers and transmission lines: basic concepts, selectivity, protection schemes, settings examples.
- Numerical protection: advanced protective algorithms, relays operation, fault analysis and secondary testing.
- Impact of unconventional elements on power system control and protection: wind and solar power plants, DC lines, FACTS devices, virtual lines, etc.
- Wide area measurement, control and protection in smart grids.

Temeljni študijski viri / Textbooks:

- D. Dolinar, B. Polajžer. *Dinamika EES*, UM-FERI, Maribor, 2010.
- A.R. Bergen, V. Vittal. *Power system analysis*, Second Edition, Prentice-Hall Series, New Jersey, 2000.
- J. Machowski, J.W. Bialek, J.R. Bumby. *Power System Dynamics: Stability and Control*, Second Edition, John Wiley & Sons, Chichester, 2008.
- B. Grčar. *Uvod v zaščito elementov EES*, UM-FERI, Maribor, 1999.
- J.L. Blackburn, T.J. Domin. *Protective Relaying: Principles and Applications*, Third edition CRC Press, Boca Raton, 2007.
- Y.G. Paithankar. *Transmission Network Protection: Theory and Practice*, Marcel Dekker, New York, 1998.

Cilji:

Cilj predmeta je seznaniti študente z metodami za načrtovanje, analizo in vrednotenje sistemov vodenja in zaščite

Objectives:

The objective of this course is to acquaint students with methods for design, analysis and evaluation of power system control and

elektroenergetskih sistemov.	protection.

Znanje in razumevanje: Po zaključku tega predmeta bo študent sposoben • razumeti temeljne koncepte vodenja in zaščite elektroenergetskih sistemov, • analizirati, načrtovati in vrednotiti sisteme vodenja in zaščite EES. Prenosljive/ključne spretnosti in drugi atributi: • *Spretnosti komuniciranja:* pisanje seminarske naloge, ustno izražanje pri izpitu. • *Uporaba informacijske tehnologije:* uporaba programskih orodij za analizo, načrtovanje in implementacijo sistemov vodenja in zaščite. • *Spretnosti računanja:* modeliranje in numerične simulacije elektroenergetskih sistemov. • *Reševanje problemov:* analiza obratovanja elektroenergetskih sistemov in načrtovanje sistemov vodenja in zaščite.	Knowledge and understanding: On completion of this course the student will be able to • demonstrate knowledge and understanding of fundamental concepts in power system control and protection, • analyse, design and evaluate power system control and protection. Transferable/Key skills and other attributes: • *Communication skills:* written seminar assignment and oral examination. • *Use of information technology:* use of software tools for analysis, design and implementation of control and protection systems. • *Calculation skills:* modelling numerical simulation for power systems. • *Problem solving:* analysis of power system operation and design of control and protection systems.

Metode poučevanja in učenja:	**Teaching and learning methods:**
• predavanja, • eksperimentalno delo, • seminarska naloga.	• lectures, • experimental work, • seminar assignment.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment methods:**
• seminarska naloga, • predstavitev seminarske naloge, • ustni izpit.	40 10 50	• completed seminar assignment, • presentation of seminar assignment, • oral examination.

Opomba: **Navedene sestavine so obvezna sestavina učnega načrta predmeta kot ga določajo Merila za akreditacijo visokošolskih zavodov in študijskih programov v 7. členu (Ur. l. RS, št. 101/2004).**

REFERENCE:

RITONJA, Jožef, PETRUN, Martin, ČERNELIČ, Jernej, BREZOVNIK, Robert, POLAJŽER, Boštjan. Analysis and applicability of Heffron-Phillips model. Elektronika ir elektrotechnika, ISSN 1392-1215. [Print ed.], 2016, vol. 22, no. 4, str. 3-10, ilustr., doi: 10.5755/j01.eie.22.4.15905. [COBISS.SI-ID 19775766], [JCR, SNIP]
kategorija: 1A4 (Z); uvrstitev: SCI, Scopus, MBP; tipologija ni verificirana
točke: 10.49, št. avtorjev: 5

POLAJŽER, Boštjan, DOLINAR, Drago, RITONJA, Jožef. Estimation of area's frequency response characteristic during large frequency changes using local correlation. IEEE transactions on power systems, ISSN 0885-8950. [Print ed.], July 2016, vol. 31, no. 4, str. 3160-3168, doi: 10.1109/TPWRS.2015.2470537. [COBISS.SI-ID 19552534], [JCR, SNIP, WoS do 6. 6. 2016: št. citatov (TC): 0, čistih citatov (CI): 0, čistih citatov na avtorja (CIAu): 0, Scopus do 19. 5. 2016: št. citatov (TC): 0, čistih citatov (CI): 0, čistih citatov na avtorja (CIAu): 0]
kategorija: 1A1 (Z, A', A1/2); uvrstitev: SCI, Scopus, MBP; tipologijo je verificiral OSICT
točke: 45.75, št. avtorjev: 3

RITONJA, Jožef, DOLINAR, Drago, POLAJŽER, Boštjan. Adaptive and robust controls for static excitation systems. Compel, ISSN 0332-1649, 2015, vol. 34, no. 3, str. 864-881, doi: 10.1108/COMPEL-11-2014-0297. [COBISS.SI-ID 18677014], [JCR, SNIP, WoS do 13. 7. 2015: št. citatov (TC): 0, čistih citatov (CI): 0, čistih citatov na avtorja (CIAu): 0, Scopus do 1. 6. 2015: št. citatov (TC): 0, čistih citatov (CI): 0, čistih citatov na avtorja (CIAu): 0]
kategorija: 1A4 (Z); uvrstitev: SCI, Scopus, MBP; tipologijo je verificiral OSICT
točke: 18.21, št. avtorjev: 3

POLAJŽER, Boštjan, ŠTUMBERGER, Gorazd, DOLINAR, Drago. Instantaneous positive-sequence current applied for detecting voltage sag sources. IET generation, transmission & distribution, ISSN 1751-8687. [Print ed.], 2015, vol. 9, iss. 4, str. 319-327.

http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=7062185, doi: 10.1049/iet-gtd.2014.0483. [COBISS.SI-ID 18369302], [JCR, SNIP, WoS do 2. 10. 2016: št. citatov (TC): 1, čistih citatov (CI): 1, čistih citatov na avtorja (CIAu): 0.33, Scopus do 2. 6. 2016: št. citatov (TC): 2, čistih citatov (CI): 2, čistih citatov na avtorja (CIAu): 0.67]
kategorija: 1A2 (Z, A1/2); uvrstitev: SCI, Scopus, MBP; tipologijo je verificiral OSICT
točke: 29.2, št. avtorjev: 3

POLAJŽER, Boštjan, ŠTUMBERGER, Gorazd, DOLINAR, Drago. Detection of voltage sag sources based on the angle and norm changes in the instantaneous current vector written in Clarke's components. International journal of electrical power & energy systems, ISSN 0142-0615. [Print ed.], Jan. 2015, vol. 64, str. 967-976, ilustr. [COBISS.SI-ID 18298646], [JCR, SNIP, WoS do 7. 1. 2015: št. citatov (TC): 0, čistih citatov (CI): 0, čistih citatov na avtorja (CIAu): 0, Scopus do 13. 10. 2015: št. citatov (TC): 0, čistih citatov (CI): 0, čistih citatov na avtorja (CIAu): 0]
kategorija: 1A1 (Z, A', A1/2); uvrstitev: SCI, Scopus, MBP; tipologijo je verificiral OSICT
točke: 38.92, št. avtorjev: 3

Univerza v Mariboru

FERI

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Komunikacija človek-računalnik v medijih
Course title:	Human-Computer Interaction in the media

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Medijske komunikacije, 3. stopnja Media Communications, 3rd degree		1	

Vrsta predmeta / Course type Izbirni / Optional

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samostojno delo Individual work	ECTS
45		15			210	**9**

Nosilec predmeta / Lecturer: Matjaž Debevc

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

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

Pogojev ni.

Prerequisites:

None.

Vsebina:

- Uvod v komunikacijo človek-računalnik in ergonomijo programske opreme: osnove analize, načrtovanja in ocenjevanja uporabniških vmesnikov.
- Človekovi vidiki v okolju medijskih komunikacij.
- Grafično oblikovanje uporabniških vmesnikov za medije: oblikovanje strani, raba medijev, interakcijski pripomočki, berljivost, principi vizualnega prikazovanja, barve.
- Načrtovanje in prototipiranje uporabniško prijaznih produktov za medije.
- Ovrednotenje medijskih produktov glede na standarde.
- Dostopnost produktov za osebe s posebnimi potrebami.
- Uporabniški vmesniki prihodnosti za medijsko komunikacijo.

Content (Syllabus outline):

- Introduction to human-computer interaction and to software ergonomics: basics about analysis, design and evaluation of user interfaces.
- Human factors in the field of media communication.
- User interface graphical design for media: page design, use of the medium, interaction aids, readability, visual design principles, colors.
- Design and prototyping of user-friendly products for media.
- Evaluation of media products according to standards.
- Accessibility of products for persons with disabilities.
- Future user interfaces.

Temeljna literatura in viri / Readings:

- M. Debevc, T. K. Stjepanovič: Osnove oblikovanja interakcije človek-računalnik, Univerza v Mariboru, Fakulteta za elektrotehniko, računalništvo in informatiko, Maribor, 2005.
- J. Preece et all: Interaction Design: beyond human-computer interaction, John Wiley & Sons, New York, 2002.
- A. Dix et all: Human-Computer Interaction, Third Edition, Prentice Hall, New York, 2003.
- J. A. Jacko: Human Computer Interaction Handbook: Fundamentals, Evolving Technologies, and Emerging Applications, Third Edition (Human Factors and Ergonomics), CRC Press, Broken Sound Parkway NW, 2012.

Cilji in kompetence:

Cilj predmeta je študenta usposobiti za sintezo znanja na področju raziskovalnega dela za učinkovito uporabo človekovih vidikov in da pridobijo sposobnosti za določanje, izbiro in izdelavo uporabniško prijaznih vmesnikov in produktov za medije.

Objectives and competences:

The objective of this course is to enable the student to synthesize knowledge in the field of research work for the effective use of human aspects and to gain the ability to determine, select and produce user-friendly interfaces and products for the media.

Predvideni študijski rezultati:

Znanje in razumevanje:

Po zaključku tega predmeta bo študent sposoben

- uporabljati načela in pravila za oblikovanje grafičnih uporabniških vmesnikov,
- uporabljati orodja za izdelavo prototipov,
- oceniti z raziskovalnimi metodami uporabniške vmesnike s pomočjo različnih metod ocenjevanja.

Prenosljive/ključne spretnosti in drugi atributi:

- *Spretnosti komuniciranja:* pisno izražanje v raziskovalnem delu, ustni in pisni zagovor raziskovalnih del.
- *Uporaba informacijske tehnologije:* uporaba orodij za oblikovanje uporabniških vmesnikov.
- *Reševanje problemov:* ocenjevanje obstoječih in lastnih uporabniških vmesnikov s pomočjo standardnih in statističnih metod.

Intended learning outcomes:

Knowledge and understanding:

On completion of this course the student will be able to

- use guidelines and standards for designing of graphical user interfaces,
- use prototyping tools,
- evaluate user interfaces with appropriate research evaluation methods.

Transferable/Key skills and other attributes:

- *Communication skills:* manner at expression in research works, oral and written defence of research work.
- *Use of information technology:* use of user interface building tools.
- *Problem solving:* evaluation of current and self-made user interfaces with help of standardised and statistical methods.

Metode poučevanja in učenja:

- predavanja,
- projektno in problemsko učenje,
- raziskovalno delo.

Learning and teaching methods:

- lectures,
- project and problem based teaching,
- research work.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
• opravljene domače naloge, • zagovor raziskovalnega dela, • pisni izpit.	20 % 30 % 50 %	• completed homeworks, • research work defence, • written examination.

Reference nosilca/Lecturer's references:

- DEBEVC, Matjaž, WEISS, Jernej, ŠORGO, Andrej, KOŽUH, Ines. Solfeggio learning and the influence of a mobile application based on visual, auditory and tactile modalities. British journal of educational technology, ISSN 1467-8535. [Online ed.], First published: 18 April 2019, str. 1-17, ilustr., doi: 10.1111/bjet.12792.
- DEBEVC, Matjaž, STJEPANOVIĆ, Zoran, HOLZINGER, Andreas. Development and evaluation of an e-learning course for deaf and hard of hearing based on the advanced Adapted Pedagogical Index method. Interactive learning environments, ISSN 1049-4820, 2014, vol. 22, iss. 1, str. 35-50, doi: 10.1080/10494820.2011.641673
- DEBEVC, Matjaž, KOSEC, Primož, HOLZINGER, Andreas. Improving multimodal web accessibility for deaf people : sign language interpreter module. Multimedia tools and applications, ISSN 1380-7501, 2011, vol. 54, no. 1, str. 181-199, doi: 10.1007/s11042-010-0529-8
- TESSENDORF, Bernd, DEBEVC, Matjaž, DERLETH, Peter, FEILNER, Manuela, GRAVENHORST, Franz, ROGGEN, Daniel, STIEFMEIER, Thomas, TRÖSTER, Gerhard. Design of a multimodal hearing system. Computer Science and Information Systems, ISSN 1820-0214, Jan. 2013, vol. 10, no. 1, str. 483-501, doi: 10.2298/CSIS120423012T
- KOŽUH, Ines, JEREMIĆ, Zoran, SARJAŠ, Andrej, LAPUH BELE, Julija, DEVEDŽIĆ, Vladan, DEBEVC, Matjaž. Social presence and interaction in learning environments : the effect on student success. Journal of educational technology & society, ISSN 1176-3647. [Print ed.], Dec. 2014, str. 1-4.

Univerza v Mariboru

FERI

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Inteligentna obdelava podatkov
Course title:	Intelligent Data Analysis

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Računalništvo in informatika, 3. stopnja Computer Science and Informatics, 3rd degree		1.	zimski, poletni Autumn, Spring

Vrsta predmeta / Course type Izbirni / Optional

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samostojno delo Individual work	ECTS
60					210	**9**

Nosilec predmeta / Lecturer: Iztok Fister ml.

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

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

Ni pogojev.

Prerequisites:

None.

Vsebina:

- Podatki in informacije.
- Multidimenzionalnost podatkov.
- Proces inteligentne obdelave podatkov
  - določitev problema,
  - predpriprava podatkov,
  - obdelava podatkov z uporabo inteligentnih metod.
- Evalvacija rezultatov
  - absolutna in relativna natančnost,
  - senzitivnost in specifičnost,
  - napačni pozitvini in napačni negativni,
  - stopnja napake,
  - zanesljivost pravil.
- Stroškovno orientirana analiza podatkov.

Content (Syllabus outline):

- Data and information.
- Multi-dimensionality of data.
- Process of intelligent data analysis
  - Problem definition,
  - Data pre-processing,
  - Data analysis using intelligent methods.
- Evaluation of results
  - Absolute and relative accuracy,
  - Sensitivity and specificity,
  - False positive and false negative,
  - Error rate,
  - Reliability of rules.
- Cost-sensitive data analysis.

Temeljna literatura in viri / Readings:

- T. Hastie, R. Tibshirani, J. Friedman: *The Elements of Statistical Learning*, Springer Series in Statistics, Berlin, 2001.
- M.J.A. Berry, G.S. Linoff: *Data Mining Techniques for Marketing, Sales, and Customer Relationship Management*, Wiley, New York, NY, USA, 1997.
- Ian H. Witten, Eibe Frank: *Data Mining: Practical Machine Learning Tools and Techniques*, Second Edition (Morgan Kaufmann Series in Data Management Systems), San Francisco, CA, USA, 2000.
- P. Cabena, P. Hadjinijan, R. Stadler, J. Verhees, A. Zanasi: *Discovering Data Mining ~ From Concept to Implementation*, Prentice Hall Ptr., New Jersey, USA, 1997.
- P.R. Cohen: *Empirical Methods for Artificial Intelligence*, MIT Press, Cambridge, MA, USA, 1995.
- D. Pyle: *Data Preparation for Data Mining*, Morgan Kaufmann Publishers, Inc., San Francisco, CA, USA, 1995.
- S.M. Weiss, N. Indurkhya: *Predictive Data Mining ~ A practical guide*, Morgan Kaufmann Publishers Inc., San Francisco, CA, USA, 1998.
- M. Berthold, D. J. Hand: *Intelligent Data Analysis*, Springer, Berlin, 2007.

Cilji in kompetence:

Objectives and competences:

Cilj predmeta je seznaniti študente z naprednimi znanji s področja inteligentne obdelave podatkov in opravljanja raziskav z uporabo znanj iz inteligentne analize podatkov na različnih aplikativnih področjih.	The objective of the subject is gain a deep insight into the methods of intelligent data analysis and their application in various areas of application.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Po zaključku predmeta bo študent sposoben • izkazati poglobljeno znanje na področju inteligentne obdelave podatkov, • izvajati raziskave s pomočjo inteligentne analize podatkov na izbranem aplikativnem področju, • analizirati probleme pridobivanja znanja, sintezirati pravi način pristopa rešitve in ustrezno vrednotiti izbrani pristop in rezultate. Prenosljive/ključne spretnosti in drugi atributi: • *Spretnosti komuniciranja:* pisanje znanstvenega poročila, pisno izražanje pri izpitu. • *Uporaba informacijske tehnologije:* uporaba programskih orodij za analizo obdelave podatkov. • *Reševanje problemov:* analiza, načrtovanje in raziskovanje z uporabo metod inteligentne obdelave podatkov.	Knowledge and understanding: On completion of the course the student will be able to • show a deep insight knowledge in the area of the intelligent data analysis, • conduct research in a selected application area using intelligent data analysis, • analyze knowledge acquisition problems, synthesize a an appropriate approach to problem solving and to evaluate chosen approach and results. Transferable/Key skills and other attributes: • *Communication skills:* written scientific report and oral defence, manner of expression at written and oral examination. • *Use of information technology:* use of software tools for data processing analysis. • *Problem solving:* analysis, design and research using intelligent data analysis methods.

Metode poučevanja in učenja:	**Learning and teaching methods:**
• predavanja, • projektna naloga.	• lectures, • project assignment.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
• opravljena projektna naloga, • ustni izpit.	50 50	• completed project work, • oral examination.

Reference nosilca/Lecturer's references:

FISTER ml., Iztok, IGLESIAS, Andres, DEB, Suash, FISTER, Dušan, FISTER, Iztok. Development of a framework for modeling preference times in triathlon. Neural computing & applications, ISSN 0941-0643, First Online: 18 July 2018, str. 1-14. https://link.springer.com/content/pdf/10.1007%2Fs00521-018-3632-9.pdf, doi: 10.1007/s00521-018-3632-9. [COBISS.SI-ID 13071900], [JCR, SNIP, Scopus do 30. 8. 2018: št. citatov (TC): 0, čistih citatov (CI): 0, čistih citatov na avtorja (CIAu): 0]
kategorija: **1A1** (Z, A', A1/2); uvrstitev: SCI, Scopus, MBP; tip dela še ni verificiran
točke: 26.68, št. avtorjev: 5

FISTER, Iztok, TEPEH, Aleksandra, FISTER ml., Iztok. Epistatic arithmetic crossover based on Cartesian graph product in ensemble differential evolution. Applied mathematics and computation, ISSN 0096-3003. [Print ed.], 2016, vol. 283, str. 181-194, doi: 10.1016/j.amc.2016.02.034. [COBISS.SI-ID 19397398], [JCR, SNIP, WoS do 2. 7. 2018: št. citatov (TC): 1, čistih citatov (CI): 1, čistih citatov na avtorja (CIAu): 0.33, Scopus do 29. 5. 2018: št. citatov (TC): 1, čistih citatov (CI): 1, čistih citatov na avtorja (CIAu): 0.33]
kategorija: **1A1** (Z, A', A1/2); uvrstitev: SCI, Scopus, MBP; tip dela je verificiral OSICT
točke: 40.27, št. avtorjev: 3

FISTER, Iztok, RAUTER, Samo, YANG, Xin-She, LJUBIČ FISTER, Karin, FISTER ml., Iztok. Planning the sports training sessions with the bat algorithm. Neurocomputing, ISSN 0925-2312. [Print ed.], 3 Feb. 2015, vol. 149, part B, str. 993-1002, doi: 10.1016/j.neucom.2014.07.034. [COBISS.SI-ID 17999638], [JCR, SNIP, WoS do 27. 8. 2018: št. citatov (TC): 29, čistih citatov (CI): 23, čistih citatov na avtorja (CIAu): 4.60, Scopus do 28. 8. 2018: št. citatov (TC): 34, čistih citatov (CI): 26, čistih citatov na avtorja (CIAu): 5.20]
kategorija: **1A1** (Z, A', A1/2); uvrstitev: SCI, Scopus, MBP; tip dela je verificiral OSICT

točke: 20.55, št. avtorjev: 5

Univerza v Mariboru

FERI

UČNI NAČRT PREDMETA / SUBJECT SPECIFICATION	
Predmet:	Porazdeljene podatkovne shrambe
Subject Title:	Distributed data storage systems

Študijski program Study programme	Študijska smer Study option	Letnik Year	Semester Semester
Računalništvo in informatika Computer Science and Informatics		1.	zimski, poletni Autumn, Spring

Univerzitetna koda predmeta / University subject code:

Predavanja Lectures	Seminar Seminar	Seminarske vaje Tutorial	Laborat. vaje Lab work	Terenske vaje Field work	Samostojno delo Individual work	ECTS
60					210	**9**

Nosilec predmeta / Lecturer: Aida Kamišalić Latifić

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

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

Pogojev ni.

Prerequisites:

None.

Vsebina:

- Uvod v tehnologije porazdeljenih podatkovnih shramb: osnovni koncepti, specifične lastnosti; vrste porazdeljenih shramb.
- Arthitekture porazdeljenih shramb: porazdeljene datotečne shrambe, shrambe v delovnem pomnilnku, decentralizirane shrambe, porazdeljene podatkovne shrambe, oblačne podatkovne shrambe, homogene in heterogene porazdeljene podatkovne baze.
- Podatkovne strukture (usmerjeni aciklični grafi, drevesa, bloki itd.), ki se uporabljajo za shranjevanje vsebin v porazdeljenih okoljih.
- Tehnike replikacije, fragmentacije, verzioniranja in razporejanja podatkov.
- Mehanizmi nadzora sočasnosti in replikacije v porazdeljenih podatkovnih shrambah.
- Izzivi dostopnosti in zagotavljanja hrambe vsebin ter zanesljivosti shramb v porazdeljenih (in decentraliziranih) okoljih.
- Varnost, avtorizacija in nadzor celovitosti v porazdeljenih okoljih.
- Procesiranje in optimizacija povpraševanj v porazdeljenih shrambah.
- Raziskovanje uporabe obstoječih sistemov porazdeljenih podatkovnih shramb.
- Raziskovanje odprtih raziskovalnih vprašanj in izzivov v zvezi s porazdeljenimi podatkovnimi shrambami.

Content (Syllabus outline):

- Introduction to distributed data storage technologies: basic concepts, specific features, types of distributed storages.
- Architectures of distributed data storages: distributed file systems, in-memory storages, decentralized systems, distributed data storages, cloud data storages, homogeneous and heterogeneous distributed databases.
- Data structures (directed acyclic graphs, trees, blocks, etc.) used for content storage in distributed environments.
- Replication, fragmentation, versioning and allocation techniques.
- Concurrency control and replica control mechanisms in distributed data storages.
- Challenges of content availability and storage assurance, and reliability of storages in distributed (and decentralized) environments.
- Security, authorization and integrity control within distributed environments.
- Query processing and optimization in distributed data storages.
- Exploring the usage of existing distributed data storage systems.
- Exploring the open research questions and challenges in relation to distributed data storages.

Temeljni študijski viri / Textbooks:

- Maarten van Steen & Andrew S. Tanenbaum: Distributed Systems, 3rd Ed., Pearson Education, 2017
- Tamer Ozsu & Patrick Valduriez: Principles of Distributed Database Systems, 3rd Ed., Springer, 2011
- Ajay D. Kshemkalyani & Mukesh Singhal: Distributed Computing - Principles, Algorithms, and Systems, Cambridge university press, 2008

Cilji:	**Objectives:**
Cilj tega predmeta je usposobiti študente za raziskovalno delo na področju porazdeljenih podatkovnih shramb.	The objective of this course is to teach students how to conduct research work in the field of distributed data storage systems.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Po zaključku predmeta bo študent sposoben • analizirati in ovrednotiti porazdeljene shrambe, • uporabiti pridobljeno znanje na praktičnih primerih načrtovanja sodobnih rešitev informacijskih sistemov, ki temeljijo na uporabi porazdeljenih podatkovnih tehnologij in sistemov porazdeljenih podatkovnih shramb, • sodelovati pri raziskavah in razvoju na področju porazdeljenih podatkovnih tehnologij. Prenosljive/ključne spretnosti in drugi atributi: • *Spretnosti komuniciranja:* pisanje strokovnega poročila, pisno izražanje pri izpitu. • *Uporaba informacijske tehnologije:* razumeti pomen in vlogo porazdeljenih shramb, primerjati posamezne sisteme, načrtovati rešitve z uporabo porazdeljenih shramb. • *Organizacijske spretnosti:* organiziranje procesa načrtovanja, vrednotenja in implementacije informacijskih rešitev, temelječih na porazdeljenih shrambah. Opredelitev vlog in porazdelitev dela v skupini. • *Reševanje problemov:* razvoj in raziskave na področju porazdeljenih podatkovnih shramb. • *Delo v skupini:* sodelovanje v interdisciplinanih raziskovalno-razvojnih ekipah.	Knowledge and understanding: On completion of this course the student will be able to • analyse and evaluate distributed data storage systems, • use the acquired knowledge in practical cases of planning modern information system solutions based on the usage of distributed data technologies and distributed data storage systems, • participate in research and development in the field of distributed data technologies. Transferable/Key skills and other attributes: • *Communication skills:* written report and oral defence, manner of expression at written and oral examination. • *Use of information technology:* understand the role and importance of distributed data storages, compare different systems, develop solutions using distributed data storages. • *Organizational skills:* organizing the process of planning, evaluating and implementing information system solutions based on distributed data storages. Role definition and work distribution. • *Problem solving*: research and development in the field of distributed data storages. • *Organisation skills: Working in a group:* working in interdisciplinary research and development teams.

Metode poučevanja in učenja:	**Teaching and learning methods:**
• predavanja, • projektna naloga.	• lectures, • project assignment.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment methods:**
• opravljena projektna naloga, • ustni izpit.	50 50	• completed project work, • oral examination.

Reference nosilca/Lecturer's references:

KAMIŠALIĆ, Aida, RIAÑO, David, KERT, Suzana, WELZER-DRUŽOVEC, Tatjana, NEMEC ZLATOLAS, Lili. Multi-level medical knowledge formalization to support medical practice for chronic diseases. Data & Knowledge Engineering, ISSN 0169-023X. [Print ed.], Jan. 2019, vol. 219, str. 36-57, doi: 10.1016/j.datak.2018.12.001. [COBISS.SI-ID 21986582]

KAMIŠALIĆ, Aida, RIAÑO, David, WELZER-DRUŽOVEC, Tatjana. Formalization and acquisition of temporal knowledge for decision support in medical processes. Computer methods and programs in biomedicine, ISSN 0169-2607. [Print ed.], May 2018, vol. 158, str. 207-228, doi: 10.1016/j.cmpb.2018.02.012. [COBISS.SI-ID 21244182]

KAMIŠALIĆ, Aida, HERIČKO, Marjan, WELZER-DRUŽOVEC, Tatjana, TURKANOVIĆ, Muhamed. Experimental study on the effectiveness of a teaching approach using Barker or Bachman notation for conceptual database design. Computer science and information systems, ISSN 1820-0214. [Print ed.], 2018, vol. 15, no. 2, str. 421-448, doi: 10.2298/CSIS180322008K. [COBISS.SI-ID 21524246]

TURKANOVIĆ, Muhamed, HÖLBL, Marko, KOŠIČ, Kristjan, HERIČKO, Marjan, KAMIŠALIĆ, Aida. EduCTX: A blockchain-based higher education credit platform. IEEE access, ISSN 2169-3536, 5 Jan. 2018, vol. 6, iss. 1, str. 5112-5127, doi: 10.1109/ACCESS.2018.2789929. [COBISS.SI-ID 21085718]

KAMIŠALIĆ, Aida, FISTER, Iztok, TURKANOVIĆ, Muhamed, KARAKATIČ, Sašo. Sensors and functionalities of non-invasive

wrist-wearable devices : a review. Sensors, ISSN 1424-8220, 2018, vol. 18, no. 6, str. 1-33, ilustr., doi: 10.3390/s18061714. [COBISS.SI-ID 21442582]

Univerza v Mariboru

FERI Fakulteta za elektrotehniko, računalništvo in informatiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Rudarjenje nestrukturiranih podatkov in obdelava besedil
Course title:	Mining unstructured data and natural language processing

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Računalništvo in informatika, 3. stopnja Computer Science and Informatics, 3rd degree		1.	zimski, poletni Autumn, Spring

Vrsta predmeta / Course type: Izbirni / Optional

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individual work	ECTS
60					240	10

Nosilec predmeta / Lecturer: Sašo Karakatič

Jeziki / Languages:	**Predavanja / Lectures:**	Slovenski / Slovene, angleški / English
	Vaje / Tutorial:	Slovenski / Slovene, angleški / English

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

Ni pogojev.

Prerequisites:

None.

Vsebina:

- Uporaba tehnik pridobivanja informacij, rudarjenja in strojnega učenja na področjih spleta, izvorne kode, besedila in drugih tipov nestrukturiranih podatkov.
- Uporaba rekurzivnih nevronskih mrež za klasifikacijo in kreacijo besedil ter drugih nestrukturiranih podatkov.
- Obdelava nestrukturiranih podatkov z uporabo konvolucijskih nevronskih mrež, Hopfiledove mreže, omejen Boltzmannov stroj, rekurzivne nevronske mreže z LSTM, GRU in drugimi tipi nevronov ter povezav v globokih nevronskih mrežah.
- Modeli predstavitve nestrukturiranih podatkov (vreča besed, LDA, tematski modeli, prezentacija v vektorjih word2vec, doc2vec in drugimi).
- Klasificiranje, gručenje in rudarjenje konceptov iz nestrukturiranih podatkov na podlagi pomena vsebine.
- Rudarjenje mnenja z namenom določitve v besedilu izraženih čustev.
- Povzemanje dokumentov za krajšanje besedil na zgolj pomembne vidike originalnega dokumenta.
- Optimizacija procesa rudarjenja nestrukturiranih podatkov s pomočjo algoritmov po vzoru iz narave.
- Prepoznava entitet in modeliranje odnosov med njimi.

Content (Syllabus outline):

- Use of information retrieval techniques, data mining and machine learning on web, source code, text and other unstructured data.
- Usage of recurrent neural networks for classification and creation of text and other unstructured data.
- Unstructured data processing with convolutional neural networks, Hopfield networks, restricted Boltzmann machine, and recursive networks with long-short term memory (LSTM), gated recurrent units (GRU) and other neuron types in deep neural networks.
- Unstructured data representation models (bag-of-words, LDA, topic models, vector representation with word2vec, doc2vec and others).
- Classification, clustering and concept mining from unstructured data based on their meaning of the content.
- Sentiment analysis aiming to determine in the text expressed feelings and attitude.
- Document summarization for shortening of text to only the major points of original document.
- Optimization of unstructured data mining with nature inspired algorithms.
- Named-entity recognition and entity relation modeling.

Temeljni literatura in viri / Readings:

- Sarkar, D., 2016. Text Analytics with Python: A Practical Real-World Approach to Gaining Actionable Insights from Your Data. Apress.
- Bird, S., Klein, E. and Loper, E., 2009. Natural language processing with Python: analyzing text with the natural language toolkit. " O'Reilly Media, Inc.".
- Reese, R.M., 2015. Natural language processing with Java. Packt Publishing Ltd.
- Hearty, J., 2016. Advanced Machine Learning with Python. Packt Publishing Ltd.
- Goodfellow, I., Bengio, Y. and Courville, A., 2016. Deep learning. MIT press.
- Géron, A., 2017. Hands-on machine learning with Scikit-Learn and TensorFlow: concepts, tools, and techniques to build intelligent systems. O'Reilly Media.

Cilji in kompetence:

Pridobitev teoretičnih in praktičnih znanj ter veščin za obdelavo nestrukturiranih podatkov.

Objectives and competences:

To acquire theoretical and practical knowledge and skills for processing unstructured data.

Predvideni študijski rezultati:

Znanje in razumevanje:

Po zaključku tega predmeta bo študent sposoben

- izkazati znanje in razumevanje celotnega procesa priprave in gradnje procesa rudarjenja nestrukturiranih podatkov
- izraziti znanje in uporabiti metode rudarjenja nestrukturiranih podatkov v realnih primerih odločanja
- izkazati sposobnost evalvacije in interpretacije rezultatov rudarjenja nestrukturiranih podatkov

Prenosljive/ključne spretnosti in drugi atributi:

- *Uporaba orodij in tehnologij:* uporaba tehnologij in orodij namenjenih za inteligentni analizo nestrukturiranih podatkov v enem izmed programskih jezikov.

Intended learning outcomes:

Knowledge and understanding:

On completion of this course the student will be able to

- demonstrate knowledge and understanding of the process of preparation and building of the mining system for unstructured data
- demonstrate knowledge and usage of methods of unstructured data mining on real cases
- demonstrate the ability to evaluate and interpret the results of the mining process for unstructured data

Transferable/Key skills and other attributes:

- *Use of tools and technologies:* use of software tools and technologies for data mining of unstructured data in one of the programming languages.

Metode poučevanja in učenja:

- predavanja,
- projekt.

Learning and teaching methods:

- lectures,
- project assignment.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
• opravljen projekt, • ustni izpit.	50 % 50 %	• completed project, • oral examination.

Reference nosilca / Lecturer's references:

- KARAKATIČ, Sašo, PODGORELEC, Vili. Improved classification with allocation method and multiple classifiers. Information fusion, ISSN 1566-2535, Sep. 2016, vol. 31, str. 26-42, doi: 10.1016/j.inffus.2015.12.006. [COBISS.SI-ID 19263510], [JCR, SNIP, WoS do 11. 11. 2018: št. citatov (TC): 9, čistih citatov (CI): 7, Scopus do 29. 8. 2018: št. citatov (TC): 11, čistih citatov (CI): 9]
- KAMIŠALIĆ, Aida, FISTER, Iztok, TURKANOVIĆ, Muhamed, KARAKATIČ, Sašo. Sensors and functionalities of non-invasive wrist-wearable devices: a review. Sensors, ISSN 1424-8220, 2018, vol. 18, no. 6, str. 1-33, ilustr., doi: 10.3390/s18061714. [COBISS.SI-ID 21442582], [JCR, SNIP, WoS do 11. 11. 2018: št. citatov (TC): 1, čistih citatov (CI): 1, Scopus do 9. 6. 2018: št. citatov (TC): 0, čistih citatov (CI): 0]
- KARAKATIČ, Sašo, PODGORELEC, Vili. A survey of genetic algorithms for solving multi depot vehicle routing problem.

Applied soft computing, ISSN 1568-4946. [Print ed.], Feb. 2015, vol. 27, str. 519-532, doi: 10.1016/j.asoc.2014.11.005. [COBISS.SI-ID 18347286], [JCR, SNIP, WoS do 15. 10. 2018: št. citatov (TC): 45, čistih citatov (CI): 45, Scopus do 28. 10. 2018: št. citatov (TC): 56, čistih citatov (CI): 56]

- KARAKATIČ, Sašo, HERIČKO, Marjan, PODGORELEC, Vili. The performance of allocation method on imbalanced data. V: JAAKKOLA, Hannu (ur.), et al. Information modelling and knowledge bases XXVIII, (Frontiers in artificial intelligence and applications, ISSN 0922-6389, Vol. 292). Amsterdam [etc.]: IOS Press. cop. 2017, str. 382-395. [COBISS.SI-ID 20206870], [WoS do 18. 6. 2017: št. citatov (TC): 0, čistih citatov (CI): 0, Scopus do 8. 4. 2017: št. citatov (TC): 0, čistih citatov (CI): 0]
- PODGORELEC, Vili, KARAKATIČ, Sašo. A multi-population genetic algorithm for inducing balanced decision trees on telecommunications churn data. Elektronika ir elektrotechnika, ISSN 1392-1215. [Print ed.], 2013, vol. 19, no. 6, str. 121-124, doi: 10.5755/j01.eee.19.6.4578. [COBISS.SI-ID 16972310], [JCR, SNIP, WoS do 2. 4. 2018: št. citatov (TC): 3, čistih citatov (CI): 1, Scopus do 26. 2. 2018: št. citatov (TC): 3, čistih citatov (CI): 1]
- KARAKATIČ, Sašo, KAMIŠALIĆ, Aida, TURKANOVIĆ, Muhamed, BREZOČNIK, Lucija, FAGANEL, Roman. Creating personnel profiles for military unit formation and role selection with artificial intelligence. V: Big data and artificial intelligence for military decision making : meeting proceedings : STO-MP-IST-160. [S. l.: s. n. 2018], str. 1-10, [COBISS.SI-ID 21799702]
- ŠIMENKO, Samo, PODGORELEC, Vili, KARAKATIČ, Sašo. Analyzing short text jokes from online sources with machine learning approaches. V: HERIČKO, Marjan (ur.). Sodelovanje, programska oprema in storitve v informacijski družbi : zbornik 21. mednarodne multikonference Informacijska družba - IS 2018, 8. in 12. oktober 2018, [Ljubljana, Slovenia] : zvezek G = Collaboration, software and services in information society : proceedings of the 21th International Multiconference Information Society - IS 2018, 8-12 October, 2018, Ljubljana, Slovenia : volume G. Ljubljana: Institut Jožef Stefan. 2018, str. 27-30. [COBISS.SI-ID 21854486]
- HERIČKO, Tjaša, KARAKATIČ, Sašo, PODGORELEC, Vili. A data science approach to the analysis of food recipes. V: HERIČKO, Marjan (ur.). Sodelovanje, programska oprema in storitve v informacijski družbi : zbornik 21. mednarodne multikonference Informacijska družba - IS 2018, 8. in 12. oktober 2018, [Ljubljana, Slovenia] : zvezek G = Collaboration, software and services in information society : proceedings of the 21th International Multiconference Information Society - IS 2018, 8-12 October, 2018, Ljubljana, Slovenia : volume G. Ljubljana: Institut Jožef Stefan. 2018, str. 31-34. [COBISS.SI-ID 21858326]
- DONAJ, Gregor, SEPESY MAUČEC, Mirjam, KARAKATIČ, Sašo, BORKO, Matej, ŽGANK, Andrej. Experimental design for activity prediction in smart home environment. V: ŽEMVA, Andrej (ur.), TROST, Andrej (ur.). Zbornik sedemindvajsete mednarodne Elektrotehniške in računalniške konference ERK 2018 = Proceedings of the Twenty-seventh International Electrotechnical and Computer Science Conference ERK 2018, ERK 2018, Portorož, Slovenija, 17.-18. september 2018, (Zbornik ... Elektrotehniške in računalniške konference (Online), ISSN 2591-0442, 27). Ljubljana: Društvo Slovenska sekcija IEEE. 2018, str. 404-407. [COBISS.SI-ID 21714966]
- ŠORGO, Andrej, DOLENC, Kosta, ŠUMAK, Boštjan, PODGORELEC, Vili, KARAKATIČ, Sašo, HERIČKO, Marjan. Proposal for developing an autonomous intelligent and adaptive e-learning system (AIAES) for education. V: STRAHONJA, Vjeran (ur.), KIRINIĆ, Valentina (ur.). CECIIS : Central European Conference on Information and Intelligent Systems : 28th international conference, September 27th-29th, 2017, Varaždin, Croatia, (Central European Conference on Information and Intelligent Systems (Print), ISSN 1847-2001), (Central European Conference on Information and Intelligent Systems (Online), ISSN 1848-2295). Varaždin: Faculty of Organization and Informatics. 2017, str. 169-174. [COBISS.SI-ID 23374856]
- ČERNEZEL, Aleš, KARAKATIČ, Sašo, BRUMEN, Boštjan, PODGORELEC, Vili. Predicting grades based on students' online course activities. V: UDEN, Lorna (ur.). Knowledge management in organizations : proceedings, 9th International conference, KMO 2014, Santiago, Chile, September 2-5, 2014, (Lecture notes in business information processing, ISSN 1865-1348, 185), (LNBIP 185). Cham; Heidelberg; New York: Springer. cop. 2014, str. 108-117. [COBISS.SI-ID 18067222], [SNIP, Scopus do 27. 9. 2018: št. citatov (TC): 1, čistih citatov (CI): 1]

OBRAZAC

Table S2.6.4.en The template for preparation of course info lists

Course title: ***Contemporary building materials***

Course code	Course status	Semester	Number of ECTS credits	Class load
	Optional	I	10	2+0+2

Study programmes for which it is organised:
Doctoral studies in sustainable development, MARDS

Admission requirement: None

Goals of course: The goal of this course is that PhD students: understand contemporary building materials and particularities of their implementation; use gained knowledge in the scientific research and in engineering practice regarding design, construction and maintenance.

Course content:

Preparatory week	Consultation with supervisor, courses selection.
I week	Introduction. Basic terms regarding contemporary materials from aspects of structure and phenomenology.
II week	Composite materials. Special types of concrete and their application – high strength concretes, lightweight concretes, heavy concretes, SC concretes.
III week	Composite materials. Special types of concrete and mortar and their application – micro reinforced concretes and mortars, polymer modified concretes and mortars, polymer concretes and mortars, epoxy resins.
IV week	Mortars for special applications – decorative mortars, hydro isolating mortars, soundproof mortars, radiationproof mortars, fireproof mortars.
V week	Corrosion and materials durability (steel, concrete, etc.), with general protection measures.
VI week	Severity of the environment and technical requirements for protection measures.
VII week	Contemporary plastics – history, characteristics and most common application in civil engineering.
VIII week	Carbon fibres based materials.
IX week	Contemporary structural materials – polymer based reinforcements and coupling with classic concretes.
X week	Ecology aspect of contemporary building materials – green construction.
XI week	Sustainable development principles and possibility of recycling, with special reference to classic building materials.
XII week	Project task. Experimental and laboratory work. (individual work)
XIII week	Project task. Experimental and laboratory work. (individual work)
XIV week	Project task. Experimental and laboratory work. (consultation and review)
XV week	Project task. Experimental and laboratory work. (discussion and defence)

Teaching methods: teaching (lectures and exercises), in combination with supervised work; consultations; project based teaching/learning; experimental and laboratory work; obtained knowledge and skills presentation

Student's workload

Per week

10 credits x 40/30 = **13.33 hours**

Structure:
- **2** hours of lectures
- **2** hours of exercises
- **9.33** hours of individual work

Per semester

Lectures and final exam: (13.33 hours) x 16 = **213.33 hours**
Necessary preparation before the start of the semester (administration, enrolment, verification):
(13.33 hours) x 2 = **26.66 hours**

Total workload for the course: **10 x 30 = 300 hours**

Additional work for preparing correction of the final exam, including taking the exam:
0 - 60 hours (remaining time from the first and the second item to the total workload for the course of 300 hours)

Structure of the workload:
213.33 hours (lectures and final exam) + 26.66 hours (preparation) + 60 hours (additional work)

Obligations of students:

- regular attending lectures and other classes or adequate activity in supervised work
- conscientious and individual elaboration of homework and project tasks, as well as realisation of experimental and laboratory work, with systematisation of material and adequately applied scientific research methodology
- individual elaboration of written exam, accompanied by oral discussion
- presenting obtained knowledge during the semester and at the final exam

Literature:

- Mihailo A. Muravljov, Dragica Lj. Jevtić: Građevinski materijali 2, Beograd, 2003
- Specijalni betoni i malteri, svojstva, tehnologija, primena – Monografija, Građevinski fakultet u Beogradu, editor Mihailo A. Muravljov, 1999
- Građevinska fizika i materijali – Monografija, JUDIMK i Građevinski fakultet u Beogradu, 2008
- Svojstva svežeg i očvrslog betona u funkciji termohigrometrijskih parametara sredine – Monografija, Građevinski fakultet u Beogradu, editor Dragica Lj. Jevtić; 2008
- current literature (scientific papers from international conferences and journals)

Learning outcomes:

Knowledge and understanding:

On completion of this course the student will be able to:

- make general classification of contemporary building materials and solve problems concerning durability and economy of civil engineering structures,
- determine by experiment design characteristics of new materials and, by means of results analysis, suggest development of new materials or composites with pre-defined characteristics,
- analyse influential parameters in different exploitation conditions and their interactions with the environment,
- analyse possibility of forming new materials based on industrial and other types of waste components,
- analyse possibility of forming new materials based on components of recycled material,
- develop and study new materials with strict requirements regarding energy efficiency and requirements regarding harmonisation with EU Directive for construction products.

Transferable / Key skills and other attributes:

- Communication skills: oral defence of lab work, manner of expression at written examination.
- Use of information technology: use of software tools in parametric and other analyses.
- Calculation skills: performing calculation operations in parametric analyses.
- Problem solving: analyses of possibilities for new materials forming.

Methods of knowledge assessment and marking:

Knowledge assessment is continuous during the semester, through pre-exam checks, and in the final exam. In total, student may collect max 100 points.
The following is assessed:

- experimental and laboratory work 25%,
- other semester activities (homework etc.) 25%,
- final exam 50%.

The final exam consists of written and oral part. Written part may be realised through project task. Grades (A, B, C, D, E, F) are adjoined to collected number of points, in line with the Law of Higher Education and study rules at the University of Montenegro.

Name and surname of professor who prepared course info-list:

Prof.Dr Radomir Zejak

Special notes for the course:

Any other note:

OBRAZAC

Tabela S2.6.4. Forma za pripremu informacionih lista predmeta

Naziv predmeta: ***Savremeni građevinski materijali***

Šifra predmeta	Status predmeta	Semestar	Broj ECTS kredita	Fond časova
	Izborni	I	10	2+0+2

Studijski programi za koje se organizuje: ***Doktorske studije u održivom razvoju, MARDS***

Uslovljenost drugim predmetima: Nema uslovljenosti drugim predmetima

Ciljevi izučavanja predmeta: Cilj izučavanja ovog predmeta je da studenti doktorskih studija poznaju savremene građevinske materijale i razumiju specifičnosti njihove primjene, te da koriste stečena znanja u naučnoistraživačkom i stručnom radu, u oblasti projektovanja, izvođenja i održavanja objekata.

Sadržaj predmeta (nastavne cjeline, oblici individualnog rada studenata, oblici provjere znanja) prikazan prema radnim nedjeljama u akademskom kalendaru:

Pripremna nedjelja	Konsultacije sa mentorom, odabir predmeta.
I nedjelja	Uvodna izlaganja. Osnovni pojmovi vezani za savremene materijale sa aspekata strukture i fenomenologije.
II nedjelja	Kompozitni materijali. Specijalne vrste betona i njihova primjena – betoni visokih čvrstoća, laki betoni, teški betoni, SCC betoni.
III nedjelja	Kompozitni materijali. Specijalne vrste betona i maltera i njihova primjena – mikroarmirani betoni i malteri, polimer modifikovani betoni i malteri, polimer betoni i malteri, epoksidne smole.
IV nedjelja	Malteri posebnih namjena – dekorativni, hidroizolacioni, malteri za zvučnu zaštitu, malteri za zaštitu od zračenja, malteri za zaštitu od požara.
V nedjelja	Korozija i trajnost materijala (čelik, beton, ...), sa opštim mjerama zaštite.
VI nedjelja	Stepeni agresivnosti sredine i tehnički zahtjevi za mjere zaštite.
VII nedjelja	Savremene plastične mase – istorijat, svojstva i najčešća primjena u građevinarstvu.
VIII nedjelja	Materijali na bazi ugljeničnih/karbonskih vlakana.
IX nedjelja	Savremeni konstrukcijski materijali – armature na bazi polimera i sprezanje sa klasičnim betonima.
X nedjelja	Ekološki aspekt savremenih građevinskih materijala – zeleno građenje.
XI nedjelja	Principi održivog razvoja i mogućnost recikliranja sa posebnim osvrtom na klasične materijale.
XII nedjelja	Projektni zadatak. Eksperimentalni i laboratorijski rad. (samostalni rad)
XIII nedjelja	Projektni zadatak. Eksperimentalni i laboratorijski rad. (samostalni rad)
XIV nedjelja	Projektni zadatak. Eksperimentalni i laboratorijski rad. (konsultacije i revizija)
XV nedjelja	Projektni zadatak. Eksperimentalni i laboratorijski rad. (diskusija i odbrana)

Metode obrazovanja: nastava (predavanja i vježbe), u kombinaciji sa mentorskim radom; konsultacije; projektno učenje; eksperimentalni i laboratorijski rad; prezentovanje stečenih znanja

Opterećenje studenata

Nedjeljno

10 kredita x 40/30 = **13.33 sati**

Struktura:
- **2** sata predavanja
- **2** sata vježbi
- **9.33** sati samostalnog rada

U semestru

Nastava i završni ispit: (13.33 sati) x 16 = **213.33 sati**
Neophodne pripreme prije početka semestra (administracija, upis, ovjera): (13.33 sati) x 2 = **26.66 sati**

Ukupno opterećenje za predmet: **10 x 30 = 300 sati**

Dopunski rad za pripremu ispita u popravnom ispitnom roku, uključujući i polaganje popravnog završnog ispita: **od 0 do 60 sati** (preostalo vrijeme od prve dvije stavke do ukupnog opterećenja za predmet 300 sati)

Struktura opterećenja:
213.33 sati (nastava i završni ispit) + 26.66 sati (priprema) + 60 sati (dopunski rad)

OBRAZAC

Obaveze studenata u toku nastave:

- redovno pohađanje nastave, odnosno adekvatna aktivnost u mentorskom radu
- savjesna i samostalna izrada domaćih i projektnih zadataka, kao i realizacija ekserimentalnog i laboratorijskog rada, uz sistematizaciju odgovarajućeg materijala i adekvatno primijenjenu naučnoistraživačku metodologiju
- samostalna izrada pismenog ispita, praćena odgovarajućom usmenom diskusijom
- prezentovanje stečenih znanja tokom semestra i na završnom ispitu

Literatura:

- Mihailo A. Muravljov, Dragica Lj. Jevtić: Građevinski materijali 2, Beograd, 2003
- Specijalni betoni i malteri, svojstva, tehnologija, primena – Monografija, Građevinski fakultet u Beogradu, editor Mihailo A. Muravljov, 1999
- Građevinska fizika i materijali – Monografija, JUDIMK i Građevinski fakultet u Beogradu, 2008
- Svojstva svežeg i očvrslog betona u funkciji termohigrometrijskih parametara sredine – Monografija, Građevinski fakultet u Beogradu, editor Dragica Lj. Jevtić; 2008
- aktuelna literatura (naučni radovi sa međunarodnih konferencija i iz časopisa)

Ishodi učenja (usklađeni sa ishodima za studijski program):

Znanje i razumijevanje:

Po završetku ovog predmeta student će moći:

- izvršiti generalnu klasifikaciju savremenih novih građevinskih materijala i rješavati probleme vezane za trajnost i ekonomičnost građevinskih konstrukcija,
- utvrditi putem eksperimenta projektovane osobine novih materijala i analizom rezultata eventualno predložiti razvijanje novih materijala ili kompozita sa unaprijed definisanim svojstvima,
- analizirati uticajne parametre u različitim uslovima eksploatacije i njihove interakcije sa životnom sredinom,
- analizirati mogućnost formiranja novih materijala na bazi komponenti od industrijskog i drugog otpada,
- analizirati mogućnost formiranja novih materijala na bazi komponenti od recikliranog materijala,
- razvijati i proučavati nove materijale sa strogim zahtjevima vezanim za energetsku efikasnost i zahtjevima usklađenim sa Direktivom EU za građevinske proizvode.

Prenosive / ključne vještine i drugi atributi:

- Vještine komunikacije: usmena odbrana laboratorijskog rada, način izražavanja na pismenom ispitu.
- Upotreba informacione tehnologije: upotreba softverskih alata za parametarske i ostale analize.
- Vještine računanja: obavljanje računarskih operacija u parametarskim analizama.
- Rješavanje problema: analize mogućnosti formiranja novih materijala.

Oblici provjere znanja i ocjenjivanje:

Provjera znanja se vrši kontinuirano tokom semestra, odnosno kroz predispitne oblike provjere znanja, i na završnom ispitu. Po osnovu svih predispitnih oblika provjere znanja, odnosno ishoda učenja, i polaganjem ispita student može ostvariti najviše 100 poena.
Ocjenjuje se sljedeće:

- eksperimentalni i laboratorijski rad 25%,
- ostale semestralne aktivnosti (domaći zadaci...) 25%,
- završni ispit 50%.

Završni ispit obuhvata pismeni i usmeni dio. Pismeni dio može biti realizovan kroz projektni zadatak. Ostvarenom broju poena odgovaraju ocjene (A, B, C, D, E, F), u skladu sa odredbama Zakona o visokom obrazovanju i sa pravilima studiranja na Univerzitetu Crne Gore.

Ime i prezime nastavnika koji je pripremio informacionu listu predmeta:

Prof.dr Radomir Zejak

Specifičnosti koje je potrebno naglasiti za predmet:

Napomena (ukoliko je potrebno):

OBRAZAC

Tabela S2.6.4. Forma za pripremu informacionih lista predmeta

Naziv predmeta: ***Eksperimentalna analiza konstrukcija***

Šifra predmeta	Status predmeta	Semestar	Broj ECTS kredita	Fond časova
	Izborni	I	10	2+0+2

Studijski programi za koje se organizuje: ***Doktorske studije u održivom razvoju, MARDS***

Uslovljenost drugim predmetima: Nema uslovljenosti drugim predmetima

Ciljevi izučavanja predmeta: Cilj izučavanja ovog predmeta je da studenti doktorskih studija razumiju principe i postupke eksperimentalne analize konstrukcija, te da koriste stečena znanja u naučno-istraživačkom i stručnom radu, u oblasti projektovanja, izvođenja i održavanja objekata.

Sadržaj predmeta (nastavne cjeline, oblici individualnog rada studenata, oblici provjere znanja) prikazan prema radnim nedjeljama u akademskom kalendaru:

Pripremna nedjelja	Konsultacije sa mentorom, odabir predmeta.
I nedjelja	Uvod – istorijski razvoj, terminologija, tehnička regulativa.
II nedjelja	Tipovi i metode eksperimentalnog ispitivanja konstrukcija u realnim objektima i u laboratorijskim uslovima. Destruktivne i nedestruktivne metode eksperimentalne analize konstrukcija.
III nedjelja	Oprema za ispitivanje, mjerni uređaji i instrumenti.
IV nedjelja	Ispitivanje konstrukcija i objekata na modelima.
V nedjelja	Veza sa ispitivanjem materijala.
VI nedjelja	Statičko ispitivanje konstrukcija – nanošenje opterećenja; mjerenje pomjeranja, nagiba i prslina; mjerenje deformacija.
VII nedjelja	Dinamičko ispitivanje konstrukcija i objekata.
VIII nedjelja	Optičke metode za određivanje naponsko-deformacionog stanja.
IX nedjelja	Defektoskopija konstrukcija – metode ultrazvuka, radiografije, termografije; uređaji i aparature za mjerenje; klasifikacija grešaka i defekata.
X nedjelja	Mjerenje tvrdoće sklerometrom. Utvrđivanje položaja i količine armature u postojećim konstrukcijama.
XI nedjelja	Metodologija eksperimentalne analize konstrukcija. Projekat/program ispitivanja i izvještaj o ispitivanju.
XII nedjelja	Obrada i interpretacija eksperimentalnih podataka.
XIII nedjelja	Projektni zadatak. Eksperimentalni i laboratorijski rad. (samostalni rad)
XIV nedjelja	Projektni zadatak. Eksperimentalni i laboratorijski rad. (konsultacije i revizija)
XV nedjelja	Projektni zadatak. Eksperimentalni i laboratorijski rad. (diskusija i odbrana)

Metode obrazovanja: nastava (predavanja i vježbe), u kombinaciji sa mentorskim radom; konsultacije; projektno učenje; eksperimentalni i laboratorijski rad; prezentovanje stečenih znanja

Opterećenje studenata

Nedjeljno

10 kredita x 40/30 = **13.33 sati**

Struktura:
- **2** sata predavanja
- **2** sata vježbi
- **9.33** sati samostalnog rada

U semestru

Nastava i završni ispit: (13.33 sati) x 16 = **213.33 sati**
Neophodne pripreme prije početka semestra (administracija, upis, ovjera): (13.33 sati) x 2 = **26.66 sati**

Ukupno opterećenje za predmet: **10 x 30 = 300 sati**

Dopunski rad za pripremu ispita u popravnom ispitnom roku, uključujući i polaganje popravnog završnog ispita: **od 0 do 60 sati** (preostalo vrijeme od prve dvije stavke do ukupnog opterećenja za predmet 300 sati)

Struktura opterećenja:
213.33 sati (nastava i završni ispit) + 26.66 sati (priprema) + 60 sati (dopunski rad)

Obaveze studenata u toku nastave:
- redovno pohađanje nastave, odnosno adekvatna aktivnost u mentorskom radu
- savjesna i samostalna izrada domaćih i projektnih zadataka, kao i realizacija ekserimentalnog

i laboratorijskog rada, uz sistematizaciju odgovarajućeg materijala i adekvatno primijenjenu naučnoistraživačku metodologiju
- samostalna izrada pismenog ispita, praćena odgovarajućom usmenom diskusijom
- prezentovanje stečenih znanja tokom semestra i na završnom ispitu

Literatura:
- J.W. Dally, W.F. Riley: *Experimental stress analysis*, 3rd edition, McGraw-Hill, 1991.
- R.T. Reese, W.A. Kawahara: *Handbook on structural testing*, PTR Prentice-Hall, 1993.
- J.S. Bendat, A.G. Piersol: *Random Data: Analysis and Measurement Procedures*, 4th edition, Wiley, 2010.
- R.S. Figliola, D.E. Beasley: *Theory and Design for Mechanical Measurements*, 6th edition, Wiley, 2014.
- N. Đuranović: *Eksperimentalna analiza konstrukcija mjernim trakama*, Građevinski fakultet, Univerzitet Crne Gore, 2008.
- N. Đuranović: *Uvod u ispitivanje konstrukcija sa primjerima*, Građevinski fakultet, Univerzitet Crne Gore, Podgorica, 2009.
- R. Vukotić: *Ispitivanje konstrukcija*, Građevinski fakultet, Univerzitet u Beogradu i Izgradnja, Beograd, 1998.
- R. Vukotić i R. Tošković: *Zbirka rešenih ispitnih zadataka iz ispitivanja konstrukcija*, Gros knjiga, Beograd, 1994.
- uputstva za upotrebu i priručnici mjerne opreme
- aktuelna literatura (naučni radovi sa međunarodnih konferencija i iz časopisa)

Ishodi učenja (usklađeni sa ishodima za studijski program):

Znanje i razumijevanje:

Po završetku ovog predmeta student će moći:
- razumjeti i objasniti potrebe za eksperimentalnom analizom konstrukcija i njene principe,
- razumjeti različite tipove i metode eksperimentalne analize konstrukcija, te valjano predložiti metodu adekvatnu konkretnoj potrebi,
- koristiti opremu za ispitivanje, mjerne uređaje i instrumente
- sprovesti različite postupke eksperimentalne analize konstrukcija,
- interpretirati rezultate eksperimentalnog ispititivanja,
- osmisliti detaljan program eksperimentalnog istraživanja.

Prenosive / ključne vještine i drugi atributi:
- Vještine komunikacije: usmena odbrana laboratorijskog rada, način izražavanja na pismenom ispitu.
- Upotreba informacione tehnologije: upotreba softverskih alata u eksperimentalnoj analizi konstrukcija.
- Vještine računanja: obavljanje računarskih operacija tokom planiranja eksperimentalne analize i obrade eksperimentalnih podataka.
- Rješavanje problema: izrada programa eksperimentalnog istraživanja; suočavanje sa različitim problemima koji se mogu javiti tokom eksperimenta, a da ih nije bilo moguće predvidjeti, te preduzimanje mjera za njihovo rješavanje; interpretacija neočekivanih rezultata eksperimenta.

Oblici provjere znanja i ocjenjivanje:

Provjera znanja se vrši kontinuirano tokom semestra, odnosno kroz predispitne oblike provjere znanja, i na završnom ispitu. Po osnovu svih predispitnih oblika provjere znanja, odnosno ishoda učenja, i polaganjem ispita student može ostvariti najviše 100 poena.
Ocjenjuje se sljedeće:
- eksperimentalni i laboratorijski rad 50%,
- ostale semestralne aktivnosti (domaći zadaci...) 20%,
- završni ispit 30%.

Završni ispit obuhvata pismeni i usmeni dio. Pismeni dio može biti realizovan kroz projektni zadatak. Ostvarenom broju poena odgovaraju ocjene (A, B, C, D, E, F), u skladu sa odredbama Zakona o visokom obrazovanju i sa pravilima studiranja na Univerzitetu Crne Gore.

Ime i prezime nastavnika koji je pripremio informacionu listu predmeta:

Prof.dr Biljana Šćepanović

Specifičnosti koje je potrebno naglasiti za predmet:

Napomena (ukoliko je potrebno):

OBRAZAC

Table S2.6.4.en The template for preparation of course info lists

Course title: ***Experimental analysis of structures***

Course code	Course status	Semester	Number of ECTS credits	Class load
	Optional	I	10	2+0+2

Study programmes for which it is organised:
Doctoral studies in sustainable development, MARDS

Admission requirement: None

Goals of course: The goal of this course is that PhD students: understand principles and procedures of experimental analysis of structures; use gained knowledge in the scientific research and in engineering practice regarding design, construction and maintenance.

Course content:

Preparatory week	Consultation with supervisor, courses selection.
I week	Introduction – history, terminology, technical regulations.
II week	Types and methods of experimental analysis of structures in real objects and in laboratory conditions. Destructive & non-destructive methods of experimental analysis of structures.
III week	Testing equipment, measuring devices and instruments.
IV week	Testing models of structures.
V week	Connection with materials testing.
VI week	Static testing of structures – load application; measuring deflection, slope and cracks; measuring deformations.
VII week	Dynamic testing of structures and objects.
VIII week	Optical methods for determination of stress-strain state.
IX week	Defectoscopy of structures – methods of ultrasound, radiography, thermography; measuring devices; classification of defects.
X week	Hardness measuring by sclerometer. Determination of position and quantity of reinforcement in real structures.
XI week	Methodology of experimental analysis of structures. Testing programme and testing report.
XII week	Processing and interpretation of experimental data.
XIII week	Project task. Experimental and laboratory work. (individual work)
XIV week	Project task. Experimental and laboratory work. (consultation and review)
XV week	Project task. Experimental and laboratory work. (discussion and defence)

Teaching methods: teaching (lectures and exercises), in combination with supervised work; consultations; project based teaching/learning; experimental and laboratory work; obtained knowledge and skills presentation

Student's workload

Per week

10 credits x 40/30 = **13.33 hours**

Structure:
2 hours of lectures
2 hours of exercises
9.33 hours of individual work

Per semester

Lectures and final exam: (13.33 hours) x 16 = **213.33 hours**
Necessary preparation before the start of the semester (administration, enrolment, verification):
(13.33 hours) x 2 = **26.66 hours**

Total workload for the course: **10 x 30 = 300 hours**

Additional work for preparing correction of the final exam, including taking the exam:
0 - 60 hours (remaining time from the first and the second item to the total workload for the course of 300 hours)

Structure of the workload:
213.33 hours (lectures and final exam) + 26.66 hours (preparation) + 60 hours (additional work)

Obligations of students:
- regular attending lectures and other classes or adequate activity in supervised work
- conscientious and individual elaboration of homework and project tasks, as well as realisation of experimental and laboratory work, with systematisation of material and adequately

applied scientific research methodology
- individual elaboration of written exam, accompanied by oral discussion
- presenting obtained knowledge during the semester and at the final exam

Literature:

- J.W. Dally, W.F. Riley: *Experimental stress analysis*, 3rd edition, McGraw-Hill, 1991.
- R.T. Reese, W.A. Kawahara: *Handbook on structural testing*, PTR Prentice-Hall, 1993.
- J.S. Bendat, A.G. Piersol: *Random Data: Analysis and Measurement Procedures*, 4th edition, Wiley, 2010.
- R.S. Figliola, D.E. Beasley: *Theory and Design for Mechanical Measurements*, 6th edition, Wiley, 2014.
- N. Đuranović: *Eksperimentalna analiza konstrukcija mjernim trakama*, Građevinski fakultet, Univerzitet Crne Gore, 2008.
- N. Đuranović: *Uvod u ispitivanje konstrukcija sa primjerima*, Građevinski fakultet, Univerzitet Crne Gore, Podgorica, 2009.
- R. Vukotić: *Ispitivanje konstrukcija*, Građevinski fakultet, Univerzitet u Beogradu i Izgradnja, Beograd, 1998.
- R. Vukotić i R. Tošković: *Zbirka rešenih ispitnih zadataka iz ispitivanja konstrukcija*, Gros knjiga, Beograd, 1994.
- measuring equipment instructions and manuals
- current literature (scientific papers from international conferences and journals)

Learning outcomes:

Knowledge and understanding:

On completion of this course the student will be able to:
- understand and explain needs for and principles of experimental analysis of structures,
- understand different types and methods of experimental analysis of structures, as well as suggest adequate method for certain purpose,
- use testing equipment, measuring devices and instruments,
- realise different procedures of experimental analysis of structures,
- interpret experimental data,
- develop detailed programme of experimental research.

Transferable / Key skills and other attributes:

- Communication skills: oral defence of lab work, manner of expression at written examination.
- Use of information technology: use of software tools in experimental analysis of structures.
- Calculation skills: performing calculation operations during experiment planning and experimental data processing.
- Problem solving: developing experimental testing programme; facing different problems that may occur during the experiment, but might not have been foreseen, and creating adequate solutions; interpreting non-expected experimental results.

Methods of knowledge assessment and marking:

Knowledge assessment is continuous during the semester, through pre-exam checks, and in the final exam. In total, student may collect max 100 points.
The following is assessed:
- experimental and laboratory work 50%,
- other semester activities (homework etc.) 20%,
- final exam 30%.

The final exam consists of written and oral part. Written part may be realised through project task. Grades (A, B, C, D, E, F) are adjoined to collected number of points, in line with the Law of Higher Education and study rules at the University of Montenegro.

Name and surname of professor who prepared course info-list:

Assoc.Prof. Biljana Šćepanović, Dr-Ing.

Special notes for the course:

Any other note:

OBRAZAC

Table S2.6.4.en The template for preparation of course info lists

Course title: ***Risk management in civil engineering***

Course code	Course status	Semester	Number of ECTS credits	Class load
	Optional	I	10	2+0+2

Study programmes for which it is organised:
Doctoral studies in sustainable development, MARDS

Admission requirement: None

Goals of course: The goal of this course is that PhD students: understand categories and terms in domain of risk management in civil engineering projects realisation; understand risk analysis and assessment procedures; use gained knowledge in the scientific research and in engineering practice.

Course content:

Preparatory week	Consultation with supervisor, courses selection.
I week	Risk definition, causes of high risk, importance of assessment, decision making.
II week	Planning in risk conditions – analysis of managing decisions.
III week	Planning in risk conditions – risk identification.
IV week	Planning in risk conditions – project risk evaluation.
V week	Planning in risk conditions – risk assessment and analysis of alternatives; responsibility and insurance of planned actions.
VI week	Planning in risk conditions – measures for risk reduction.
VII week	Implementation of project risk management plan, conflicts solving, analysis of plan realisation consequences.
VIII week	Data bases application in risk management.
IX week	Fuzzy logic in risk management.
X week	Neural networks in risk management.
XI week	Genetic algorithms in risk management.
XII week	Project task. Seminar paper. (individual work)
XIII week	Project task. Seminar paper. (individual work)
XIV week	Project task. Seminar paper. (consultation and review)
XV week	Project task. Seminar paper. (discussion and defence)

Teaching methods: teaching (lectures and exercises), in combination with supervised work; consultations; project based teaching/learning; practical work; obtained knowledge and skills presentation

Student's workload

Per week

10 credits x 40/30 = **13.33 hours**

Structure:
2 hours of lectures
2 hours of exercises
9.33 hours of individual work

Per semester

Lectures and final exam: (13.33 hours) x 16 = **213.33 hours**
Necessary preparation before the start of the semester (administration, enrolment, verification):
(13.33 hours) x 2 = **26.66 hours**

Total workload for the course: **10 x 30 = 300 hours**

Additional work for preparing correction of the final exam, including taking the exam:
0 - 60 hours (remaining time from the first and the second item to the total workload for the course of 300 hours)

Structure of the workload:
213.33 hours (lectures and final exam) + 26.66 hours (preparation) + 60 hours (additional work)

Obligations of students:
- regular attending lectures and other classes or adequate activity in supervised work
- conscientious and individual elaboration of homework and project tasks, as well as realisation of practical work through seminar paper, with systematisation of material and adequately applied scientific research methodology

- individual elaboration of written exam, accompanied by oral discussion
- presenting obtained knowledge during the semester and at the final exam

Literature:

- Anthony M. “Neural Network Learning: Theoretical Foundations”, Cambridge University Press, 2002, ISBN-13: 978-0521573535
- Barnes M. "How to Allocate Risks in Construction Contracts" – Project Management, Vol 1, pp 24-57, 1993
- Bowers J.A. "Data for Project Risk Analysis" - International Journal of Project Management, Vol 12, No 1, pp 9-16, 1994
- Bowman E.H. "A Risk-return Paradox for Strategic Management", Sloan Management Review, 23(4), 1980
- Dembo R, Freeman A. "The rules of risk", John Wiley and Sons, Inc, 1998
- Haykin S.O, "Neural Networks and Learning Machines", Prentice Hall, Englewood Cliffs, New Jersey, 2008, ISBN-13: 978-0131471399
- Raftery J. “Risk Analysis in Project Management”, E&FN Spon, 1994
- Smith N. J. Managing risk in Construction Project, Blackwell Science Ltd, 1999
- current literature (scientific papers from international conferences and journals)

Learning outcomes:

Knowledge and understanding:

On completion of this course the student will be able to:

- explain basic categories and terms in domain of risk management in civil engineering,
- understand matter of planning and plan implementation in risk conditions in civil engineering projects,
- apply data bases, fuzzy logic, neural networks and genetic algorithms in domain of risk management in civil engineering,
- apply adequate skills in recognition of risks, their influence and mutual dependence,
- make categorisation of risks and recognise their weight criteria in multi-criteria analysis,
- make risk assessment for certain situation.

Transferable / Key skills and other attributes:

- Communication skills: oral defence of seminar paper, manner of expression in seminar paper and at written examination.
- Use of information technology: use of risk management software tools.
- Calculation skills: performing calculation operations in risk management algorithms.
- Problem solving: risk assessment.

Methods of knowledge assessment and marking:

Knowledge assessment is continuous during the semester, through pre-exam checks, and in the final exam. In total, student may collect max 100 points.
The following is assessed:

- seminar paper and other semester activities (homework etc.) 50%,
- final exam 50%.

The final exam consists of written and oral part. Written part may be realised through project task. Grades (A, B, C, D, E, F) are adjoined to collected number of points, in line with the Law of Higher Education and study rules at the University of Montenegro.

Name and surname of professor who prepared course info-list:

Prof.Dr Miloš Knežević

Special notes for the course:

Any other note:

OBRAZAC

Tabela S2.6.4. Forma za pripremu informacionih lista predmeta

Naziv predmeta: ***Upravljanje rizikom u građevinarstvu***

Šifra predmeta	Status predmeta	Semestar	Broj ECTS kredita	Fond časova
	Izborni	I	10	2+0+2

Studijski programi za koje se organizuje: ***Doktorske studije u održivom razvoju, MARDS***

Uslovljenost drugim predmetima: Nema uslovljenosti drugim predmetima

Ciljevi izučavanja predmeta: Cilj izučavanja ovog predmeta je da studenti doktorskih studija razumiju kategorije i pojmove iz oblasti upravljanja rizikom pri realizaciji građevinskih projekata, da poznaju postupke analize i procjene rizika, te da koriste stečena znanja u naučno-istraživačkom i stručnom radu.

Sadržaj predmeta (nastavne cjeline, oblici individualnog rada studenata, oblici provjere znanja) prikazan prema radnim nedjeljama u akademskom kalendaru:

Pripremna nedjelja	Konsultacije sa mentorom, odabir predmeta.
I nedjelja	Definicija rizika, uzroci visokog rizika, značaj procjene, donošenje odluka.
II nedjelja	Planiranje u uslovima rizika – analiza upravljačkih odluka.
III nedjelja	Planiranje u uslovima rizika – identifikacija rizika.
IV nedjelja	Planiranje u uslovima rizika – ocjena rizika projekta.
V nedjelja	Planiranje u uslovima rizika – vrednovanje rizika i analiza alternativa; odgovornost i osiguranje planiranih akcija.
VI nedjelja	Planiranje u uslovima rizika – mjere za smanjenje rizika.
VII nedjelja	Implementacija plana upravljanja rizikom projekta, rješavanje eventualnih konflikata, analiza posljedica izvršenja plana.
VIII nedjelja	Primjena baza podataka u upravljanju rizikom.
IX nedjelja	Fazi logika u upravljanju rizikom.
X nedjelja	Neuronske mreže u upravljanju rizikom.
XI nedjelja	Genetski algoritmi u upravljanju rizikom.
XII nedjelja	Projektni zadatak. Seminarski rad. (samostalni rad)
XIII nedjelja	Projektni zadatak. Seminarski rad. (samostalni rad)
XIV nedjelja	Projektni zadatak. Seminarski rad. (konsultacije i revizija)
XV nedjelja	Projektni zadatak. Seminarski rad. (diskusija i odbrana)

Metode obrazovanja: nastava (predavanja i vježbe), u kombinaciji sa mentorskim radom; konsultacije; projektno učenje; praktični rad; prezentovanje stečenih znanja

Opterećenje studenata

Nedjeljno

10 kredita x 40/30 = **13.33 sati**

Struktura:
- **2** sata predavanja
- **2** sata vježbi
- **9.33** sati samostalnog rada

U semestru

Nastava i završni ispit: (13.33 sati) x 16 = **213.33 sati**
Neophodne pripreme prije početka semestra (administracija, upis, ovjera): (13.33 sati) x 2 = **26.66 sati**

Ukupno opterećenje za predmet: **10 x 30 = 300 sati**

Dopunski rad za pripremu ispita u popravnom ispitnom roku, uključujući i polaganje popravnog završnog ispita: **od 0 do 60 sati** (preostalo vrijeme od prve dvije stavke do ukupnog opterećenja za predmet 300 sati)

Struktura opterećenja:
213.33 sati (nastava i završni ispit) + 26.66 sati (priprema) + 60 sati (dopunski rad)

Obaveze studenata u toku nastave:
- redovno pohađanje nastave, odnosno adekvatna aktivnost u mentorskom radu
- savjesna i samostalna izrada domaćih i projektnih zadataka, kao i realizacija praktičnog rada kroz seminarski rad, uz sistematizaciju odgovarajućeg materijala i adekvatno primijenjenu naučnoistraživačku metodologiju
- samostalna izrada pismenog ispita, praćena odgovarajućom usmenom diskusijom

- prezentovanje stečenih znanja tokom semestra i na završnom ispitu

Literatura:

- Anthony M. “Neural Network Learning: Theoretical Foundations”, Cambridge University Press, 2002, ISBN-13: 978-0521573535
- Barnes M. "How to Allocate Risks in Construction Contracts" – Project Management, Vol 1, pp 24-57, 1993
- Bowers J.A. "Data for Project Risk Analysis" - International Journal of Project Management, Vol 12, No 1, pp 9-16, 1994
- Bowman E.H. "A Risk-return Paradox for Strategic Management", Sloan Management Review, 23(4), 1980
- Dembo R, Freeman A. "The rules of risk", John Wiley and Sons, Inc, 1998
- Haykin S.O, "Neural Networks and Learning Machines", Prentice Hall, Englewood Cliffs, New Jersey, 2008, ISBN-13: 978-0131471399
- Raftery J. “Risk Analysis in Project Management”, E&FN Spon, 1994
- Smith N. J. Managing risk in Construction Project, Blackwell Science Ltd, 1999
- aktuelna literatura (naučni radovi sa međunarodnih konferencija i iz časopisa)

Ishodi učenja (usklađeni sa ishodima za studijski program):

Znanje i razumijevanje:

Po završetku ovog predmeta student će moći:

- objasniti osnovne kategorije i pojmove iz oblasti upravljanja rizikom u građevinarstvu,
- razumjeti materiju planiranja i implementacije plana u uslovima rizika kod građevinskih projekata,
- primijeniti baze podataka, fazi logiku, neuronske mreže i genetske algoritme u oblasti upravljanja rizikom u građevinarstvu,
- primijeniti odgovarajuće vještine u prepoznavanju rizika, njihovog uticaja i međusobne zavisnosti,
- napraviti kategorizaciju rizika i uočiti nihove težinske kriterijume u višekriterijumskoj analizi,
- izvršiti procjenu rizika u datoj situaciji.

Prenosive / ključne vještine i drugi atributi:

- Vještine komunikacije: usmena odbrana seminarskog rada, način izražavanja u seminarskom radu i na pismenom ispitu.
- Upotreba informacione tehnologije: upotreba softverskih alata za upravljanje rizikom.
- Vještine računanja: obavljanje računarskih operacija u algoritmima upravljanja rizikom.
- Rješavanje problema: procjena rizika.

Oblici provjere znanja i ocjenjivanje:

Provjera znanja se vrši kontinuirano tokom semestra, odnosno kroz predispitne oblike provjere znanja, i na završnom ispitu. Po osnovu svih predispitnih oblika provjere znanja, odnosno ishoda učenja, i polaganjem ispita student može ostvariti najviše 100 poena.
Ocjenjuje se sljedeće:

- seminarski rad i ostale semestralne aktivnosti (domaći zadaci...) 50%,
- završni ispit 50%.

Završni ispit obuhvata pismeni i usmeni dio. Pismeni dio može biti realizovan kroz projektni zadatak. Ostvarenom broju poena odgovaraju ocjene (A, B, C, D, E, F), u skladu sa odredbama Zakona o visokom obrazovanju i sa pravilima studiranja na Univerzitetu Crne Gore.

Ime i prezime nastavnika koji je pripremio informacionu listu predmeta:

Prof.dr Miloš Knežević

Specifičnosti koje je potrebno naglasiti za predmet:

Napomena (ukoliko je potrebno):

OBRAZAC

Tabela S2.6.4. Forma za pripremu informacionih lista predmeta

Naziv predmeta: ***Energetska efikasnost zgrada***

Šifra predmeta	Status predmeta	Semestar	Broj ECTS kredita	Fond časova
	Izborni	I	10	2+0+2

Studijski programi za koje se organizuje: ***Doktorske studije u održivom razvoju, MARDS***

Uslovljenost drugim predmetima: Nema uslovljenosti drugim predmetima

Ciljevi izučavanja predmeta: Cilj izučavanja ovog predmeta je da studenti doktorskih studija poznaju aktuelne strategije, principe i mjere za ostvarivanje energetske efikasnosti zgrada, te da koriste stečena znanja u naučno-istraživačkom i stručnom radu, u oblasti projektovanja, izvođenja i održavanja objekata.

Sadržaj predmeta (nastavne cjeline, oblici individualnog rada studenata, oblici provjere znanja) prikazan prema radnim nedjeljama u akademskom kalendaru:

Pripremna nedjelja	Konsultacije sa mentorom, odabir predmeta.
I nedjelja	Uvod. Osnovni pojmovi u vezi energetske efikasnosti sa aspekta građenja i energetskih performansi zgrada.
II nedjelja	Potencijali za povećanje energetske efikasnosti zgrade – niskoenergetski aspekti građenja.
III nedjelja	Savremena regulativa iz oblasti građevinskih proizvoda i energetske efikasnosti pri građenju.
IV nedjelja	Energetske potrebe u vezi sa životnim ciklusom zgrade (ugrađena energija, energetski zahtjevi u eksploataciji, energija pri recikliranju).
V nedjelja	Proračun toplotnih performansi i protoka toplote kroz elemente omotača zgrade. Protok kroz neprovidne i zastakljene površine. Protok preko tla.
VI nedjelja	Aspekti difuzije vodene pare kroz omotač zgrade – proračun; uticaj na energetsku efikasnost.
VII nedjelja	Uticaj klimatskih parametara na energetske performanse zgrada. Ostali proračunski parametri.
VIII nedjelja	Efekti toplotnih mostova na energetsku efikasnost – aspekti i metode proračuna.
IX nedjelja	Toplotni kapacitet konstrukcije i toplotna stabilnost – uticaj na energetsku efikasnost.
X nedjelja	Analiza proračunskih parametara energetskih performansi zgrada u zavisnosti od građevinskih proizvoda i sistema.
XI nedjelja	Optimizacija koštanja minimalnih (zahtijevanih) energetskih performansi zgrade.
XII nedjelja	Zgrade sa energetskim potrebama koje su blizu nule (NZEB).
XIII nedjelja	Projektni zadatak. Seminarski rad. (samostalni rad)
XIV nedjelja	Projektni zadatak. Seminarski rad. (konsultacije i revizija)
XV nedjelja	Projektni zadatak. Seminarski rad. (diskusija i odbrana)

Metode obrazovanja: nastava (predavanja i vježbe), u kombinaciji sa mentorskim radom; konsultacije; projektno učenje; praktični rad; prezentovanje stečenih znanja

Opterećenje studenata

Nedjeljno

10 kredita x 40/30 = **13.33 sati**

Struktura:
- **2** sata predavanja
- **2** sata vježbi
- **9.33** sati samostalnog rada

U semestru

Nastava i završni ispit: (13.33 sati) x 16 = **213.33 sati**
Neophodne pripreme prije početka semestra (administracija, upis, ovjera):
(13.33 sati) x 2 = **26.66 sati**

Ukupno opterećenje za predmet: **10 x 30 = 300 sati**

Dopunski rad za pripremu ispita u popravnom ispitnom roku, uključujući i polaganje popravnog završnog ispita: **od 0 do 60 sati** (preostalo vrijeme od prve dvije stavke do ukupnog opterećenja za predmet 300 sati)

Struktura opterećenja:
213.33 sati (nastava i završni ispit) + 26.66 sati (priprema) + 60 sati (dopunski rad)

Obaveze studenata u toku nastave:

- redovno pohađanje nastave, odnosno adekvatna aktivnost u mentorskom radu
- savjesna i samostalna izrada domaćih i projektnih zadataka, kao i realizacija praktičnog rada koz seminarski rad, uz sistematizaciju odgovarajućeg materijala i adekvatno primijenjenu naučnoistraživačku metodologiju
- samostalna izrada pismenog ispita, praćena odgovarajućom usmenom diskusijom
- prezentovanje stečenih znanja tokom semestra i na završnom ispitu

Literatura:

- Hugo Hens: "Building Physics – Heat, Air and Moisture" Fundamentals and Engineering methods with Examples and Exercises, Ernst&Sohn, 2011
- Hugo Hens: "Applied Building Physics – Boundary Conditions, Building Performance and Material Properties", Ernst&Sohn, 2011
- Vilems V., Šild K., Dinter S.: "Građevinska fizika - Priručnik", prevod, Građevinska knjiga, Beograd, 2006
- Jong-Jin Kim: "Qualities, Use, and Examples of Sustainable Building Materials" Fundamentals and Engineering methods with Examples and Exercises, Ernst&Sohn, 2011
- Ray Williams: "Next generation materials and technologies". http://cfsd.org.uk/eco-innovation_workshops/24.09.07_presentations/Ray_Williams_NPL_Next_Generation_Materials&Technologies.pdf
- Osman Attmann: "Green Architecture: Advanced Technologies and Materials", London, New York, Toronto 2010
- Karma Sawyer: "Windows and Building Envelope Research and Development", Road map for Emerging Technologies, Building Technologies Office, U.S. Department of Energy, February 2014.
- A.J. Marszal, et al., Zero Energy Building – A review of definitions and calculation methodologies, Energy Buildings (2011), doi:10.1016/j.enbuild.2010.12.022.
- Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance buildings
- Commission Delegated Regulation (EU) No 244/2012, Annex I: cost-optimal methodology framework.
- MEST EN ISO 50001:2014 Sistemi upravljanja energijom - Zahtjevi sa uputstvom za upotrebu / Energy management systems - Requirements with guidance for use
- MEST EN ISO 13790: Energy performance of buildings - Calculation of energy use for space heating and cooling.
- aktuelna literatura (naučni radovi sa međunarodnih konferencija i iz časopisa)

Ishodi učenja (usklađeni sa ishodima za studijski program):

Znanje i razumijevanje:

Po završetku ovog predmeta student će moći:

- prezentovati aspekte energetske efikasnosti pri građenju objekata, kao i aspekte energetskih performansi zgrada,
- analizirati adekvatnost postupaka proračuna i proračunskih pokazatelja energetskih performansi zgrada, u okviru životnog ciklusa,
- dati objektivnu ocjenu ulaznih parametara za analizu energetskih performansi zgrada,
- analizirati efekte difuzije vodene pare i akumuliranja vlage u slojevima omotača zgrade,
- ocijeniti toplotne gubitke i dobitke zgrade i formulisati toplotni bilans,
- utvrditi i ocijeniti parametre toplotne stabilnosti zgrada,
- procijeniti energetsku efikasnost zgrade i preporučiti mjere za poboljšanje,
- vrednovati tehničku dokumentaciju za poboljšanje energetskih performansi zgrada.

Prenosive / ključne vještine i drugi atributi:

- Vještine komunikacije: usmena odbrana seminarskog rada, način izražavanja na pismenom ispitu.
- Upotreba informacione tehnologije: upotreba softverskih alata za analizu i proračune energetske efikasnosti.
- Vještine računanja: obavljanje računarskih operacija u analizama i proračunima energetske efikasnosti.
- Rješavanje problema: analize energetske efikasnosti i formiranje predloga za unapređenje.

Oblici provjere znanja i ocjenjivanje:

Provjera znanja se vrši kontinuirano tokom semestra, odnosno kroz predispitne oblike provjere znanja, i na završnom ispitu. Po osnovu svih predispitnih oblika provjere znanja, odnosno ishoda učenja, i polaganjem ispita student može ostvariti najviše 100 poena. Ocjenjuje se sljedeće:

- seminarski rad i ostale semestralne aktivnosti (domaći zadaci...) 50%,
- završni ispit 50%.

Završni ispit obuhvata pismeni i usmeni dio. Pismeni dio može biti realizovan kroz projektni zadatak.
Ostvarenom broju poena odgovaraju ocjene (A, B, C, D, E, F), u skladu sa odredbama Zakona o visokom obrazovanju i sa pravilima studiranja na Univerzitetu Crne Gore.

Ime i prezime nastavnika koji je pripremio informacionu listu predmeta:

Prof.dr Radmila Sinđić Grebović

Specifičnosti koje je potrebno naglasiti za predmet:

Napomena (ukoliko je potrebno):

OBRAZAC

Table S2.6.4.en The template for preparation of course info lists

Course title: ***Energy efficiency of buildings***

Course code	Course status	Semester	Number of ECTS credits	Class load
	Optional	I	10	2+0+2

Study programmes for which it is organised:
Doctoral studies in sustainable development, MARDS

Admission requirement: None

Goals of course: The goal of this course is that PhD students: understand contemporary strategies, principles and measures for achieving energy efficiency of buildings; use gained knowledge in the scientific research and in engineering practice regarding design, construction and maintenance.

Course content:

Preparatory week	Consultation with supervisor, courses selection.
I week	Introduction. Basic terms regarding energy efficiency from aspects of construction and energy performance of buildings.
II week	Potentials for building energy efficiency increase – low-energy aspects of construction.
III week	Contemporary regulations in domain of construction products and energy efficiency in construction.
IV week	Energy needs regarding building life cycle (built-in energy, energy demands in exploitation, energy during recycling).
V week	Calculation of heat performance and heat flow through elements of building envelope. Flow through opaque and glass surfaces. Flow over soil.
VI week	Aspects of water vapour diffusion through building envelope – calculation; influence on energy efficiency.
VII week	Climate parameters influence on energy performance of buildings. Other calculation parameters.
VIII week	Effects of thermal bridges on energy efficiency – aspects and calculation methods.
IX week	Heat capacity of structure and thermal stability – influence on energy efficiency.
X week	Analysis of calculation parameters of building energy performance depending on construction products and systems.
XI week	Cost optimisation of minimum (required) building energy performance.
XII week	Nearly zero-energy buildings (NZEB).
XIII week	Project task. Seminar paper. (individual work)
XIV week	Project task. Seminar paper. (consultation and review)
XV week	Project task. Seminar paper. (discussion and defence)

Teaching methods: teaching (lectures and exercises), in combination with supervised work; consultations; project based teaching/learning; practical work; obtained knowledge and skills presentation

Student's workload

Per week	**Per semester**
10 credits x 40/30 = **13.33 hours** Structure: **2** hours of lectures **2** hours of exercises **9.33** hours of individual work	**Lectures and final exam**: (13.33 hours) x 16 = **213.33 hours** **Necessary preparation** before the start of the semester (administration, enrolment, verification): (13.33 hours) x 2 = **26.66 hours** **Total workload for the course**: **10 x 30 = 300 hours** **Additional work** for preparing correction of the final exam, including taking the exam: **0 - 60 hours** (remaining time from the first and the second item to the total workload for the course of 300 hours) **Structure of the workload**: 213.33 hours (lectures and final exam) + 26.66 hours (preparation) + 60 hours (additional work)

Obligations of students:

- regular attending lectures and other classes or adequate activity in supervised work
- conscientious and individual elaboration of homework and project tasks, as well as realisation of practical work through seminar paper, with systematisation of material and adequately applied scientific research methodology
- individual elaboration of written exam, accompanied by oral discussion
- presenting obtained knowledge during the semester and at the final exam

Literature:

- Hugo Hens: "Building Physics – Heat, Air and Moisture" Fundamentals and Engineering methods with Examples and Exercises, Ernst&Sohn, 2011
- Hugo Hens: "Applied Building Physics – Boundary Conditions, Building Performance and Material Properties", Ernst&Sohn, 2011
- Vilems V., Šild K., Dinter S.: "Građevinska fizika - Priručnik", prevod, Građevinska knjiga, Beograd, 2006
- Jong-Jin Kim: "Qualities, Use, and Examples of Sustainable Building Materials" Fundamentals and Engineering methods with Examples and Exercises, Ernst&Sohn, 2011
- Ray Williams: "Next generation materials and technologies". http://cfsd.org.uk/eco-innovation_workshops/24.09.07_presentations/Ray_Williams_NPL_Next_Generation_Materials&Technologies.pdf
- Osman Attmann: "Green Architecture: Advanced Technologies and Materials", London, New York, Toronto 2010
- Karma Sawyer: "Windows and Building Envelope Research and Development", Road map for Emerging Technologies, Building Technologies Office, U.S. Department of Energy, February 2014.
- A.J. Marszal, et al., Zero Energy Building – A review of definitions and calculation methodologies, Energy Buildings (2011), doi:10.1016/j.enbuild.2010.12.022.
- Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance buildings
- Commission Delegated Regulation (EU) No 244/2012, Annex I: cost-optimal methodology framework.
- MEST EN ISO 50001:2014 Sistemi upravljanja energijom - Zahtjevi sa uputstvom za upotrebu / Energy management systems - Requirements with guidance for use
- MEST EN ISO 13790: Energy performance of buildings - Calculation of energy use for space heating and cooling.
- current literature (scientific papers from international conferences and journals)

Learning outcomes:

Knowledge and understanding:

On completion of this course the student will be able to:

- present aspects of energy efficiency in construction, as well as aspects of energy performance of buildings,
- analyse adequacy of calculation procedures and calculation indicators of building energy performance, within life cycle,
- make objective assessment of input parameters for analysis of building energy performance,
- analyse effects of water vapour diffusion and moisture accumulation in building envelope layers,
- assess heat losses and gains of building and formulate thermal balance,
- determine and assess parameters of building thermal stability,
- estimate energy efficiency of building and recommend measures for improvement,
- evaluate technical documentation for improvement of building energy performance.

Transferable / Key skills and other attributes:

- Communication skills: oral defence of seminar paper, manner of expression at written examination.
- Use of information technology: use of software tools in analysis and calculation of energy efficiency.
- Calculation skills: performing calculation operations in analysis and calculation of energy efficiency.
- Problem solving: analyses of energy efficiency and formulation of solutions for improvements.

Methods of knowledge assessment and marking:

Knowledge assessment is continuous during the semester, through pre-exam checks, and in the final exam. In total, student may collect max 100 points. The following is assessed:

- seminar paper and other semester activities (homework etc.) 50%,
- final exam 50%.

The final exam consists of written and oral part. Written part may be realised through project task.
Grades (A, B, C, D, E, F) are adjoined to collected number of points, in line with the Law of Higher Education and study rules at the University of Montenegro.

Name and surname of professor who prepared course info-list:

Assoc.Prof. Radmila Sinđić Grebović, Dr-Ing.

Special notes for the course:

Any other note:

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Tabela S2.6.4. Forma za pripremu informacionih lista predmeta

Naziv predmeta: IZABRANA POGLAVLJA IZ ELEKTRIČNIH MAŠINA

Šifra predmeta	Status predmeta	Semestar	Broj ECTS kredita	Fond časova
	Izborni	II	10 ECTS	2+0+2

Studijski programi za koje se organizuje: Doktorske studije u održivom razvoju, MARDS

Uslovljenost drugim predmetima: Ne postoji uslovljenosti drugim predmetima

Ciljevi izučavanja predmeta: Cilj izučavanja predmeta je upoznavanje studenata doktorskih studija sa savremenim trendovima u oblasti električnih mašina i specifičnim mašinama i načinima analize koji prevazilaze okvire dodiplomskih studija.

Sadržaj predmeta (nastavne cjeline, oblici individualnog rada studenata, oblici provjere znanja) prikazan prema radnim nedjeljama u akademskom kalendaru:

Pripremna nedjelja	Razgovor i upoznavanje sa zainteresovanim PhD studentima, razmjena mišljenja u cilju uvida u njihova stečena znanja iz oblasti električnih mašina
I nedjelja	Funkcija navojka, funkcija namotaja, prostorna raspodjela magnetomotorne sile polifaznog distribuiranog namotaja.
II nedjelja	Spektralni sadržaj magnetomotorne sile polifaznog distribuiranog namotaja.
III nedjelja	Magnetomotorna sila kaveznog namotaja: spektralni sadržaj.
IV nedjelja	Žljebni harmonici u spektru struje statora asinhrone mašine i uslovi njihove egzistencije u zavisnosti od broja štapova rotora i broja pari polova mašine.
V nedjelja	Pulsacioni momenti asinhrone mašine, uslov njihove egzistencije i njihova učestanost.
VI nedjelja	Izračunavanje induktivnosti namotaja korišćenjem koncepta funkcije namotaja.
VII nedjelja	Iskošenje štapova rotora, potreba, značaj, optimalni ugao iskošenja i način inkorporiranja u dinamički model asinhrone mašine.
VIII nedjelja	Dvostrano napajana asinhrona mašina – princip rada.
IX nedjelja	Dvostrano napajana asinhrona mašina – primjena u savremenom elektroenergetskom sistemu.
X nedjelja	Stalni magneti u električnim mašinama, primjena, osobine, način modeliranja.
XI nedjelja	Sinhroni motori sa stalnim magnetima: vrste rotora u zavisnosti od načina postavljanja stalnih magneta, modeliranje i analiza.
XII nedjelja	Transformator pomjerač faze – princip rada i primjena u elektroenergetskom sistemu
XIII nedjelja	Osnovni pojmovi o primjeni metode konačnih elemenata u modeliranju električnih mašina.
XIV nedjelja	Projektni zadatak.
XV nedjelja	Projektni zadatak. Diskusija, konsultacije.

Metode obrazovanja:

- Predavanja
- Interaktivne vježbe
- Domaći zadaci
- Induvidualni projekat.

Opterećenje studenata

OBRAZAC

Nedjeljno:	**U semestru:**
10 kredita x 40/30 = **13.33 sati** Struktura: **2** sata predavanja **2** sata vježbi **9.33** sati samostalnog rada	Nastava i završni ispit: (13.33 sati) x 16 = 213.33 sati Neophodne pripreme prije početka semestra (administracija, upis, ovjera): (13.33 sati) x 2 = 26.66 sati Ukupno opterećenje za predmet: 10 x 30 = 300 sati Dopunski rad za pripremu ispita u popravnom ispitnom roku, uključujući i polaganje popravnog završnog ispita: od 0 do 60 sati (preostalo vrijeme od prve dvije stavke do ukupnog opterećenja za predmet 300 sati) Struktura opterećenja: 213.33 sati (nastava i završni ispit) + 26.66 sati (priprema) + 60 sati (dopunski rad)

Obaveze studenata u toku nastave:

- da redovno pohađaju nastavu,
- da savjesno i samostalno realizuju seminarske radove ili domaće zadatke,
- da radi u timu,
- da naučno-metodološki odrađuje ispitne obaveze i sistematizuje odgovarajući materijal,
- da samostalno odrađuje praktični dio ispita, uz pomoć literature
- prezentuje stečena znanja i postignute rezultate.

Literatura:

1. G. Joksimović, *Asinhrone mašine*, Narodna knjiga / MIBA Books, Podgorica, Beograd, 2019, ISBN: 9789940251482

2. J. Faiz, V. Gorbanian, G. Joksimović, *Fault diagnosis of induction motors*, The Institution of Engineering and Technology, IET, UK, 2017, ISBN-13: 978-1-78561-328-9

3. T. A. Lipo, *Analysis of synchronous machines*, CRC Press, Taylor and Francis Group, 2017.

4. C. M. Ong, *Dynamic simulation of electric machinery*, Prentice Hall, 1997.

Ishodi učenja (usklađeni sa ishodima za studijski program):

Po završetku ovog predmeta student će moći da:

- formira talasni oblik magnetomotorne sile i nađe njen spektralni sadržaj,
- dimenzioniše primitivnu mašinu sa stalnim magnetima,
- objasni princip rada dvostrano napajane asinhrone mašine,
- objasni princip rada transformatora pomjerača faze i njegovu ulogu u elektroenergetskom sistemu
- napravi prosti model dijela električne mašine u softveru baziranom na metodi konačnih elemenata i izvede osnovne zaključke iz tako dobijenih rezultata.

Oblici provjere znanja i ocjenjivanje:

- domaći zadaci, 50%
- projektni zadatak, 50%

Ime i prezime nastavnika i saradnika:
Prof. dr Gojko Joksimović

Specifičnosti koje je potrebno naglasiti za predmet:
Predmet se preporučuje i za niži oblik studija, MSc, uz odredjene modifikacije

Napomena (ukoliko je potrebno):

OBRAZAC

Table S2.6.4 (en). The template for preparation course info lists				
SUBJECT TITLE	*Selected topics in electrical machines*			
SUBJECT CODE	**SUBJECT STATUS**	**SEMESTER**	**NUMBER OF ECTS CREDITS**	**CLASS LOAD**
?	optional	II	10	?

STUDY PROGRAMMES FOR WHICH IT IS ORGANIZED:
PhD Program "Natural sciences and Technology for Sustainable Development",
Module Electrical and Computer Engineering, 3rd degree

ADMISSION REQUIREMENT: No prerequisites

GOALS OF STUDY: The course objective is to introduce postgraduate students with the up to date trends in area of electrical machines, with the specific topics and tools that overcomes the frames of undergraduate studies.

SUBJECT CONTENT:

Preparatory weeks	**Introduction with PhD students, talks**
I week	Turns function, winding function, polyphase AC winding Magnetomotive force space distribution.
II week	Spectral content of polyphase AC winding Magnetomotive force space distribution.
III week	Cage rotor winding Magnetomotive force: spectral content.
IV week	Rotor slot harmonics in induction machine stator current spectrum: rules for their existence regarding the rotor bar number and number of pole pairs.
V week	Pulsating torques, rules for their existence and frequencies at which they occur.
VI week	Self and mutual inductance calculation using winding function concept.
VII week	Skewing of rotor bars, significance of this measure, optimal skewing angle and manner of incorporating this effect into the dynamical induction machine model.
VIII week	Double-fed induction machine – principle of operation.
IX week	Double-fed induction machine – its use in the modern electric power system.
X week	Permanent magnets in electrical machines, their use and properties and manner of their modelling.
XI week	Synchronous motors with permanent magnets: different rotor structures regarding manner of its placement on the rotor, modelling and analysis
XII week	Phase shifting transformer – principle of operation and its use in modern electric power system.
XIII week	Basic elements and introductory terms of finite element modelling of electrical machines.
XIV week	Project definition
XV week	Project activities: discussions, consultations

TEACHING METHODS: Lectures, project based teaching

STUDENTS' WORKLOAD PER SUBJECT

Per week	**During semester**
10 credits x 40/30 = **13.33 hours** Structure: **2** hours of lectures **2** hours of exercises **9.33** hours of individual work	Lectures and final exam: (13.33 hours) x 16 = 213.33 hours Necessary preparation before the start of the semester (administration, enrolment, verification): (13.33 hours) x 2 = 26.66 hours Total workload for the course: 10 x 30 = 300 hours Additional work for preparing correction of the final exam, including taking the exam: 0 - 60 hours (remaining time from the first and the second item to the total workload for the course of 300 hours) Structure of the workload: 213.33 hours (lectures and final exam) + 26.66 hours (preparation) + 60 hours (additional work)

THE OBLIGATIONS OF THE STUDENTS DURING COURSE:

Students are obliged to attend lectures, submit homework assignments and successfully complete the assigned project

LITERATURE:

1. G. Joksimović, *Asinhrone mašine*, Narodna knjiga / MIBA Books, Podgorica, Beograd, 2019, ISBN: 9789940251482

2. J. Faiz, V. Gorbanian, G. Joksimović, *Fault diagnosis of induction motors*, The Institution of Engineering and Technology, IET, UK, 2017, ISBN-13: 978-1-78561-328-9

3. T. A. Lipo, *Analysis of synchronous machines*, CRC Press, Taylor and Francis Group, 2017.

4. C. M. Ong, *Dynamic simulation of electric machinery*, Prentice Hall, 1997.

EXPECTED LEARNING OUTCOMES:

On completion of this course the student will be able to:

∗ construct the magnetomotive force waveshape and analyse its spectral content,
∗ design primitive electrical machine with permanent magnets,
∗ describe double-fed induction machine principle of operation,
∗ understand and describe phase shifting transformer the principle of operation and its role in electric power system,
∗ make simple model of part of electric machine in software that is based on finite element method and derive basic conclusions from the obtained results.

METHODS OF KNOWLEDGE ASSESSMENT AND MARKING:

Homeworks, 50%
Completed project assignement, 50%

DATA PREPARED BY (NAME AND SURNAME OF PROFESSOR AND ASSISTANT IF DEFINED):

Prof. dr Gojko Joksimović

SPECIAL NOTE FOR THE SUBJECT:

ANY OTHER NOTE:

Table S2.6.4 (en). The template for preparation course info lists				
SUBJECT TITLE	*IoT ecosystems*			
SUBJECT CODE	**SUBJECT STATUS**	**SEMESTER**	**NUMBER OF ECTS CREDITS**	**CLASS LOAD**
	elective		10	2+0+4

STUDY PROGRAMMES FOR WHICH IT IS ORGANIZED:
PhD in Sustainable Development, MARDS

ADMISSION REQUIREMENT:
None

GOALS OF STUDY:
The main goals of this course is that postgraduate students understand the basics concepts of IoT ecosystems and use gained knowledge in the analysis and synthesis of a IoT ecosystems in different applications.

SUBJECT CONTENT:

Preparatory weeks	**Interview and survey of interested PhD students, the level of their knowledge related to the subject matter, the area of interest, skills they have, etc.**
I week	Introduction to the IoT Ecosystems, overview and short history
II week	IoT development platforms.
III week	Sensing and embedding components.
IV week	Sensors: temperature, gyroscope, pressure, light, GPS and many others.
V week	RFID: RFID readers, RFID tags and smart labels, UHF RFID, RFID applications, RFID used inside a living body, benefits of RFID solutions.
VI week	Connectivity Layer: connectivity of devices, gateways, standards and protocols, cloud, user interfaces.
VII week	Analytics Layer: using data to derive important business insights and drive business decisions, predictive learning/ deep learning-based models, big data infrastructure based on the use case.
VIII week	Data Management Layer: acquiring, managing and manipulating large scale raw and processed data, cloud-based architectures, very large-scale organizations.
IX week	Edge IT: architecture of software and hardware gateways to pre-process raw data, collect the raw data from sensors, transformation of the raw data before sending it to the cloud servers.
X week	End Components: smart devices like smartphones, tablets, PDA, etc., connecting to the IoT computational engine through cloud applications and remote connectivity.
XI week	Security in the IoT ecosystem: surveying IoT security challenges, creating an IoT cybersecurity plan, best practices in managing IoT cybersecurity
XII week	Application examples: smart homes, smart cities, smart markets, agriculture applications, environmental applications, etc.
XIII week	Project task. Defining the project task in groups.
XIV week	Project task. Discussion.
XV week	Project task. Consultations.

TEACHING METHODS:
- Lectures,
- Practical lab work,
- Team and/or individual project,
- Presentation of acquired knowledge

STUDENTS' WORKLOAD PER SUBJECT

Per week	**During semester**
10 credits x 40/30 = 13 hours and 20 minutes **Structure:** **2** hours of **lectures** **0** hours of **exercises** **4** hours of **practical work** 7 hours and **20** minutes of **individual work, including consultation**	**Lectures and final exam:** (13 hours and 20 minutes) x 15 = 200 hours **Necessary preparations before the start of the semester:** *(administration, enrolment, verification)* 2 x (13 hours and 20 minutes) = 26 hours and 40 minutes **Total subject load:** 10 x 30 = 300 hours **Additional hours for preparing correction of final exam, including the taking of the exam:** 300h - (226h and 40 minutes) = 73h and 20 minutes **Load structure:** 200 hours (Lectures) + 26 hours and 40 minutes

	(Preparation) + 73h and 20 minutes (Remedial classes)

THE OBLIGATIONS OF THE STUDENTS DURING COURSE:

- regularly attends classes and exercises,
- realizes seminar papers or homework,
- team work,
- scientifically and methodologically performs exam obligations and systematizes appropriate material,
- independently completes the practical part of the exam (with the help of literature),
- presents the acquired knowledge and achieved results.

LITERATURE:

- S. R. Sinha, Y. Park, Building an Effective IoT Ecosystem for Your Business, Springer, 2017.

- M. Yildiz, A Practical Guide for IoT Solution Architects: Architecting secure, agile, economic, highly available, well-performing IoT Ecosystems, S.T.E.P.S. Publishing Australia, 2019.

- A. Salam, Internet of Things for Sustainable Community Development: Wireless Communications, Sensing, and Systems, Springer, 2019.

- G. Colbach, RFID Handbook: Technology, Applications, Security and Privacy, independently published, 2018.

- N. Lekić, Z. Mijanović, Identifikacioni sistemi i primjene u zdravstvu, BioEMIS (530417-TEMPUS-1-2012-1-UK-TEMPUS-JPCR) Edition, Podgorica, 2016

EXPECTED LEARNING OUTCOMES:

Demonstrates a theoretical and practical knowledge and understanding of:

- principles of IoT ecosystems,
- structure of the IoT ecosystems,
- security challenges into the IoT ecosystems,
- cases in which IoT ecosystems can be successfully applied,
- structure of a particular IoT system,
- how to apply IoT ecosystems

METHODS OF KNOWLEDGE ASSESSMENT AND MARKING:

- *Seminar-colloquial work,*
- *project*

DATA PREPARED BY (NAME AND SURNAME OF PROFESSOR AND ASSISTANT IF DEFINED):

Prof. dr Nedjeljko Lekic

SPECIAL NOTE FOR THE SUBJECT:

With cetain modification, the course is also recommended for a lower form of study (MSc)

ANY OTHER NOTE:

OBRAZAC

Tabela S2.6.4. Forma za pripremu informacionih lista predmeta				
Naziv predmeta: IoT ekosistemi				
Šifra predmeta	**Status predmeta**	**Semestar**	**Broj ECTS kredita**	**Fond časova**
	Izborni		*10 ECTS*	2+0+4
Studijski programi za koje se organizuje: *Doktorske studije u održivom razvoju, MARDS*				
Uslovljenost drugim predmetima: *Ne postoji uslovljenosti drugim predmetima*				
Ciljevi izučavanja predmeta: *Cilj ovog kursa je da studenti postdiplomskih studija razumiju osnove IoT u ekososstemima, i da koriste stečena znanja u analizi i sintezi IoT ecosistema u razilčitim primjenama.*				
Sadržaj predmeta (nastavne cjeline, oblici individualnog rada studenata, oblici provjere znanja) prikazan prema radnim nedjeljama u akademskom kalendaru:				
Pripremna nedjelja	Intervju i anketa zainteresovanih PhD studenata, nivo njihovog znanja vezano za materiju koju kurs obrađuje, oblast interesovanja, vještine kojima raspolažu, itd.			
I nedjelja	Uvod u IoT ekosisteme, pregled i kratka istorija.			
II nedjelja	IoT razvojne platforme			
III nedjelja	Senzorske i ugrađene komponente			
IV nedjelja	Senzori; sensor temperature, žoroskop, sensor pritiska, GPS i mnogi drugi.			
V nedjelja	RFID: RFID čitači, RFID tagoci i pamatne labele, UHF RFID, RFID aplikacije, RFID u živom tijelu, dobiti of RFID rješenja.			
VI nedjelja	Sloj povezivanja: povezivanje uređaja, gateway-evi, standardi i protokoli, oblak, korisnički interfejsi.			
VII nedjelja	Analitički sloj: korišćenje podataka za dobivanje važnih poslovnih uvida i pokretanje poslovnih odluka, prediktivno/duboko učenje, big data infrestruktura zasnovana na primjeru upotrebe.			
VIII nedjelja	Sloj upravljanja podacima: pribavljanje, upravljanje i manipulisanje neobrađenih i obrađenih podataka velikih razmjera, arhitektura zasnovana na oblaku, ordanizacija podataka velikih razmjera.			
IX nedjelja	Edge IT: arhitektura softverskog i hardverskog gateway-a za prethodnu obradu neobrađenih podataka, prikupljanje neobrađenih podataka sa senzora, transformacija neobrađenih podataka podataka prije slanja na servere oblaka.			
X nedjelja	Krajnje komponente: pametni uređaji poput pametnih telefona, tableta, PDA itd., povezivanje sa IoT računarskom mašinom putem aplikacija oblaka i daljinskog povezivanja.			
XI nedjelja	Sigurnost u IoT ekosistemu: istraživanje IoT bezbednosnih izazova, kreiranje IoT ciber-bezbednosnog plana, najbolje prakse u upravljanju IoT ciber-sigurnošću.			
XII nedjelja	Primjeri primjene: pametne kuće, pametni gradovi, pametni marketi, aplikacije u agrikulturi, itd.			
XIII nedjelja	Projektni zadatak. Definicija projektnog zadatka u grupama.			
XIV nedjelja	Projektni zadatak. Diskusija.			
XV nedjelja	Projektni zadatak. Konsultacije.			
Metode obrazovanja: - Predavanja - Praktični laboratorijski rad - Timski i induvidualni projekat. - Prezentovanje stečenih znanja.				
Opterećenje studenata				

OBRAZAC

Nedjeljno:	**U semestru:**
10 kredita x 40/30 = 13 sati i 20 minuta Struktura: 2 sata predavanja 4 sata vježbi 7 sat i 20 minuta samostalnog rada uključujući konsultacije	Nastava i završni ispit: (13 sati 20 minuta) x 15 = 200 sati Neophodne pripreme prije početka semestra (administracija, upis, ovjera): 2 x (13 sati i 20 minuta) = 26 sati i 40 minuta Ukupno opterećenje za predmet: 10x30 = 300 sati Dopunski rad za pripremu ispita u popravnom ispitnom roku, uključujući i polaganje popravnog ispita:36 sati i 40 minuta Struktura opterećenja: 200 sati (nastava) + 26 sati i 40 min. (priprema) + 73 sati i 20 min (dopunski rad)

Obaveze studenata u toku nastave:

- redovno pohadja nastavu i vježbe,
- realizuju seminarske radove ili domaće zadatke,
- rad u timu,
- naučno-metodološki odradjuje ispitne obaveze i sistematizuje odgovarajući material,
- samostalno odradjuje praktični dio ispita (uz pomoć literature),
- prezentuje stečena znanja i postignute rezultate.

Literatura:

- S. R. Sinha, Y. Park, Building an Effective IoT Ecosystem for Your Business, Springer, 2017.
- M. Yildiz, A Practical Guide for IoT Solution Architects: Architecting secure, agile, economic, highly available, well-performing IoT Ecosystems, S.T.E.P.S. Publishing Australia, 2019.
- A. Salam, Internet of Things for Sustainable Community Development: Wireless Communications, Sensing, and Systems, Springer, 2019.
- G. Colbach, RFID Handbook: Technology, Applications, Security and Privacy, independently published, 2018.
- N. Lekić, Z. Mijanović, Identifikacioni sistemi i primjene u zdravstvu, BioEMIS (530417-TEMPUS-1-2012-1-UK-TEMPUS-JPCR) Edition, Podgorica, 2016

Ishodi učenja (usklađeni sa ishodima za studijski program):

- Objasniti principe IoT ekosistema.
- Razumjeti strukturu IoT ekosistema.
- Analizirati bezbjednosne izazove u IoT ekosistemima.
- Prepoznati slučajeve u kojima se IoT ekosistemi mogu uspješno primijeniti.
- Predložiti stukturu konkretnog IoT ekosistema
- Primijeniti IoT ekosisteme.

Oblici provjere znanja i ocjenjivanje:

- Seminarski-kolokvijalni rad
- Projekat

Ime i prezime nastavnika i saradnika:

Prof. dr Nedjeljko Lekic

Specifičnosti koje je potrebno naglasiti za predmet:

Predmet se preporucuje i za nizi oblik studija, MSc, uz odredjene modifikacije

Napomena (ukoliko je potrebno):

OBRAZAC

Tabela S2.6.4. Forma za pripremu informacionih lista predmeta

Naziv predmeta: EKSERGETSKE ANALIZE U HVAC INSTALACIJAMA

Šifra predmeta	Status predmeta	Semestar	Broj ECTS kredita	Fond časova
	Izborni		*10 ECTS*	3+1+1

Studijski programi za koje se organizuje: *Doktorske studije u održivom razvoju, MARDS*

Uslovljenost drugim predmetima: *Ne postoji uslovljenosti drugim predmetima*

Ciljevi izučavanja predmeta: *Osnovna ideja izučavanja predmeta je upoznavanje sa metodama eksergetske analize objekata i postrojenja. Eksergija kao veličina sadrži u sebi i principe II zakona termodinamike kao najznačajnijeg zakona fizike,a razumijevanje i energetske analize korišćenjem njegovih principa je od izuzetnog značaja sa stanovišta održivosti prije svega. Nakon savladavanja ovog predmeta i materije stiče se bolja slika o energetskoj potrošnji ali sada iz drugačijeg ugla, koji u sebi sadrži pitanje održivosti najnovijih tehnologija za korišćenje energije u svim sektorima potrošnje.*

Sadržaj predmeta (nastavne cjeline, oblici individualnog rada studenata, oblici provjere znanja) prikazan prema radnim nedjeljama u akademskom kalendaru:

Pripremna nedjelja	Priprema i upis semestra
I nedjelja	Pojam eksergije. Definicija eksergije toplote, mehaničke energije, električne energije. Eksergetska i energetska efikasnost. Eksergija i održivost. Eksergija, okolina i održivost.
II nedjelja	Energetska i eksergetska analiza. Izmenjivači toplote. Analize efikasnosti. Efikasnost izmenjivača toplote.
III nedjelja	Eksergetska analiza elemenata instalacija i procesa (pumpe, kompresori, ventili, miješanje struja, fazni prelaz)
IV nedjelja	Eksergija i industrijsko grijanje i hlađenje. Obnovljivo grijanje i hlađenje. Industrijske toplotne pumpe.
V nedjelja	Grijanje bazirano na sagorijevanju i eksergetska analiza. Električno procesno grijanje. Grijanje bazirano na sistemima sa parom. Studije slučaja.
VI nedjelja	Eksergija i toplotne pumpe. Efkasnost toplotnih pumpi. Sezonski faktor grijanja. Sezonski faktor energetske efikasnosti.
VII nedjelja	Klasifikacija toplotnih pumpi. Energetska i eksergetska analiza kompresorskih toplotnih pumpi sa isparavanjem.
VIII nedjelja	Kolokvijum 1
IX nedjelja	Kogeneraciona postrojenja. Studije slučaja i eksergetske analize. Energetska i eksergetska efikasnost kogeneracije. Uticaj kogeneracije na emisije i životnu sredinu.
X nedjelja	Daljinsko grijanje i hlađenje bazirano na kogeneraciji. Eksergetska analiza. Studije slučaja.
XI nedjelja	Sistemi za skladištenje energije. Klasifikacija sistema za skladištenje energije. Termodinamičke analize akumulatora energije.
XII nedjelja	Punjenje akumulatora. Pražnjenje akumulatora. Uticaj na životnu sredinu i eksergetska analiza.
XIII nedjelja	Sistemi za hlađenje i klimatizaciju bazirani na obnovljivim vidovima energije. Studije slučaja. Energetska i eksergetska analiza OiE i sistema za klimatizaciju kao integralnog sistema.
XIV nedjelja	Metode optimizacije bazirane na eksergetskim analizama. Studije slučaja. Vjetar, solar, diesel, prirodni gas.
XV nedjelja	Kolokvijum II

Metode obrazovanja:

- Predavanja
- Interaktivne vježbe
- Timski i induvidualni projekat.

Opterećenje studenata

OBRAZAC

Nedjeljno:	**U semestru:**
10 kredita x 40/30 = 13 sati i 30 minuta Struktura: 3 sata predavanja 2 sata vježbi 1 sat i 20 minuta samostalnog rada uključujući konsultacije	Nastava i završni ispit: (13 sati 30 minuta) x 15 = 200 sati Neophodne pripreme prije početka semestra (administracija, upis, ovjera): 2 x (10 sati i 30 minuta) = 21 sat Ukupno opterećenje za predmet:5x30 = 150 sati Dopunski rad za pripremu ispita u popravnom ispitnom roku, uključujući i polaganje popravnog ispita:36 sati i 55 minuta Struktura opterećenja: 99 sati i 45 min.(nastava)+13 sati i 20 min. (priprema)+36 sati i 55 min (dopunski rad)

Obaveze studenata u toku nastave:

- redovno pohadja nastavu i vježbe,
- savjesno i samostalno realizuju seminarske radove ili domaće zadatke,
- radi u timu,
- samostalno odradjuje praktični dio ispita, uz pomoć literature
- prezentuje stečena znanja i postignute rezultate.

Literatura:

- [1] I. Dincer, M. A. Rosen : Exergy Analysis of Heating,Refrigerating, and Air Conditioning, Elsevier publishing, 2015.
- [2] Kostas, T.J., The Exergy Method of Thermal Plant Analysis, Paragon Publishing, 2012.

Ishodi učenja (usklađeni sa ishodima za studijski program):

1. razumiju i vladaju osnovnim teorijskim znanjima iz Termodinamike
2. da razumiju koncept energetske i ekserergetske analize,eksergija
3. analiziraju različite slučajeve u raznim energetskim instalacijama
4. sprovedu i urade energetsku i eksergetsku analizu različitih energetskih instalacija

Oblici provjere znanja i ocjenjivanje:

I kolokvijum 25 poena, II kolokvijum 25 poena Završni ispit 50 poena
Prelazna ocjena se dobija ako se kumulativno sakupi namanje 50 poena

Ime i prezime nastavnika i saradnika:

Prof. dr Igor Vušanović

Specifičnosti koje je potrebno naglasiti za predmet:

Predmet se preporucuje onima koji će se baviti energetskim analizama i uštedama energije u svim sektorima.

Napomena (ukoliko je potrebno):

OBRAZAC

Tabela S2.6.4. Forma za pripremu informacionih lista predmeta

Naziv predmeta: Kompleksi metala i njihova primjena

Šifra predmeta	Status predmeta	Semestar	Broj ECTS kredita	Fond časova
	Izborni	II	*5 ECTS*	2+0+2

Studijski programi za koje se organizuje: *Doktorske studije u održivom razvoju*

Uslovljenost drugim predmetima: *Ne postoji uslovljenosti drugim predmetima*

Ciljevi izučavanja predmeta: Cilj izučavanja ovog predmeta je da se studentI upoznaju i razumiju jednu veoma važnu grupu jedinjenja sa velikom primjenom i potencijalno novom primjenom u medicini, farmaciji, industriji, poljoprivredi

Sadržaj predmeta (nastavne cjeline, oblici individualnog rada studenata, oblici provjere znanja) prikazan prema radnim nedjeljama u akademskom kalendaru:

Pripremna nedjelja	Podjela informacija o predmetu
I nedjelja	Klasifikacija liganada, klasifikacija kompleksnih jedinjenja
II nedjelja	Novi ligandi i nova kompleksna jedinjenja
III nedjelja	Geomerrijske strukture i izomerizam kod komplesnih jedinjenja
IV nedjelja	Metode sinteze komplekshih jedinjenja
V nedjelja	Osobine kompleksnih jedinjenja
VI nedjelja	Spektroskopske metode-tehnike za karakterizaciju komplesnih jedinjenja-NMR
VII nedjelja	Spektroskopske metode-tehnike za karakterizaciju komplesnih jedinjenja- NQR, EPR, ESR
VIII nedjelja	Spektroskopske metode-tehnike za karakterizaciju komplesnih jedinjenja- X-Ray
IX nedjelja	Spektroskopske metode-tehnike za karakterizaciju komplesnih jedinjenja- Raman
X nedjelja	Spektroskopske metode-tehnike za karakterizaciju komplesnih jedinjenja- FTIR)
XI nedjelja	Neki aspekti bioneorganske hemije
XII nedjelja	Grupe liganada i njihovih selektovanih kompleksa –primjena u medicini
XIII nedjelja	Grupe liganada i njihovih selektovanih kompleksa –primjena u farmaciji
XIV nedjelja	Grupe liganada i njihovih selektovanih kompleksa –primjena u poljoprivredi
XV nedjelja	Grupe liganada i njihovih selektovanih kompleksa –primjena u industriji

Metode obrazovanja:

- predavanja,
- projektno učenje,
- eksperimentalni rad.

OBRAZAC

Opterećenje studenata

Nedjeljno:	**U semestru:**
5 kredita x 40/30 = 6 sati i 40 minuta Struktura: 2 sata predavanja 2 sata vježbi 1 sat i 20 minuta samostalnog rada uključujući konsultacije	Nastava i završni ispit: (6 sati 40 minuta) x 15 = 99 sati i 45 minuta Neophodne pripreme prije početka semestra (administracija, upis, ovjera): 2 x (6 sati i 40 minuta) = 13 sati i 20 minuta Ukupno opterećenje za predmet:5x30 = 150 sati Dopunski rad za pripremu ispita u popravnom ispitnom roku, uključujući i polaganje popravnog ispita:36 sati i 55 minuta Struktura opterećenja: 99 sati i 45 min.(nastava)+13 sati i 20 min. (priprema)+36 sati i 55 min (dopunski rad)

Obaveze studenata u toku nastave:

- redovno pohadja nastavu i vježbe,

Literatura:

S.F.A. Kettle, Physical Inorganic Chemistry Oxford University Press, 1998,

Vasishta Bhatt Essentials of Coordination Chemistry Academic Press, 2015

P. L. Soni, V. Soni, Metal Complexes: Transition Metal Chemistry with Lanthanides and Actinides Publisher: CRC Pr I Llc, 2013

A. Takashiro, Basic Concepts Viewed from Frontier in Inorganic Coordination Chemistry, BoD – Books on Demand, 2018

Ž.Jaćimović, Unpublished materials

Ishodi učenja (usklađeni sa ishodima za studijski program):

Po završetku ovog predmeta student će moći:

Razumije geometrijske strukture i izomerizam kompleksnih jedinjenja kao važnog aspekta dobijenih osobina.

Poznaje pojedine klase liganada i njihove komplekse

Poznaje i upoređuje tehnike za karakterizaciju kompleksa

Analizira razlike i sličnosti između pojedinih liganada i kompleksa u strukturnom tipu a samim tim i u osobinama i primjeni

Selektuje kompleksna jedinjenja prema praktičnoj i potencijalno praktičnoj primjeni

Prenosive / ključne vještine i drugi atributi:

Laboratorijske vještine: Vještine laboratorijskog sintetičkog rada i korišćenje metoda –tehnika za karakterizaciju kompleksa

Oblici provjere znanja i ocjenjivanje:

- odrađene laboratorijske vježbe 35%
- pismeni ispit 50%
- ostale aktivnosti (domaći...) 15%

OBRAZAC

Ime i prezime nastavnika i saradnika: Prof. Dr Željko Jaćimović, Prof.dr Nedeljko Latinović
Specifičnosti koje je potrebno naglasiti za predmet: -
Napomena (ukoliko je potrebno): -

Table S2.6.4 (en). The template for preparation course info lists				
SUBJECT TITLE	*Metal complexes and their application*			
SUBJECT CODE	**SUBJECT STATUS**	**SEMESTER**	**NUMBER OF ECTS CREDITS**	**CLASS LOAD**
	Elective course	2	2	

STUDY PROGRAMMES FOR WHICH IT IS ORGANIZED:
PhD Program "Natural sciences and Technology for Sustainable Development",

ADMISSION REQUIREMENT:
No

GOALS OF STUDY:
The objective of this course is for students to understand one very important group of compounds with application use and potentially new application use in medicine, pharmacy, industry, agriculture.

SUBJECT CONTENT:

Preparatory weeks	
I week	Classification of ligands, classification of complex compounds
II week	New Ligands And New Complex Compounds
III week	Geometric structures and isomerism in complex compounds
IV week	Synthesis methods for complex compounds
V week	Properties of complex compounds
VI week	Spectroscopic methods-techniques for characterizing complex compounds (NMR, NQR, EPR, ESR, PES X-Ray, Raman, FTIR)
VII week	Spectroscopic methods-techniques for characterizing complex compounds -NMR
VIII week	Spectroscopic methods-techniques for characterizing complex compounds - NQR, EPR, ESR
IX week	Spectroscopic methods-techniques for characterizing complex compounds -X-Ray
X week	Spectroscopic methods-techniques for characterizing complex compounds - Raman
XI week	Spectroscopic methods-techniques for characterizing complex compounds - FTIR
XII week	Some aspects of bioinorganic chemistry
XIII week	Groups of ligands and their selected complexes - applications in medicine
XIV week	Groups of ligands and their selected complexes - application in pharmacy
XV week	Groups of ligands and their selected complexes - applications in agriculture
XVI week	Ligand groups and their selected complexes - industrial applications
Final week	Exam preparation
XVIII-XXI week	

TEACHING METHODS:

Lectures, project based teaching, experimental lab work

STUDENTS' WORKLOAD PER SUBJECT

Per week	During semester
5 credits x 40/30 = 6 hours and 40 minutes Structure: 2 hours of lectures 0 hours of exercises 1 hours of practical work 3 hours and 40 minutes of individual work, including consultation	Lectures and final exam: (6 hours and 40 minutes) x 16 = 106 hours and 40 minutes Necessary preparations before the start of the semester: *(administration, enrolment, verification)* 2 x (6 hours and 40 minutes) = 13 hours and 20 minutes Total subject load: 5 x 30 = 150 hours Additional hours for preparing correction of final exam, including the taking of the exam: 150h - (120h) = 30h Load structure: 106 hours and 40 minutes (Lectures) + 13 hours and 20 minutes (Preparation) + 30 hours (Remedial classes)

THE OBLIGATIONS OF THE STUDENTS DURING COURSE:

Students are obliged to attend lectures and laboratory exercises

LITERATURE:

S.F.A. Kettle, Physical Inorganic Chemistry Oxford University Press, 1998,
Vasishta Bhatt Essentials of Coordination Chemistry Academic Press, 2015
P. L. Soni, V. Soni, Metal Complexes: Transition Metal Chemistry with Lanthanides and Actinides Publisher: CRC Pr I Llc, 2013
A. Takashiro, Basic Concepts Viewed from Frontier in Inorganic Coordination Chemistry, BoD – Books on Demand, 2018
Ž.Jaćimović, Unpublished materials

EXPECTED LEARNING OUTCOMES:

Demonstrates a theoretical and practical knowledge and understanding of:

Upon completion of this course the student will be able to:
He understands the geometric structures and isomerism of complex compounds as an important aspect of the properties obtained.
He knows the particular classes of ligands and their complexes
Knows and compares techniques for characterizing complexes
Analyzes differences and similarities between individual ligands and complexes in structural type and therefore in properties and applications
Selects complex compounds according to practical and potentially practical use

Transferable / Key Skills and other attributes:

Laboratory skills: Laboratory synthetic work skills and the use of methods - techniques for characterizing complexes

METHODS OF KNOWLEDGE ASSESSMENT AND MARKING:

Completed lab work	35%
Written examination	50%
0ther activities (homeworks…).	15%

DATA PREPARED BY (NAME AND SURNAME OF PROFESSOR AND ASSISTANT IF DEFINED):

Prof. Željko Jaćimović, Prof. Nedeljko Latinovic

SPECIAL NOTE FOR THE SUBJECT:

-

ANY OTHER NOTE:

-

FORM

Table S2.6.4. Form for the preparation of the course information sheets

Name of the subject
Environmental chemistry

Code of the subject	Status of the subject	Semester	Number of ECTS credits	Class load
	Optional	Autumn, Winter	10	**5**

Study programme for which it is organized PhD Program "Natural sciences and Technology for Sustainable Development", Module Environment protection 3rd degree

Dependency by other subjects No prerequisites

Objectives of studying this subject
The aim of this course is for students to gain knowledge about pollutants, their interaction with the environment and their negative effects that can cause in ecosystems.

Contents of the subject (teaching units, forms of students' individual work, forms of testing) presented per working weeks in the academic calendar:

Preparatory week	
I week	Substances of anthropogenic origin in the environment.
II week	Flow and processes that cause the formation and distribution of pollutants in the atmosphere.
III week	Properties and chemical transformations of pollutants in the environment.
IV week	Sulfur and nitrogen oxides, ozone, fluorides, carbon (II) -oxide, nitrogen (I) -oxide, methane, halogenated hydrocarbons.
V week	Classification of pollutants according to environmental impact.
VI week	Effects due to their deposition (vegetation damage, metal corrosion, damage to industrial facilities and installations, climate change, deterioration of freshwater quality, soil, sea, forest damage, etc. ecosystem. Human health.
VII week	Chemicals that pollute the soil
VIII week	Micropollutants of organic origin in waters. Adsorption, sorption, distribution.
IX week	Organic acids and bases. Bioaccumulation. Transformation processes: oxidation and reduction, photolysis, hydrolysis, biodegradation.
X week	Polychlorinated biphenyls and chlorinated insecticides. Carbamates and organophosphorus insecticides.
XI week	Herbicides. Phenols. Halogenated aliphatic and monocyclic aromatic hydrocarbons.
XII week	Phthalate esters.Polychlorinateddibenzo-p-dioxins.
XIII week	Polycyclic aromatic hydrocarbons.
XIV week	Heavy metals.
XV week	Biological contaminants. Radiological contaminants.

Methods of education

- lectures
- experimental and laboratory work
- consultations

Students' load

Weekly	In Semester
3 hours lectures 2 hour tutorial 8 hours and 20min individual work including consultations Total: 13 hours and 20 minutes	300 hours Including preparatory and additional work

Students' obligations during the teaching:

Students are required to attend lectures regularly

Literature:

1. Abdullah, M.J., Ringstad, O. And Kveseth, N.J. (1982): Polychlorinated biphnyls in the Sediments of the Inner Oslofjord: Water, Air and Soil Pollution.
2. Vukašin D. Radmilović, "Kancerogeni u radnoj i životnoj sredini", IP Velašta, Beograd 2002.g.

FORM

Learning outcomes (complied with the outcomes for the study programme):

Knowledge and understanding:

On completion of this course the student will be able to:

- recognizes substances of anthropogenic origin in the environment,
- explains the flow and processes that cause the formation and distribution of pollutants contaminants in the environment as well as their properties and transformations
- classifies basic groups of inorganic and organic pollutants / contaminants,
- compares the basic types of pollutants / contaminants by their properties, structure and their toxicity to flora and fauna, humans and the environment
- integrates the adopted theoretical and experimental knowledge in the direction of protection of the environment and man from pollutants / contaminants
- plans a strategy for the protection of the environment and man from potential accident situations
- recommends experimental techniques for monitoring important polutants / contaminants

Transferable / Key Skills and other attributes:

- Communication skills: presentations, way of expressing oneself in the written exam.
- Basic laboratory skills
- Teamwork skills

Forms of tests and evaluation:

- completed lab work, 25%
- written examination 50%
- other activities (homeworks…) 25%

Name and surname of teacher and associate:
To be decided

Particularities needed to be emphasized for the subject:

Note (if needed):

FORM

Table S2.6.4. Form for the preparation of the course information sheets

Name of the subject
Ecology and environment

Code of the subject	Status of the subject	Semester	Number of ECTS credits	Class load
	Optional	Autumn, Winter	10	**5**

Study programme for which it is organized PhD Program "Natural sciences and Technology for Sustainable Development", Module Environment protection 3rd degree

Dependency by other subjects No prerequisites

Objectives of studying this subject
Introducing students to the scientific principles of ecology as a science and the application of principles of ecology in environmental protection

Contents of the subject (teaching units, forms of students' individual work, forms of testing) presented per working weeks in the academic calendar:

Preparatory week	
I week	Introduction. Ecology and environment. Diversity within the environment. Environmental conditions (Temperature, relative humidity, salinity, water flow). Ecological niche. Resources.
II week	Nutritional resources and users. Space as a resource. Life cycles of organisms. Population. Tables of life.
III week	Survival curves, Reproduction rates, population growth rate. Life cycle diversity. Reproductive success and the cost of reproduction. Life strategies.
IV week	Migrations and dispersions of organisms. Types of spatial arrangement of organisms. Demographic significance of dispersion. Dormancy.
V week	Competition within species. Competition and population size regulation. Territoriality. Mathematical models of intraspecific competition. Logistic equation. Competition between species. Gaussian principle of competitive exclusion. Mutual antagonism. Lotka-Voltaire model. Coexistence of a stronger and more famous competitor.
VI week	Predation. Division of predators. Predator feeding spectrum width and food composition. Functional responses.
VII week	Influence of consumer population density. Group distribution and influence on population dynamics.
VIII week	Symbiosis. Mutualism Amensalism, Commensalism. Parasites. Host-parasite interactions. Detritophases.
IX week	Population density. Population density regulation. Analysis of key factors. Population cycles.
X week	Logarithmic normal distribution of population densities in communities. Extinction of species.
XI week	The nature of communities. Describing communities. Ecosystem: definition and diversity Environmental disturbance. Biomi. Community successions. Island biogeography. Island communities and evolution.
XII week	Flow of energy and matter in communities. Primary production of ecosystems on Earth. Factors limiting primary production. Energy circulation in communities. Trophic structure of communities. Food chains.
XIII week	Biodiversity. Species diversity. Alpha, beta and gamma diversity. Biodiversity hot and cold spots.Ecoregions. Genetic diversity. Endemics and relics.
XIV week	Climate change and populations. Ecological applications at the level of organisms and individual populations: Restoration and conservation. Ecological applications at the level of population interactions. Control of harmful species. Invasive species.
XV week	Environmental applications at the community and ecosystem level. Management based on the theory of succession, food chains, ecosystem functioning and bidiversity. Designing protected areas

Methods of education

- lectures
- experimental and laboratory work
- consultations

Students' load

FORM

Weekly	In Semester
3 hours lectures 2 hour tutorial 8 hours and 20min individual work including consultations Total: 13 hours and 20 minutes	300 hours Including preparatory and additional work

Students' obligations during the teaching:

Students are required to attend lectures regularly

Literature:

Begon, M., Harper, J. L. & Towsend, C. R. (2014) Ecology: From individuals to ecosystems. Blackwell Scientific Publications, Oxford

Learning outcomes (complied with the outcomes for the study programme):

Knowledge and understanding:

Upon completion of this course the student will be able to:

- Understands the goals and principles of ecology as a science
- Uses and understands methods used in ecology
- Understands an ecological approach to environmental management
- Be trained for laboratory and field research in autecology and synecology

Transferable / Key Skills and other attributes:

- Communication skills: presentations, way of expressing oneself in the written exam.
- Basic laboratory skills
- Teamwork skills

Forms of tests and evaluation:

- completed lab work, 25%
- written examination 50%
- other activities (homeworks…) 25%

Name and surname of teacher and associate:

To be decided

Particularities needed to be emphasized for the subject:

Note (if needed):

FORM

Table S2.6.4. Form for the preparation of the course information sheets

Name of the subject
Ecology and biodiversity of aquatic ecosystems

Code of the subject	Status of the subject	Semester	Number of ECTS credits	Class load
	Optional	Autumn, Winter	10	**5**

Study programme for which it is organized PhD Program "Natural sciences and Technology for Sustainable Development", Module Environment protection 3rd degree

Dependency by other subjects No prerequisites

Objectives of studying this subject
Detailed acquaintance with aquatic habitats, ecological factors in them, and the structure and dynamics of the corresponding biocenoses that inhabit them.

Contents of the subject (teaching units, forms of students' individual work, forms of testing) presented per working weeks in the academic calendar:

Preparatory week	
I week	Introduction to community ecology. Ecosystem diversity.
II week	Genetic biodiversity
III week	Species biodiversity
IV week	Species extinction, species biodiversity as a surrogate for global biodiversity
V week	Metapopulation concept
VI week	Anthropogenic impact on ecosystems - ecological effect
VII week	Ecological effects of abiotic environment. Adaptations of organisms to the abiotic environment.
VIII week	Test
IX week	Ecosystems and successions
X week	Community analysis and statistical analysis
XI week	Ecosystems - vertical and horizontal zoning
XII week	Ecosystem division and boundaries between ecosystems
XIII week	Structure of communities in ecosystems - theoretical foundations
XIV week	Test
XV week	Ecosystem diversity of Montenegro

Methods of education

- lectures
- experimental and laboratory work
- consultations

Students' load

Weekly	In Semester
3 hours lectures 2 hour tutorial 8 hours and 20min individual work including consultations Total: 13 hours and 20 minutes	300 hours Including preparatory and additional work

Students' obligations during the teaching:

Students are required to attend lectures regularly

Literature:

1. Brien Moss, Ecology of Fresh Waters: A View for the Twenty-First Century, Wiley-Blackwell (2011)
2. George Karleskint, Richard Turner and James Small, Introduction to Marine Biology, Cengage Learning; 3 edition (2009)

FORM

Learning outcomes (complied with the outcomes for the study programme): After the student passes this exam they will be able to find and explain the relationship between structure, function and processes at the level of population, community and ecosystem, and understand their mutual influence, to recognize hierarchical levels of biodiversity and factors affecting biodiversity, explain concepts related to ecology and biodiversity of aquatic ecosystems, apply the acquired knowledge about ecology and biodiversity of aquatic ecosystems in everyday life and predict how changes in the environment and various abiotic factors can affect aquatic habitats.
Forms of tests and evaluation: • Oral examination, 40% • Written examination 60%
Name and surname of teacher and associate: To be decided
Particularities needed to be emphasized for the subject:
Note (if needed):

FORM

Table S2.6.4. Form for the preparation of the course information sheets

Name of the subject
Biological processes in the environment - selected chapters

Code of the subject	Status of the subject	Semester	Number of ECTS credits	Class load
	Optional	Autumn, Winter	10	**5**

Study programme for which it is organized PhD Program "Natural sciences and Technology for Sustainable Development", Module Environment protection 3rd degree

Dependency by other subjects No prerequisites

Objectives of studying this subject
Detailed introduction to biological and ecological processes in organisms, populations, communities and ecosystems.

Contents of the subject (teaching units, forms of students' individual work, forms of testing) presented per working weeks in the academic calendar:

Preparatory week	
I week	Characteristics of living things. Prokaryotic cell - structure and biological processes, bacteria and cyanobacteria.
II week	Eukaryotic cell - origin, structure and biological processes, differences between eukaryotes and prokaryotes.
III week	Plant cell, plant tissues and organs - biological processes.
IV week	Animal cells, tissues and organs - biological processes.
V week	Invertebrates - groups and biological processes.
VI week	Vertebrates - groups and biological processes.
VII week	Plants and algae - groups and biological processes.
VIII week	Test 1
IX week	Biological processes at the population level
X week	Biological processes at the level of biocenosis
XI week	Biological processes in natural ecosystems
XII week	Biological processes in anthropogenic and polluted ecosystems (local and global impact)
XIII week	Biological processes in water and soil
XIV week	Test 2
XV week	Test 3

Methods of education
- lectures
- consultations

Students' load

Weekly	In Semester
3 hours lectures 2 hour tutorial 8 hours and 20min individual work including consultations Total: 13 hours and 20 minutes	300 hours Including preparatory and additional work

Students' obligations during the teaching:

Students are required to attend lectures regularly

Literature:

1. Brock TD, Biology of microrganisms, 12th edititon, New Hersey: Prentice-Hall Inc. (2008)
2. Walker C, Hopkins S. P., Principles of Ecotoxicology, Taylor & Francis (2006)
3. Brien Moss, Ecology of Fresh Waters: A View for the Twenty-First Century, Wiley-Blackwell (2011)
4. George Karleskint, Richard Turner and James Small, Introduction to Marine Biology, Cengage Learning; 3 edition (2009)

FORM

Learning outcomes (complied with the outcomes for the study programme): After the student passes this exam he will be able to find and explain the connection between structure, function and processes at different levels of living world organization (at the level of molecules, cells, organisms, populations, communities, ecosystems), understand the main cellular processes and recognize differences between eukaryotic and prokaryotic organisms, explain the concepts related to morphology, anatomy and physiology of living beings (from the simplest unicellular to complex multicellular organisms), apply the acquired knowledge about the structure and function of organisms in everyday life and predict how changes in the environment and various abiotic factors can affect them.
Forms of tests and evaluation: • Oral examination, 40% • Written examination 60%
Name and surname of teacher and associate: To be decided
Particularities needed to be emphasized for the subject:
Note (if needed):

Table S2.6.4 (en). The template for preparation course info lists				
SUBJECT TITLE	*Precision agriculture*			
SUBJECT CODE	**SUBJECT STATUS**	**SEMESTER**	**NUMBER OF ECTS CREDITS**	**CLASS LOAD**
	Elective	II	*10 ECTS*	2+0+2

STUDY PROGRAMMES FOR WHICH IT IS ORGANIZED: *PhD study in sustainable development*

ADMISSION REQUIREMENT: Basic knowledge of bio-geo sciences and ICT technologies

GOALS OF STUDY: This course will provide an intermediate level to Precision Agriculture (PA) technologies, covering both the applications and the different technologies (e.g. geographic information systems (GIS), global positioning systems (GPS), remote sensing systems, sensoring, variable rate application, Internet of Things (IoT) etc that make precision farming possible. The students will acquire an inside to PA in order to apply multidisciplinary knowledge in this field.

SUBJECT CONTENT:

Preparatory weeks	Interview and survey of interested PhD students, checking their level of entrepreneurial knowledge as well as area of interest, transferable and soft skills etc
I week	Importance of Precision Agriculture and mapping in farming for decision making. What is “Precision Agriculture”? Decision making process. Senosring and signal processing. Value of maps in making decision.
II week	Benefits of Precision Agriculture. Economic benefits. Environmental benefits. Farm management improvement. Recordkeeping improvement. Improving interdisciplinary skills.
III week	Geographical concepts of PA. Coordinate systems. Scales. Projection. Resolution. Spatial data. Time data.
IV week	Geographical Position System (GPS). GPS Basics (Space Segment, Receiver Segment, Control Segment). Error and correction. Function and usage of GPS. GPS technologies and devices.
V week	Topic 2 Introduction to GIS. Basics of GIS. Function of GIS. Use of GIS for decisions. GIS Bowsers.
VI week	Intelligent Devices and Implement (IDI) devices usage in Precision Agriculture. Yield monitor. VR Application (fertilizers, seed, chemicals), vegetation index, different types of the sensoring. Examples of sensor and actuators systems.
VII week	Remote sensing. Aerial and satellite imagery. Above ground (non-contact) sensors. Different radars.
VIII week	Data collection. Methods of data collection (traditional and new). Data Collection by Grid Sampling. Collecting Data by Yield Monitor. Remote Sensing. Using of sensors for data collection
IX week	Data analysis. Concepts of data analysis. Resolution. Surface analysis. Computer systems for data analysis. Different signal processing algorithms.
X week	Internet of Things (IoT) concept in precision agriculture.
XI week	Machine vision concept in precision agriculture.
XII week	Case studies in precision agriculture.
XIII week	Guest lectures of the experts from local community dealing with PA.
XIV week	Project task. Discussion.
XV week	Project task. Discussion.

TEACHING METHODS:

Lectures.
Interactive exercises
Guest lectures.
Team and individual project.
Presentation of acquired knowledge.

STUDENTS' WORKLOAD PER SUBJECT

Per week	**During semester**
10 credits x 40/30 = **13.33 hours** Structure: **2** hours of lectures **2** hours of exercises **9.33** hours of individual work	Lectures and final exam: (13.33 hours) x 16 = 213.33 hours Necessary preparation before the start of the semester (administration, enrolment, verification): (13.33 hours) x 2 = 26.66 hours Total workload for the course: 10 x 30 = 300 hours Additional work for preparing correction of the final exam, including taking the exam: 0 - 60 hours (remaining time from the first and the second item to the total workload for the course of 300 hours) Structure of the workload: 213.33 hours (lectures and final exam) + 26.66 hours (preparation) + 60 hours (additional work)

THE OBLIGATIONS OF THE STUDENTS DURING COURSE:

- regularly attends classes and exercises,
- conscientiously and independently realize seminars or homework,
- works in a team,
- scientifically and methodologically performs course obligations and systematizes appropriate material,
- independently completes the practical part of the exam, with the help of literature
- presents the acquired knowledge and achieved results.

LITERATURE:

1. Introduction to Precision Agriculture, https://atecentral.net/downloads/1254/International%20Precision%20Agriculture%20Instructional%20Module.doc
2. Precision Agriculture: Sensors Drive Agricultural Efficiency. Sensors and Systems, Making Sense of Global Change, https://sensorsandsystems.com/precision-agriculturesensors-drive-agricultural-efficiency/, 2013.
3. Grisso, R.B., Precision Farming Tools: Global Positioning System (GPS). Publications and Educational Resources http://pubs.ext.vt.edu/442/442-503/442-503.html, 2009.
4. Chris Anderson, "Agricultural Drones Relatively cheap drones with advanced sensors and imaging capabilities are giving farmers new ways to increase yields and reduce crop damage.", MIT Technology Review, May/June, 2014. Retrieved December 21, 2016
5. Available from: https://www.researchgate.net/publication/322156374_PRECISION_AGRICULTURE [accessed Jul 21 2020].
6. Prof. dr Radovan Stojanović , Developing a smart ICT solutions in agriculture, design challenges, VIRAL – Conference, Banja Luka, Januaru 2020. http://hightech-hub.me/literatura/pametna-poljoprivreda/
7. N. Latinović at all, Architecting an IoT-enabled platform for precision agriculture andecological monitoring: A case study. Available from: https://www.researchgate.net/publication/317670755_Architecting_an_IoT-enabled_platform_for_precision_agriculture_and_ecological_monitoring_A_case_study

EXPECTED LEARNING OUTCOMES:

- Define precision agriculture from the managerial technological and social perspectives.
- Understand the overall scope of PA.
- Understand how GPS works and how this technology is used in PA.
- Explore the role of GIS in precision farming and site-specific crop production.
- Understand the role of database management system in precision agriculture, including the role of centralized farm management data warehouse.
- Define remote sensing and characterize its role in precision farming.
- Identify the soil and management factors that influence crop yield.
- Understand the concept of spatial variability and soil sampling.
- Identify key issues in variable rate application technology, including the different options for implementing variable rate technology.
- Understand the application of variable rate technology in agriculture.
- Identify the various methods for measuring grain yield.
- Understand the potential benefits and limitations of yield maps.
- Generate a vision for precision agriculture in the future

- Understand the concept of IoT and its application in industry.

METHODS OF KNOWLEDGE ASSESSMENT AND MARKING:

- Seminar-colloquial work / project, after series of lectures and exercises.
- Seminar-colloquial papers will be performed in groups, which will be formed respecting the principle of heterogeneity (interdisciplinary).
- The final grade will contain two criteria:
    a. assessment of group work 50%,
    b. assessment of individual contribution of 50%. Individual contribution is assessed according to the description of each author's contribution to the overall project and the thematic interview with the candidate..
- The above items of knowledge assessment can be replaced by publishing a paper presented at doctoral colloquium (the paper should briefly describe the content of the paper / project)

DATA PREPARED BY (NAME AND SURNAME OF PROFESSOR AND ASSISTANT IF DEFINED):

Prof. dr Radovan Stojanović and Prof. dr Nedeljko Latinović

SPECIAL NOTE FOR THE SUBJECT:

The course is also recommended for a lower form of study, MSc, with certain modifications

ANY OTHER NOTE:

NAZIV PREDMETA	*Brodska alternativna goriva i pogoni*			
ŠIFRA PREDMETA	**STATUS PREDMETA**	**SEMESTAR**	**BROJ ECTS KREDITA**	**FOND ČASOVA**
	Izborni	I	10	3P+1V+0L

STUDIJSKI PROGRAM ZA KOJI SE ORGANIZUJE:
Doktorske akademske studije na Pomorskom fakultetu, studijski program Pomorske nauke, 3 godine (4 semestra), 180 ECTS kredita

USLOVLJENOST DRUGIM PREDMETIMA:

Nema posebnih zahtjeva za praćenje i polaganje ovog predmeta.

CILJ IZUČAVANJA PREDMETA:

Studenti će se upoznati sa vrstama i svojstvima alternativnih goriva, mogućnostima njihove primjene u pomorstvu. Takođe, studenti će se upoznati sa vrstama i principom funkcionisanja brodskih alternativnih pogona.

IME I PREZIME NASTAVNIKA I SARADNIKA: Prof. dr Danilo Nikolić

NASTAVNE METOD:

Predavanja i vježbe. Učenje na daljinu putem moodle portala na Pomorskom fakultetu Kotor. Izrada seminarskih radova. Polaganje završnog ispita. Konsultacije putem email-a i foruma. Samostalni rad.

SADRŽAJ PREDMETA

Pripremna nedjelja	Priprema i upis semestra
I nedjelja	Uvod u goriva. Primjena alternativnih goriva u sektoru transporta.
II nedjelja	Biogoriva. Biodizel. Standardi kvaliteta biodizela. Resursi za proizvodnju biodizela. Proizvodnja biodizela. Mogućnosti primjene biodizela u pomorstvu. Skladištenje i transport biodizela.
III nedjelja	Biogoriva. Bioetanol. Resursi za proizvodnju bioetanola. Proizvodnja bioetanola. Mogućnosti primjene bioetanola u pomorstvu. Skladištenje i transport bioetanola.
IV nedelja	Biogoriva. BioMetanol. Resursi za proizvodnju biometanola. Mogućnosti primjene biometanola u pomorstvu. Skladištenje i transport biometanola.
V nedjelja	LNG. Fizičko hemijska svojstva LNGa. Primjena LNG u pomorstvu. Skladištenje i transport LNGa.
VI nedjelja	Ostala alternativna goriva za primjenu u pomorstvu.
VII nedjelja	Seminarski rad I. Uputstva za izradu seminarskog rada.
VIII nedjelja	Uvod u brodski pogon. Primjena alternativnih brodskih pogona.
IX nedjelja	Dual fuel motori. Mogućnosti primjene DF motora za brodski pogon.
X nedjelja	Spark gas motori. Mogućnosti primjene SG motora za brodski pogon.
XI nedjelja	Električni brodski pogon.
XII nedjelja	Hibridni sistemi brodskog pogona.
XIII nedjelja	Seminarski rad II.
XIV nedjelja	Upotreba energije vjetra za pogon brodova.
XV nedjelja	Upotreba energije sunca za pogon brodova.
XVI-XX nedjelja	Nedjelje završnih i popravnih ispita. Usvajanje ocjena.

OPTEREĆENJE STUDENATA PO PREDMETU

Nedjeljno	**U semestru**
10 kredita x 40/30 = 13 sati i 20 minuta Struktura: **3 sati** predavanja **1 sati** vježbi **9 sati i 20 minuta** individualnog rada studenta (priprema za laboratorijske vježbe, za kolokvijume, izrada domaćih zadataka) uključujući i konsultacije	Nastava i završni ispit: (13 sati i 20 minuta) x 16 = **199 sati i 30 minuta** Neophodna priprema prije početka semestra (administracija, upis, ovjera): 2 x (13 sati i 20 minuta) = 26 sati i 40 minuta **Ukupno opterećenje za predmet: 10 x 30 = 300 sati** **Dopunski rad** za pripremu ispita u popravnom ispitnom roku, uključujući i polaganje popravnog ispita od 73 sata i 50 minuta. Struktura opterećenja: 199 sati i 20 minuta (nastava) + 26 sati i 40 minuta (priprema) + 73 sata i 50 minuta (dopunski rad)

Studenti su u obavezi da pohađaju nastavu (predavanja i vježbe) i da pristupe završnom spitu.

LITERATURA:

1. Gajendra Babu i Subramanian, Alternative transportation fuels, ISBN 978-1-4398-7282-6, 2013 by Taylor & Francis Group, LLC.

2. D. Woodyard, Pounder's Marine Diesel Engines and Gas Turbines (9th Edition) ISBN 978-0-7506-8984-7.
3. Diesel Engines For Ship Propulsion And Power Plants Volume I & II. K. Kuiken Target Global Energy ISBN 978-90-79104-02-4.

METODE PROVJERE ZNANJA I OCJENJIVANJE:

Seminarski rad I, od 0 do 25 poena;
Seminarski rad II, od 0 do 25 poena;
Završni ispit, od 0 do 50 poena.
Prolazna ocjena se dobija ako student sakupi najmanje 50 poena.

POSEBNA NAPOMENA ZA PREDMET: Predmet se može držati na engleskom jeziku.

OČEKIVANI REZULTATI:

Očekuje se da studenti nakon položenog ispita mogu:

- Identifikovati i klasifikovati vrste alternativna goriva;
- Definisati resurse, načine proizvodnje i osnovna svojstva alternativnih goriva;
- Identifikovati i klasifikovati vrste alternativnih brodskih pogona;
- Definisati princip funkcionisanja alternativnih brodskih pogona;
- Povezati alternativna goriva i alternativne brodske pogone.

METODE PROCJENE KVALITETA ZA POSTIZANJE ŽELJENIH REZULTATA:

Kontrola od strane Univerziteta, Kontrola nastavnog procesa od strane Fakulteta, Spisak prisustva studenata, Analiza podataka i mjerenja zadovoljstva u skladu sa sertifikovanim sistemom kvaliteta (Sistem upravljanja kvalitetom u skladu sa ISO 9001:2015).

PODATKE PRIPREMIO/LA:	Prof. dr Danilo Nikolić
NAPOMENA:	

SUBJECT TITLE	*Ships' Alternative Fuels and Propulsion*			
SUBJECT CODE	**SUBJECT STATUS**	**SEMESTER**	**NUMBER OF ECTS CREDITS**	**CLASS LOAD**
	Elective	I	10	3L+1E+0P

STUDY PROGRAMMES FOR WHICH IT IS ORGANIZED:

Academic Postgraduate Doctoral Studies on Maritime Faculty, Study Programme Maritime Sciences, 3 years (6 Terms), 180 ECTS credits

ADMISSION REQUIREMENT:

No prerequisites for course enrolment and attending.

GOALS OF STUDY:

The subject aims to teach students about types of alternative marine fuels and perspectives of its use in ships. Also, it is foreseen to teach students about types and functioning principles of alternative ship propulsion plants.

NAME AND SURNAME OF PROFESSOR AND ASSISTANT:

Phd. Danilo Nikolić, teacher – Full professor

TEACHING METHOD:

Lectures, seminar papers, practical exercises, learning, performing individual practical exercises, debates, consultations.

SUBJECT CONTENT:

Preparatory weeks	Preparation and semester enrolment.
I week	Introduction to marine fuels. Use of alternative fuels in shipping sector.
II week	Biofules. Biodiesel. Quality standards for biodiesel. Resources for production of biodiesel. Production of biodiesel. Perspectives of use of biodiesel in shipping. Storage and transport of biodiesel.
III week	Biofuels. Bioethanol. Resources for production of bioethanol. Production of bioethanol. Perspectives of use of bioethanol in shipping. Storage and transport of bioethanol.
IV week	Biofuels. Bio-methanol. Resources for production of bio-methanol. Production of bio-methanol. Perspectives of use of bio-methanol in shipping. Storage and transport of bio-methanol.
V week	LNG. Physical properties of LNG. Perspectives of use of LNG in shipping. Storage and transport of LNG.
VI week	Other alternative marine fuels in use in ships.
VII week	**Seminar paper I.** Instructions for preparation of Seminar paper.
VIII week	Introduction to ship propulsion plants. Use of alternative ship propulsion plants.
IX week	Dual fuel ship engines. Perspectives of DF ship engines in shipping.
X week	Spark gas ship engines. Perspectives of DF ship engines in shipping.
XI week	Electrical propulsion plants for ships.
XII week	Hybrid propulsion plants for ships.
XIII week	**Seminar paper II.**
XIV week	Use of Wind propulsion systems on ships.
XV week	Use of Solar propulsion systems on ships.
XVI-XX week	Final examination and correction term. Semester verification and marks registration.

STUDENTS' WORKLOAD PER SUBJECT

Per week	**During semester**
10 credits x 40/30 = 13hours + 20 minutes **Structure:** **3** hours of lectures **1** hours of exercise **0** hours of practical work **9** hours **20** minutes of individual work, including consultations	**Teaching and the Final Exam:** 13h + 20 min. x 16 = 199h + 30 minutes **Necessary preparation before Term starting (admin., enrolment, verification):** 2 x (13h + 20 min) = 26h + 40min **Total hours for the course:** 10 x 30 = 300h **Additional hours for preparing correction of final exam, including the taking of the exam:** 0 do 73h and 50 minutes **Structure of the students' duties: 199**h + 20 min.(lectures) + 26h + 40min + 73h and 50 minutes(additional work)

THE OBLIGATIONS OF THE STUDENTS DURING COURSE:

Students are required to attend classes (lectures and exercises) and to take Preliminary Exams and the Final Exam.

IMO RECOMMENDED LITERATURE:

There is no IMO recommended literature.

LITERATURE:

1. Gajendra Babu i Subramanian, Alternative transportation fuels, ISBN 978-1-4398-7282-6, 2013 by Taylor &

Francis Group, LLC.
2. D. Woodyard, Pounder's Marine Diesel Engines and Gas Turbines (9th Edition) ISBN 978-0-7506-8984-7.
3. Diesel Engines For Ship Propulsion And Power Plants Volume I & II. K. Kuiken Target Global Energy ISBN 978-90-79104-02-4.

METHODS OF KNOWLEDGE ASSESSMENT AND MARKING:

1. Seminar paper I, from 0 to 25 points.
2. Seminar paper II, from 0 to 25 points.
3. Final exam, 0 to 50 points.

Passing mark is obtained if the student collects at least 50 points.

SPECIAL NOTE FOR THE SUBJECT: If needed, the subject can be thought in English.

EXPECTED LEARNING OUTCOMES:

1. Identify and classify the types of alternative marine fuels;
2. Define resources, production processes and essential characteristics of alternative marine fuels;
3. Identify and classify the types of alternative ship propulsion plants;
4. Define the functioning principles of alternative ship propulsion plants;
5. Correlate alternative marine fuels and ship propulsion plants.

QUALITY ASSESSMENT METHODS ENSURING THE DESIRED LEARNING OUTCOMES:

Survey carried out by the University, List of student attendance, Teaching process monitored by the Faculty, Analysis of the examination passing rate (Quality Management System in compliance with ISO 9001)

DATA PREPARED BY:	PhD. Danilo Nikolić, teacher – Full professor
SPECIAL NOTE FOR THE SUBJECT:	
ANY OTHER NOTE:	

INAZIV PREDMETA	*Održavanje zasnovano na pouzdanosti*			
ŠIFRA PREDMETA	**STATUS PREDMETA**	**SEMESTAR**	**BROJ ECTS KREDITA**	**FOND ČASOVA**
	Izborni	II	10	3P+1V+0L

STUDIJSKI PROGRAM ZA KOJI SE ORGANIZUJE:
Doktorske studije održivog razvoja – MARDS, Pomorskog fakulteta Kotor, studijski program Pomorske nauke, 3 godine (6 semestara), 180 ECTS kredita.

USLOVLJENOST DRUGIM PREDMETIMA:
Nema posebnih uslova za upis i slušanje ovoga predmeta.

CILJ IZUČAVANJA PREDMETA:
Studenti će ovladati koncepcipcijama pogodnosti I pouzdanosti održavanja, te analizirati pouzdanost brodskih Sistema i istraživati uticaje i zavisnosti na eksploataciju broda.

IME I PREZIME NASTAVNIKA I SARADNIKA: Prof. dr. Špiro Ivošević

METOD NASTAVE I SAVLADAVANJA GRADIVA:
Predavanja. Izrada konferencijskog I stručnog rada. Završni ispit. Konsultacije.

SADRŽAJ PREDMETA:

Pripremna nedjelja	Priprema i upis semestra
I nedjelja	Efektivnost Sistema.
II nedjelja	Teorijske osnove pouzdanosti tehničkih sistema.
III nedjelja	Primjena pouzdanosti u funkciji održavanja različitih tehničkih Sistema.
IV nedelja	Metode određivanja pouzdanosti vremenskih Sistema.
V nedjelja	Predviđanje pouzdanosti.
VI nedjelja	Alokacija pouzdanosti.
VII nedjelja	Rast pouzdanosti.
VIII nedjelja	Optimizacija troškova pouzdanosti.
IX nedjelja	Postavljanje zahtjeva pouzdanosti i mjere za njihovo ostvarivanje.
X nedjelja	Pouzdanost različitih strukturnih elemenata.
XI nedjelja	Vjerovatnoća i rizik zasnovan na planiranim inspekcijama tehničkih struktura.
XII nedjelja	Sistem izvještavanja. Analiza korektivnih akcija u slučaju otkaza.
XIII nedjelja	Analize otkaza Sistema i praktični primjeri i vježbe.
XIV nedjelja	Pogodnost održavanja i raspoloživost tehničkih sistema.
XV nedjelja	Procjena rizika tehničkih struktura. Formalna procjena sigurnosti.
XVI-XX nedjelja	*Nedelje završnih i popravnih ispita, Usvajanje ocjena.*

OPTEREĆENJE STUDENATA PO PREDMETU

Nedjeljno	U semestru
10 kredita x 40/30 = 13 sati i 20 minuta Struktura: **3 sati** predavanja **1 sati** vježbi **9 sati i 20 minuta** individualnog rada studenta (priprema za laboratorijske vježbe, za kolokvijume, izrada domaćih zadataka) uključujući i konsultacije	Nastava i završni ispit: (13 sati i 20 minuta) x 16 = **199 sati i 30 minuta** Neophodna priprema prije početka semestra (administracija, upis, ovjera): 2 x (13 sati i 20 minuta) = 26 sati i 40 minuta **Ukupno opterećenje za predmet: 10 x 30 = 300 sati** **Dopunski rad** za pripremu ispita u popravnom ispitnom roku, uključujući i polaganje popravnog ispita od 73 sata i 50 minuta. Struktura opterećenja: 199 sati i 20 minuta (nastava) + 26 sati i 40 minuta (priprema) + 73 sata i 50 minuta (dopunski rad)

Studenti su u obavezi da pohađaju nastavu, izrađuju radove i polažu zavšni ispit

LITERATURA:

1. B. Vasić I dr., Održavanje tehničkih Sistema, Beograd 2006.
2. Marinko Aleksić, Napredne koncepcije održavanja brodskih i lučkih postrojenja, Skripta
3. Nikola Vujanović: Teorija pouzdanosti tehničkih sistema, Beograd, 1990.
4. M. Aleksić, D. Petrović. P. Stanojević., Održavanje prema pouzdanosti, Zenica 2011.
5. Yong Bai, Marine Structural Design, Elsevier, 2003.
6. G. Wang, et. All, Condition Assessment of Aged Ships and Offshore Structures, 17th International Ship and Offshore Structures Congress, Volume 2, 16-21 August 2009. Seoul, Korea,

OBLICI PROVJERE ZNANJA I OCJENJIVANJE:

1. Stručni rad, 50 poena.
2. Završni Ispit, 50 poena.

Prolazna ocjena se dobija ako student sakupe više od 50 poena.

POSEBNA NAPOMENA ZA PREDMET: Po potrebi, predavanja se mogu održavati na engleskog jeziku.

OČEKIVANI ISHODI UČENJA:

Očekuje se da studenti nakon položenog ispita mogu:

- Upoznati studente sa specifičnim znanjima o pouzdanosti održavanju brodskih i tehničkih Sistema.
- Analiziraju pouzdanost pojedinih brodskih Sistema.
- Procjene, izračunaju i vrednuju pouzdanost pojedinih tehničkih Sistema.
- Interpretiraju pogodnost i upotrebljivost brodskih Sistema.
- Primjeniti formalnu procjenu sigurnosti na različite elemente brodske industrije.
- Izraditi stručni rad na temu pouzdanosti brodskih sistema.

METODE PROCJENE KVALITETA ZA POSTIZANJE ŽELJENIH REZULTATA:

Kontrola od strane Univerziteta, Kontrola nastavnog procesa od strane Fakulteta, Spisak prisustva studenata, Analiza podataka i mjerenja zadovoljstva u skladu sa sertifikovanim sistemom kvaliteta (Sistem upravljanja kvalitetom u skladu sa ISO 9001:2015).

PODATKE PRIPREMIO:	Prof. dr. Špiro Ivošević
NAPOMENA:	

SUBJECT TITLE	*Reliability-based maintenance*			
SUBJECT CODE	**SUBJECT STATUS**	**SEMESTER**	**NUMBER OF ECTS CREDITS**	**CLASS LOAD**
	Obligatory	II	10	3L+1E+0P

STUDY PROGRAMMES FOR WHICH IT IS ORGANIZED:

Doctoral Studies in Sustainable Development, MARDS , Studies on Maritime Faculty, Study Programme Nautical Studies, 3 years (6 Terms), 180 ECTS credits

ADMISSION REQUIREMENT:

No prerequisites for course enrolment and attending

GOALS OF STUDY:

Students will master the concepts of convenience and reliability of maintenance, and analyze the reliability of different systems and explore the impacts and dependencies on the operation

NAME AND SURNAME OF PROFESSOR AND ASSISTANT:

Phd. Špiro Ivošević, teacher – Associated professor

TEACHING METHOD:

Lectures, preparation conference and practical work, final exam, consultations.

SUBJECT CONTENT:

Preparatory weeks	Preparation and semester enrolment
I week	System Efficiency.
II week	Theoretical bases of reliability of technical systems.
III week	Application of reliability in the function of maintenance of various technical systems.
IV week	Methods for determining the reliability of time systems.
V week	Reliability prediction.
VI week	Reliability allocation.
VII week	Reliability growth.
VIII week	Reliability cost optimization
IX week	Setting reliability requirements and measures for their realization.
X week	Reliability of different structural elements.
XI week	Probability and risk based on planned inspections of technical structures.
XII week	Reporting system. Analysis of corrective actions in case of failure.
XIII week	System failure analyzes and practical examples and exercises.
XIV week	Convenience of maintenance and availability of technical systems.
XV week	Risk assessment of technical structures. Formal safety assessment.
XVI-XX week	Final examination and correction term. Semester verification and marks registration.

STUDENTS' WORKLOAD PER SUBJECT

Per week	**During semester**
10 credits x 40/30 = 13hours + 20 minutes **Structure:** **3** hours of lectures **1** hours of exercise **0** hours of practical work **9** hours 2**0** minutes of individual work, including consultations	**Teaching and the Final Exam:** 13h + 20 min. x 16 = 199h + 30 minutes **Necessary preparation before Term starting (admin., enrolment, verification):** 2 x (13h + 20 min) = 26h + 40min **Total hours for the course:** 10 x 30 = 300h **Additional hours for preparing correction of final exam, including the taking of the exam:** 0 do 73h and 50 minutes **Structure of the students' duties: 199**h + 20 min.(lectures) + 26h + 40min + 73h and 50 minutes(additional work)

THE OBLIGATIONS OF THE STUDENTS DURING COURSE:

Students are required to attend classes (lectures and exercises) and to take Preliminary Exams and the Final Exam.

LITERATURE:

1. B. Vasić I dr., Održavanje tehničkih Sistema, Beograd 2006.
2. Marinko Aleksić, Napredne koncepcije održavanja brodskih i lučkih postrojenja, Skripta
3. Nikola Vujanović: Teorija pouzdanosti tehničkih sistema, Beograd, 1990.
4. M. Aleksić, D. Petrović. P. Stanojević., Održavanje prema pouzdanosti, Zenica 2011.
5. Yong Bai, Marine Structural Design, Elsevier, 2003.
6. G. Wang, et. All, Condition Assessment of Aged Ships and Offshore Structures, 17th International Ship and Offshore Structures Congress, Volume 2, 16-21 August 2009. Seoul, Korea,

METHODS OF KNOWLEDGE ASSESSMENT AND MARKING:

1. Proffesional paper, 0 to 50 points.
2. Final exam, 0 to 50 points.

Passing mark is obtained if the student collects at least 50 points.

SPECIAL NOTE FOR THE SUBJECT: If necessary, lectures can be held in English.

EXPECTED LEARNING OUTCOMES:

1. To acquaint students with specific knowledge about the reliability of maintenance of ship and technical systems.
2. Analyze the reliability of individual ship systems.
3. Evaluates, calculates and evaluates the reliability of individual technical systems.
4. Interpret the convenience and usability of ship systems.
5. Apply a formal safety assessment to the various elements of the shipping industry.
6. Develop professional work on the topic of reliability of ship systems.

QUALITY ASSESSMENT METHODS ENSURING THE DESIRED LEARNING OUTCOMES:

Survey carried out by the University, List of student attendance, Teaching process monitored by the Faculty, Analysis of the examination passing rate (Quality Management System in compliance with ISO 9001)

DATA PREPARED BY:	01.01.2020.
SPECIAL NOTE FOR THE SUBJECT:	No any
PREPARED BY:	Assoc. Prof. Špiro Ivošević

SUBJECT TITLE	*Modeling the Supply Chain*			
SUBJECT CODE	**SUBJECT STATUS**	**SEMESTER**	**NUMBER OF ECTS CREDITS**	**CLASS LOAD**
	Elective	I	10	3L+1E+0L

STUDY PROGRAMMES FOR WHICH IT IS ORGANIZED:

PhD studies on Maritime Faculty, Study Program: Marine Sciences, 3 years (6 Terms), 180 ECTS credits

ADMISSION REQUIREMENT:

No prerequisites for course enrolment and attending

GOALS OF STUDY:

The main goals of the subject are primarily aimed at acquiring academic knowledge in relation to modeling in Supply Chain Management (SCM) and Green Supply Chain Management (GSCM) with special emphasis on maritime transport technologies, port systems, maritime logistics and shipping, as well as their role and importance in modeling processes in SCM and GSCM.

NAME AND SURNAME OF PROFESSOR AND ASSISTANT:

Professor Branislav Dragovic

TEACHING METHOD:

Lectures, practical exercises, learning, performing individual practical exercises, debates, consultations.

SUBJECT CONTENT:

Preparatory weeks	Preparation and enrolment of the Semester
I week	Supply Chain Management (SCM), Integrated Planning, Models
II week	Information Technology
III week	Fundamentals of optimization models: Linear programming I
IV week	Fundamentals of optimization models: Linear programming II
V week	Fundamentals of optimization models: Mixed-Integer Programming
VI week	Overview of Descriptive Models
VII week	**The First Compulsory Assignment**
VIII week	Supply Chain Decision Databases
IX week	Operational Supply Chain Planning
X week	Green Supply Chain Management (GSCM), Environmental Collaboration and Sustainability Performance
XI week	Green transportation and reverse logistics
XII week	The Role of Seaports in Green Supply Chain Management: Initiatives, Attitudes, and Perspectives in the South Adriatic Ports
XIII week	Sustainable Sea Port Systems within Green Transport Corridors
XIV week	Role of Logistics and Transportation in Green Supply Chain Management
XV week	**The Second Compulsory Assignment**
XVI-XX week	Final examination and correction term. Semester verification and marks registration.

STUDENTS' WORKLOAD PER SUBJECT

Per week	**During semester**
10 credits x 40/30 = 13hours + 20 minutes **Structure:** **3** hours of lectures **1** hours of exercise **0** hours of practical work **9** hours 2**0** minutes of individual work, including consultations	**Teaching and the Final Exam:** 13h + 20 min. x 16 = 199h + 30 minutes **Necessary preparation before Term starting (admin., enrolment, verification):** 2 x (13h + 20 min) = 26h + 40min **Total hours for the course:** 10 x 30 = 300h **Additional hours for preparing correction of final exam, including the taking of the exam:** 0 do 73h and 50 minutes **Structure of the students' duties: 199**h + 20 min.(lectures) + 26h + 40min + 73h and 50 minutes(additional work)

THE OBLIGATIONS OF THE STUDENTS DURING COURSE:

Students are required to attend classes (lectures and exercises) and to take Preliminary Exams and the Final Exam.

LITERATURE:

1. Shapiro, J.F., (2007), *Modeling the Supply Chain*, 2nd edition, Duxbury Applied Series.

2. Dragović, B., (2007), *Logistics Decision Making*, Korea Maritime University, Logistics System Engineering.

METHODS OF KNOWLEDGE ASSESSMENT AND MARKING:

1. The First Compulsory Assignment, 0 to 15 points.
2. The Second Compulsory Assignment, 0 to 15 points.

3. Seminar paper, from 0 to 20 points.
4. Final exam, 0 to 50 points.

Passing mark is obtained if the student collects at least 50 points.

SPECIAL NOTE FOR THE SUBJECT:

EXPECTED LEARNING OUTCOMES:

Description and application of the modeling theories in SCM and GSCM;

1. Application of the the optimization methodology for planning in SCM and GSCM;
2. Application of the methodology for site selection of distribution centers in SCM and GSCM;
3. Useing the experience of modeling logistics centers in SCM and GSCM;
4. Modelling of the network configuration and supply chain through adequate models;
5. Optimizarion of the transport chain in SCM and GSCM;
6. Solving of the examples from practice in relation to strategic and tactical planning in SCM and GSCM;
7. Using of the simulation models in SCM and GSCM ;
8. Modelling of the activities in SCM and GSCM;
9. Solving of the practical examples in Maritime Logistics and Ports as parts SCM and GSCM from the immediate environment;
10. Solving of the practical examples in Maritime Shipping as parts SCM and GSCM from the immediate environment;
11. Solving of the practical examples in SCM and GSCM from the immediate environment.

QUALITY ASSESSMENT METHODS ENSURING THE DESIRED LEARNING OUTCOMES:

Survey carried out by the University, List of student attendance, Teaching process monitored by the Faculty, Analysis of the examination passing rate (Quality Management System in compliance with ISO 9001)

DATA PREPARED BY:	Prof. Dr. Branislav Dragovic
SPECIAL NOTE FOR THE SUBJECT:	
ANY OTHER NOTE:	

COURSE SYLLABUS

I week	**Supply Chain Management (SCM), Integrated Planning, Models**
	Fundamentals of SCM Overview of SCM SCM incorporates concepts from several management discipline Innovations and Information Technology require and support SCM Organizational adaptation to integrated SCM and modelling

II week	**Information Technology**
	Enterprise resource planning systems E-Commerce Radio-Frequency Identification Comparison on transactional and analytical information technology Hierarchy of Supply Chain Systems

III week	**Fundamentals of optimization models: Linear programming I**
	Linear Programming Modelling Examples Properties of Linear Programming Models

IV week	**Fundamentals of optimization models: Linear programming II**
	Multiple-Objective Optimization Stochastic Programming

V week	**Fundamentals of optimization models: Mixed-Integer Programming**
	Mixed-Integer Programming modelling Vignettes Distribution Centre Location Model SC Optimization Network

VI week	**Overview of Descriptive Models**
	Demand Forecasting Simulation Models

VII week	**The First Compulsory Assignment**

VIII week	**Supply Chain Decision Databases**
	Data Aggregations Facility Data Transportation Network Data Inventory Data Supplier Data Cost Data Model Output Data

IX week	**Operational Supply Chain Planning**
	Taxonomies of Operational Planning Problems Modelling System for Operational Planning

X week	**Green Supply Chain Management (GSCM), Environmental Collaboration and Sustainability Performance**
	The role of critical success factors in Green Supply Chain Management Environmental Collaboration in GSCM Sustainability Performance in GSCM

XI week	**Green transportation and reverse logistics**
	Green practices in transportation and reverse logistics Sustainable Supply Chain Management and Green transportation The Development and Analysis of Environmentally Responsible green transportation model

XII week	**The Role of Seaports in Green Supply Chain Management: Initiatives, Attitudes, and Perspectives in the South Adriatic Ports**
	The Role of Seaports in GSCM Initiatives, Attitudes, and Perspectives in the South Adriatic Ports

XIII week	**Sustainable Sea Port Systems within Green Transport Corridors**
	Sustainable Development of Seaport Systems Sustainable Development of Green Transport Corridors Sustainable Development: Seaport Systems vs. Green Transport Corridors.

XIV week	**Role of Logistics and Transportation in Green Supply Chain Management**
	Development of green shipping network The Role of Green Logistics and Transportation in Sustainable Supply Chains From green to sustainable shipping. Maritime Green Supply Chain Management Development of green shipping network

XV week	**The Second Compulsory Assignment**

XVI - XX weeks	**Weeks for final Exams. Decision for the final Grades.**

NAZIV PREDMETA	*Modeliranje u Supply Chain Management-u*			
ŠIFRA PREDMETA	**STATUS PREDMETA**	**SEMESTAR**	**BROJ ECTS KREDITA**	**FOND ČASOVA**
	Izborni	I	10	3P+1V+0L

STUDIJSKI PROGRAM ZA KOJI SE ORGANIZUJE:
Doktorske studije Pomorskog fakulteta, studijski program Pomorske nauke, 3 godine (6 semestara), 180 ECTS kredita

USLOVLJENOST DRUGIM PREDMETIMA:
Nema posebnih uslova za upis i slušanje ovoga predmeta.

CILJ IZUČAVANJA PREDMETA:
Ovi ciljevi prvenstveno su usmjereni na sticanje akademskih znanja u odnosu na modeliranje u Supply Chain Management-u (SCM) sa posebnim naglaskom na pomorske transportne tehnologije i njihovu ulogu i značaj u procesima modeliranja u SCM.

IME I PREZIME NASTAVNIKA I SARADNIKA: Prof. dr Branislav Dragović

METOD NASTAVE I SAVLADAVANJA GRADIVA:
Predavanja. Vježbe. Vježbe na terenu. Kolokvijumi. Završni ispit. Konsultacije. Samostalni rad.

SADRŽAJ PREDMETA:

Pripremna nedjelja	Priprema i upis semestra
I nedjelja	Supply Chain Management (SCM)
II nedjelja	SCM – Integrativno planiranje i modeli
III nedjelja	SCM – Informacione tehnologije
IV nedelja	Optimizacioni modeli u SCM
V nedjelja	Case study: modeli lokacije distributivnih centara
VI nedjelja	Kolokvijum I
VII nedjelja	Optimizaciona metodologija i operativni problemi planiranja
VIII nedjelja	Case study: SCM mrežna optimizacija u pomorskom transportu
IX nedjelja	Pregled deskriptivnih modela
X nedjelja	Simulacioni modeli
XI nedjelja	Predviđanje potražnje
XII nedjelja	Strategijsko i taktičko planiranje u SCM
XIII nedjelja	Operativno planiranje u SCM
XIV nedjelja	Case study: Primjeri modeliranja u SCM iz najbližeg okruženja
XV nedjelja	Kolokvijum II
XVI –XX nedjelja	Nedjelje završnih i popravnih ispita. Usvajanje ocjena.

OPTEREĆENJE STUDENATA PO PREDMETU

Nedjeljno	**U semestru**
10 kredita x 40/30 = 13 sati i 20 minuta Struktura: **3 sati** predavanja **1 sati** vježbi **9 sati i 20 minuta** individualnog rada studenta (priprema za laboratorijske vježbe, za kolokvijume, izrada domaćih zadataka) uključujući i konsultacije	Nastava i završni ispit: (13 sati i 20 minuta) x 16 = **199 sati i 30 minuta** Neophodna priprema prije početka semestra (administracija, upis, ovjera): 2 x (13 sati i 20 minuta) = 26 sati i 40 minuta **Ukupno opterećenje za predmet: 10 x 30 = 300 sati** **Dopunski rad** za pripremu ispita u popravnom ispitnom roku, uključujući i polaganje popravnog ispita od 73 sata i 50 minuta. Struktura opterećenja: 199 sati i 20 minuta (nastava) + 26 sati i 40 minuta (priprema) + 73 sata i 50 minuta (dopunski rad)

Studenti su obavezni da pohađaju nastavu, računske vježbe, rade i predaju domaći zadatak ili seminarski rad, rade kolokvijume i polažu zavšni ispit

LITERATURA:
1. Shapiro, J.F., (2007), *Modeling the supply chain*, 2nd edition, Duxbury Applied Series.
2. Dragović, B., (2007), *Logistics decision making*, Korea Maritime University, Logistics System Engineering.

OBLICI PROVJERE ZNANJA I OCJENJIVANJE:
- 1 domaći zadatak se ocjenjuje sa ukupno 8 poena,
- Dva kolokvijuma po 15 poena (ukupno 30 poena)
- 1 seminarski rad 12 poena
- Završni ispit 50 poena.

Prelazna ocjena se dobija ako se kumulativno sakupi 50 i više poena.

POSEBNA NAPOMENA ZA PREDMET: Po potrebi, predavanja se mogu održavati na engleskog jeziku.

OČEKIVANI ISHODI UČENJA:

Nakon položenog ispita, studenti će moći da: - opišu i primijene teorije modeliranja u SCM; - primijene optimizacionu metodologiju za planiranje u SCM; - primijene metodologiju za izbor lokacije distributivnih centara u SCM; - koriste iskustva modeliranja logističkih centara u SCM; - modeliraju mrežnu konfiguraciju i supply chain-u preko adekvatnih modela; - optimiziraju transportni lanac u SCM; - rješavaju primjere iz prakse u odnosu na strategijsko i taktičko planiranje u SCM; - koriste simulacione modele u SCM; - modeliraju aktivnostima u SCM; - rješavaju primjere iz prakse u SCM iz najbližeg okruženja.
METODE PROCJENE KVALITETA ZA POSTIZANJE ŽELJENIH REZULTATA: Kontrola od strane Univerziteta, Kontrola nastavnog procesa od strane Fakulteta, Spisak prisustva studenata, Analiza podataka i mjerenja zadovoljstva u skladu sa sertifikovanim sistemom kvaliteta (Sistem upravljanja kvalitetom u skladu sa ISO 9001:2015).

PODATKE PRIPREMIO:	Prof. dr Branislav Dragović
NAPOMENA:	

Table S2.6.4 (en). The template for preparation course info lists				
SUBJECT TITLE	Science Communication and Writing			
SUBJECT CODE	**SUBJECT STATUS**	**SEMESTER**	**NUMBER OF ECTS CREDITS**	**CLASS LOAD**
	Optional	1	5	2+0

STUDY PROGRAMMES FOR WHICH IT IS ORGANIZED:
PhD Program "Natural sciences and Technology for Sustainable Development", All modules
3rd degree

ADMISSION REQUIREMENT:
None

GOALS OF STUDY:
It is important to disseminate one's research broadly, and the Science Communication and Writing course aims at developing student's skills in order to do that effectively. Students shall be informed on the best practices for science communication intended for a variety of audiences, including colleague in the field, other scientists in related field, media representatives and public audiences. A central focus of the course will be on effective communication methods, verbal, visual and written, so that students develop skills on effectively communicating their research for different audiences and through different outlets - scientific papers, conferences, general media articles etc.

- Students will gain factual knowledge about the publication process, including preparation of a manuscript, interaction with journal submission systems and editorial staff and the review process.
- Students will gain factual knowledge about the process of requesting funding for research, teaching or extension projects and the process of grant review.
- Students will develop skills for communicating specialist knowledge to science peers and to non-specialist audiences.
- Students will develop skills for science communication via oral and written presentations for technical and lay audiences.
- Students will learn how to find and use resources for preparing science articles, proposals or public materials.
- Students will apply course material to improve thinking, problem solving and decisions through course activities, including class discussions and oral and poster presentations.

SUBJECT CONTENT:

Preparatory weeks	
I week	- Introduction and objectives
II week	- Reading and writing well - interpreting scientific data
III week	- Visualization of scientific data, graphic tools
IV week	- Journal articles - elements of a standard journal article, graphics, formatting and presentation
V week	- Journal articles - where to submit and what happens next? Proofing, reviewing and revising articles
VI week	- Other types of science writing
VII week	- Writing scientific proposals for grants
VIII week	- Strategies for effective proposals
IX week	- Other types of funding
X week	- Oral scientific communication - strategies for professional meetings, invited lectures
XI week	- Oral scientific communication - conferences, thesis defense, and lectures for general public
XII week	- Critique of scientific oral presentations
XIII week	- Putting it all together: preparing oral presentations

XIV week	- Putting it all together: poster presentations
XV week	- Putting it all together: writing a journal article
XVI week	- Preparation for exam
Final week	- Exam
XVIII-XXI week	-

TEACHING METHODS:

- Students will participate in class discussions, read assignments, critically evaluate presentations and visual and written information
- Attend conference/seminar with the task to write abstracts of the presentations, critique talks for scientific content and presentation style and discuss in class.
- Students will make one poster presentation, one oral presentation of their research, and will write a scientific paper on a topic related to their thesis.

STUDENTS' WORKLOAD PER SUBJECT

Per week	**During semester**
5 credits x 40/30 = 6 hours and 40 minutes **Structure:** **2** hours of **lectures** **0** hours of **exercises** **1** hours of **practical work** **3** hours and **40** minutes of **individual work, including consultation**	**Lectures and final exam:** (6 hours and 40 minutes) x 16 = 106 hours and 40 minutes **Necessary preparations before the start of the semester:** *(administration, enrolment, verification)* 2 x (6 hours and 40 minutes) = 13 hours and 20 minutes **Total subject load:** 5 x 30 = 150 hours **Additional hours for preparing correction of final exam, including the taking of the exam:** 150h - (120h) = 30h **Load structure:** 106 hours and 40 minutes (Lectures) + 13 hours and 20 minutes (Preparation) + 30 hours (Remedial classes)

THE OBLIGATIONS OF THE STUDENTS DURING COURSE:
Students are obliged to attend lectures, submit homework assignments and take final exam

LITERATURE:

- Hofmann, Angelika H. (2010) Scientific Writing and Communication, ISBN 978-0-19-539005-6, 1st edition, Oxford University Press
- Goldbort, Robert Writing for Science, Yale University Press, ISBN #9780300117936
- Boeglin, Martha (2010) Akademsko pisanje korak po korak, Akademska knjiga, Novi Sad;
- Oraić-Tolić, Dubravka (2011) Akademsko pismo, Naklada Ljevak, Zagreb;
- Kleut, Marija (2008) Naucno delo od istrazivanja do stampe, Akademska knjiga, Novi Sad;
- Kuba, Li; Koking, Dzo (2003) Metodologija izrade naucnog teksta, CID, Podgorica;
- Ranjit Kumar (2005) Research methodology, Pearson education, New Delhi, India;.

EXPECTED LEARNING OUTCOMES:

Demonstrates a theoretical and practical knowledge and understanding of science communication and writing. After completing this course students will:

- have acquired tools to analyze and present quantitative data using correct cognitive techniques and styles
- have the skills to effectively communicate scientific topics in visual, written and oral form including formulation of effective oral and poster presentations;
- will have the knowledge how to prepare a written, journal-appropriate research paper and a grant proposal

METHODS OF KNOWLEDGE ASSESSMENT AND MARKING:

- Discussions (15%)
- Critique of seminar/conference presentations (15%)
- Poster presentation (15%)
- Oral presentation (15%)
- Writing assignments (40%)

DATA PREPARED BY (NAME AND SURNAME OF PROFESSOR AND ASSISTANT IF DEFINED):

SPECIAL NOTE FOR THE SUBJECT:
ANY OTHER NOTE:

Tabela S2.6.4. Forma za pripremu informacionih lista predmeta				
NAZIV PREDMETA	Naučna komunikacija i pisanje			
ŠIFRA PREDMETA	**STATUS PREDMETA**	**SEMESTAR**	**BROJ ECTS KREDITA**	**FOND ČASOVA**
	Izborni	1	5	2+0

STUDIJSKI PROGRAMI ZA KOJE SE ORGANIZUJE:
Doktorski program "Prirodne nauke i tehnologija za održivi razvoj", Svi moduli, 3. stepen

USLOVLJENOST DRUGIM PREDMETIMA:
Nema

CILJEVI IZUČAVANJA PREDMETA:
Diseminacija istraživanja koje sprovodi pojedinac je veoma važna, stoga predmet Naučna komunikacija i pisanje ima za cilj da razvije studentske vještine sa ciljem uspješnog obavljanja diseminacije. Studenti će biti upoznati sa najboljim iskustvima za naučnu komunikaciju sa različitim oblicima publike, uključujući kolege iz oblasti, druge naučnike iz sličnih oblasti, predstavnike medija i širu javnost. Fokus ovog predmeta biće na efikasnim metodama komunikacije, verbalnim, vizuelnim i pisanim, kako bi studenti mogli da razviju vještine efikasne komunikacije o njihovim istraživanjima sa različitom poblikom i kroz različite oblike- naučni radovi, konferencije, članci za medije i sl.

- Studenti će dobiti znanje o procesima objavljivanja, uključujući pripremu rada, interakciju sa sistemima za predaju radova i uredničkim timom, kao i sa procesom recenzije.
- Studenti će dobiti znanje o postupcima za apliciranje za sredstva za finansiranje istraživanja, nastavne boravke ili produženje projekta, kao i o procesima evaluiranja grantova.
- Studenti će razviti vještine komuniciranja specijalizovanog znanja sa kolegama u nauci, ali takođe i sa nenaučnom, širom publikom
- Studenti će razviti vještine naučne komunikacije kroz usmene i pisane prezentacije za tehničku i širu javnost
- Studenti će naučiti kako da nađu i koriste izvore za pripremu naučnih radova, projekata ili materijala za širu publiku.

Studenti će primjeniti materijale sa ovog kursa da unaprijede način razmišljanja, rješavanja problema i donošenja odluka kroz aktivnosti na predmetu, uključujući i diskusije na času i usmene i pisane prezentacije

SADRŽAJ PREDMETA:

Pripremna nedjelja	
I nedjelja	- Uvod i ciljevi
II nedjelja	- Čitanje i lijepo pisanje- interpretacija naučnih podataka
III nedjelja	- Vizualizacija naučnih podataka, grafičke tehnike
IV nedjelja	- Naučni radovi- elementi standardnog naučnog rada, grafici, formatiranje i prezentacija
V nedjelja	- Naučni radovi- gdje predate i šta se dešava nakon toga? lektura i korektura, validacija i unaprijeđenje rada
VI nedjelja	- Drugi tipovi naučnih članaka
VII nedjelja	- Pisanje naučnih prijedloga za grantove
VIII nedjelja	- Strategije za efikasne prijedloge
IX nedjelja	- Drugi tipovi finansiranja
X nedjelja	- Usmena naučna komunikacija- strategije za profesionalnim skupovima, predavanja po pozivu
XI nedjelja	- Usmena naučna komunikacija- konferencije, odbranu teze i predavanja za širu javnost
XII nedjelja	- Kritika naučnih usmenih prezentacija
XIII nedjelja	- Objedinjavanje: priprema usmene prezentacije
XIV nedjelja	- Objedinjavanje: poster prezentacije

XV nedjelja	- Objedinjavanje: pisanje naučnog rada
XVI nedjelja	- Priprema za ispit
Finalna nedjelja	- Ispit
XVIII-XXI nedjelja	-

METODE OBRAZOVANJA:

- Studenti će učestovati u diskusijama na času, čitati zadate materijale, kritički evaluirati prezentacije i vizuelne i pisane informacije
- Učestvovati na konferenciji/seminaru sa ciljem pisanja apstrakta prezentacije, kritike naučnog sadržaja ili stila prezentiranja i diskutovati na času
- Studenti će pripremiti jednu poster prezentaciju, jednu usmenu prezentaciju njihovog istraživanja i napisati naučni rad o temi koja je bliska temi njihove teze

Opterećenje studenta

Nedjeljno	**U semsetru**
5 kredita x 40/30 = 6 sati i 40 minuta **Struktura:** **2** sata **predavanja** **0** sati **vježbi** **1** sat **praktičnog rada** **3** sata i **40** minuta **individualnog rada, uključujući i konsultacije**	**Nastava i završni ispit:** (6 sati i 40 minuta) x 16 = 106 sati i 40 minuta **Neophodne pripreme prije početka semstra:** *(administracija, upis, ovjera)* 2 x (6 sati i 240 minuta) = 13 sati i 20 minuta **Ukupno opterećenje za predmet:** 5 x 30 = 150 sati **Dopunski rad za pripremu ispita u popravnom ispitnom roku, uključujući i polaganje popravnog ispita:** 150h - (120h) = 30h **Struktura opterećenja:** 106 sati i 40 minuta (nastava) + 13 sati i 20 minuta (priprema) + 30 sati (dopunski rad)

OBAVEZE STUDENTA U TOKU NASTAVE:

Studenti su dužni da prisustvuju nastavi, predaju domaće zadatke i polažu završni ispit.

LITERATURA:

- Hofmann, Angelika H. (2010) Scientific Writing and Communication, ISBN 978-0-19-539005-6, 1st edition, Oxford University Press
- Goldbort, Robert Writing for Science, Yale University Press, ISBN #9780300117936
- Boeglin, Martha (2010) Akademsko pisanje korak po korak, Akademska knjiga, Novi Sad;
- Oraić-Tolić, Dubravka (2011) Akademsko pismo, Naklada Ljevak, Zagreb;
- Kleut, Marija (2008) Naucno delo od istrazivanja do stampe, Akademska knjiga, Novi Sad;
- Kuba, Li; Koking, Dzo (2003) Metodologija izrade naucnog teksta, CID, Podgorica;
- Ranjit Kumar (2005) Research methodology, Pearson education, New Delhi, India;.

OČEKIVANI ISHODI UČENJA:

Demonstrira teorijska i praktična znanja i razumjevanje naučnog komuniciranja i pisanja. Nakon završetka ovog kursa studenti će:

- Razumjeti sredstva koja se koriste za analizu i prezentaciju kvantitativnih podataka korišćenjem ispravnih kognitivnih tehnika i stilova
- Posjedovati vještine da efikasno komuniciraju naučne teme u vizuelnoj, pisanoj i usmenoj formi, uključujući formulaciju efikasne usmene i poster prezentacije
- Imati znanje da pripreme pisani naučni rad koji je odgovrajući za naučne časopise, kao i prijedlog projekta

METODI PROVJERE ZNANJA I OCJENJIVANJA:

- Diskusija (15%)
- Kritika seminara/prezentacije na konferenciji (15%)
- Poster prezentacija (15%)
- Usmena prezentacija (15%)
- Pisani zadatak (40%)

PODACI PRIPREMLJENI OD STRANE (IME I PREZIME PROFESORA I ASISTENTA UKOLIKO SU

DEFINISANI):
SPECIFIČNOSTI KOJE JE POTREBNO NAGLASITI ZA OVAJ PREDMET:
DRUGE NAPOMENE:

Table S2.6.4 (en). The template for preparation course info lists				
SUBJECT TITLE	*Advanced Entrepreneurship*			
SUBJECT CODE	**SUBJECT STATUS**	**SEMESTER**	**NUMBER OF ECTS CREDITS**	**CLASS LOAD**
	Optional	I	5	2+0+2

STUDY PROGRAMMES FOR WHICH IT IS ORGANIZED:
PhD Program "Natural sciences and Technology for Sustainable Development", All modules
3rd degree

ADMISSION REQUIREMENT: Not conditioned by other subjects.

GOALS OF STUDY:
The objective of the course is to develop fundamental managerial skills of the students of the Doctoral Program in Natural Sciences and Technology for Sustainable Development, and to give them an entrepreneurial mindset to be able to perform various tasks as future leaders in their field of expertise. Entrepreneurship is defined as the ability of an individual to turn their ideas into actions. It involves creativity, innovation and a willingness to take risks, as well as the ability of an individual to plan and manage projects to achieve the set goals. The idea of Advanced Entrepreneurship is to motivate students to recognize their ambitions and talents, to develop them by working on themselves on a daily basis, and to motivate them to achieve what they can really do in their jobs. Studying the subject involves:
- *personal development of the student* (confidence building, motivation, strengthening of entrepreneurial mindset, strengthening of desire for achievement and inspiration for action);
- *business development* (the basics of technical and financial literacy to enable the student to think about self-employment);
- *development of entrepreneurial skills* (networking, creative problem solving, opportunity seeking, presentation skills, leadership skills, cooperation with the environment, knowledge of local cultural norms and their impact on entrepreneurial endeavor, etc.).
This course will help students develop their own entrepreneurial skills, understand business models and explore market opportunities in the context of starting their own businesses.

SUBJECT CONTENT:

Preparatory weeks	Introduction and objectives
I week	- Is an entrepreneur born or you can become an entrepreneur?
II week	- Entrepreneurial mindset, characteristics of entrepreneurs and interactions with the environment
III week	- Entrepreneurship, culture and moral
IV week	- Sources of business ideas and its evaluation
V week	- Entrepreneurship and Innovation
VI week	- The basics of startup development
VII week	- Project management: How can you best organize and steer large- and small-scale projects?
VIII week	- Case studies' analysis
IX week	- Entrepreneurial teams and leadership: how do you lead a team? How can you solve conflicts? How can you motivate others and initiate change?
X week	- Startup & communication
XI week	- Business plan development/CANVAS model
XII week	- Funding Sources: How to negotiate successfully with investors (business angels and venture capital)
XIII week	- Defining strategy
XIV week	- Marketing and internationalization
XV week	- Corporate entrepreneurship
XVI week	- Social entrepreneurship
Final week	
XVIII-XXI week	

TEACHING METHODS:
- Students will participate in class discussions, read assignments, and solve case studies
- Guest speakers – successful entrepreneurs and investors
- Team work and presentation.

STUDENTS' WORKLOAD PER SUBJECT

Per week	**During semester**
5 credits x 40/30 = 6 hours and 40 minutes	**Lectures and final exam:** (6 hours and 40 minutes) x 15 = 99 hours and 45 minutes

Structure: **2** hours of **lectures** **2**hours of **exercises** **1** hours and **20** minutesof **individual work, including consultation**	**Necessary preparations before the start of the semester:** *(administration, enrolment, verification)* 2 x (6 hours and 40 minutes) = 13 hours and 20 minutes **Total subject load:** 5 x 30 = 150 hours **Additional hours for preparing correction of final exam, including the taking of the exam:** 36 hours and 55 minutes **Load structure:** 99 hours and 45 minutes (Lectures) + 13 hours and 20 minutes (Preparation) + 30 hours (Remedial classes)

THE OBLIGATIONS OF THE STUDENTS DURING COURSE:
Students are obliged to attend lectures, submit homework assignments and take the final exam

LITERATURE:

- Vukotić, V. (2003), *Psihofilozofija biznisa*, CID, Podgorica
- Hisrich R, Peters M, Shepherd D, (2008) "*Poduzetništvo*", MATE, Zagreb
- Drucker, P (1985) *Inovation and Entrepreneruship, Practive and Principles,* Harper Business
- Ries, Eric (2013), LEAN startup, Kako današnji poduzetnici koriste neprestanu inovativnost za stvaranje u potpunosti uspješnih poslova
- Fitzpatrick, R. (2013) *"The Mom Test: how to talk to customers and learn if your business is a good idea when everyone is lying to you"*

Aulet, B. (2013) "*Disciplinirano poduzetništvo – 24 koraka do uspješnog startapa*", MATE, Zagred

EXPECTED LEARNING OUTCOMES:

Knowledge and understanding:

By the end of this course students will:

- Understand both theoretical and practical perspectives on entrepreneurship
- Identify and apply key knowledge and theory relating to entrepreneurship and intrapreneurship for economic and social impact
- Research, develop and communicate new business ideas based on knowledge of the new venture creation process
- Learn best practices and gain deep insights into entrepreneurship from real entrepreneurs
- Gain knowledge on how investors look at new business ideas

Transferable / Key skills and other attributes:

- Improved problem solving capabilities and presentation skills
- Established and built a solid entrepreneurial network to advance own business and careers
- Commercial awareness
- Self-management
- Team working
- Communications skills

METHODS OF KNOWLEDGE ASSESSMENT AND MARKING:

- Discussions
- Essay
- Team work and Oral presentation
- Writing assignment

DATA PREPARED BY (NAME AND SURNAME OF PROFESSOR AND ASSISTANT IF DEFINED):

SPECIAL NOTE FOR THE SUBJECT:

ANY OTHER NOTE:

OBRAZAC

Tabela S2.6.4. Forma za pripremu informacionih lista predmeta

Naziv predmeta: Napredno preduzetništvo

Šifra predmeta	Status predmeta	Semestar	Broj ECTS kredita	Fond časova
	Izborni	I	*5 ECTS*	2+0+2

Studijski programi za koje se organizuje: ***Doktorski program "Prirodne nauke i tehnologija za održivi razvoj",*** *Svi moduli, 3.stepen*

Uslovljenost drugim predmetima: *Ne postoji uslovljenosti drugim predmetima*

Ciljevi izučavanja predmeta: *Cilj predmeta je da kod studenata Doktorskog programa "Prirodne nauke i tehnologija za održivi razvoj", razvije fundamentalne menadžerske vještine, te da im približi preduzetnički način razmišljanja kako bi se pripremili za obavljanje različitih zadataka kao budući lideri u oblastima svog usavršavanja.*

Preduzetništvo se definiše kao sposobnost pojedinca da svoje ideje pretvori u akcije. Podrazumijeva kreativnost, inovaciju i spremnost da se preuzme rizik, kao i sposobnost pojedinca da planira i upravlja projektima kako bi ostvario zacrtane ciljeve.

Ideja predmeta Napredno preduzetništvo je da motiviše studenta da prepozna svoje ambicije i talente, da ih razvija radeći na sebi svakodnevno, i da ga motiviše da u poslu postigne ono što shodno svojim mogućnostima zaista i može.

Izučavanje predmeta podrazumijeva:
- lični razvoj studenta (izgradnju samopouzdanja, motivaciju, jačanje preduzetničkog načina razmišljanja, jačanje želje za postignućem i inspiraciju za akciju);
- poslovni razvoj (osnove tehničke i finansijske pismenosti kako bi student bio u mogućnosti da razmišlja o samozaposlenju);
- razvoj preduzetničkih vještina (networking, kreativno rješavanje problema, traženje prilika, prezentacione vještine, liderske sposobnosti, saradnja sa okruženjem, poznavanje lokalnih kulturnih normi i njihov uticaj na preduzetnički poduhvat i sl).
Ovaj predmet pomoći će studentima da razviju sopstvene preduzetničke vještine, razumiju biznis modele i istraže tržišne mogućnosti u kontekstu pokretanja sopstvenog biznisa

Sadržaj predmeta (nastavne cjeline, oblici individualnog rada studenata, oblici provjere znanja) prikazan prema radnim nedjeljama u akademskom kalendaru:

Pripremna nedjelja	- Uvod i ciljevi - Da li se preduzetnik rađa ili se preduzetnikom može postati? - Preduzetnički način razmišljanja, karakteristike preduzetnika i interakcija sa okolinom - Preduzetništvo, kultura i moral - Izvori biznis ideja i njihova ocjena - Preduzetništvo i inovacije - Osnove razvoja startap-a - Upravljanje projektima: Kako se organizovati na najbolji način i kako upravljati velikim i malim projektima? - Analisa studija slučaja - Preduzetnički timovi i liderstvo: kako voditi tim? Kako rješavati konflikte u timu? Kako motivisati članove tima i pokrenuti promjenu? - Startup & komunikacija - Izrada biznis plana/CANVAS model - Izvori finansiranja: kako uspješno pregovarati sa investitorima (niznis anđeli i rizični kapital) - Definisanje strategije - Marketing i internacionalizacija - Korporativno preduzetništvo - Socijalno preduzetništvo
I nedjelja	
II nedjelja	
III nedjelja	
IV nedjelja	
V nedjelja	
VI nedjelja	
VII nedjelja	
VIII nedjelja	
IX nedjelja	
X nedjelja	
XI nedjelja	
XII nedjelja	
XIII nedjelja	
XIV nedjelja	
XV nedjelja	

OBRAZAC

Metode obrazovanja:
Studenti će učestovati u diskusijama na času, čitati zadate materijale i rješavati studije slučaja

Gostujući predavači – uspješni preduzetnici i investitori

Grupni rad i prezentacija

Opterećenje studenata

Nedjeljno:	**U semestru:**
5 kredita x 40/30 = 6 sati i 40 minuta Struktura: 2 sata predavanja 2 sata vježbi 1 sat i 20 minuta samostalnog rada uključujući konsultacije	Nastava i završni ispit:(6 sati 40 minuta) x 15 = 99 sati i 45 minuta Neophodne pripreme prije početka semestra (administracija, upis, ovjera): 2 x (6 sati i 40 minuta) = 13 sati i 20 minuta Ukupno opterećenje za predmet:5x30 = 150 sati Dopunski rad za pripremu ispita u popravnom ispitnom roku, uključujući i polaganje popravnog ispita:36 sati i 55 minuta Struktura opterećenja: 99 sati i 45 min.(nastava)+13 sati i 20 min. (priprema)+36 sati i 55 min (dopunski rad)

Obaveze studenata u toku nastave:
- Redovno pohadja nastavu i vježbe,
- Savjesno i samostalno realizuju seminarske radove ili domaćezadatke,
- radi u timu,
- naučno-metodološki odradjuje ispitne obaveze i sistematizuje odgovarajući material,
- samostalno odradjuje praktični dio ispita, uz pomoć literature
- prezentuje stečena znanja i postignute rezultate.

Literatura:

- Vukotić, V. (2003), *Psihofilozofija biznisa*, CID, Podgorica
- Hisrich R, Peters M, Shepherd D, (2008) "*Poduzetništvo*", MATE, Zagreb
- Drucker, P (1985) *Inovation and Entrepreneruship, Practive and Principles,* Harper Business
- Ries, Eric (2013), LEAN startup, Kako današnji poduzetnici koriste neprestanu inovativnost za stvaranje u potpunosti uspješnih poslova
- Fitzpatrick, R. (2013) *"The Mom Test: how to talk to customers and learn if your business is a good idea when everyone is lying to you"*

Aulet, B. (2013) "*Disciplinirano poduzetništvo – 24 koraka do uspješnog startapa*", MATE, Zagred

OBRAZAC

Ishodi učenja (usklađeni sa ishodima za studijski program):

- Znanje i razumijevanje:
- Po završetku ovog predmeta studenti će:
- Razumjeti teorijsku i praktičnu perspektivu preduzetništva
- Prepoznavati i primjenjivati ključna znanja i teoriju koji se odnose na preduzetništvo i intrapreduzetništvo u kontekstu ekonomskog i socijalnog uticaja
- Biti u mogućnosti da istražuju, razvijaju i komuniciraju nove poslovne ideje zasnovane na znanju o procesu stvaranja novih poduhvata
- Poznavati najbolje prakse i steći uvid u osnove preduzetništva na osnovu realnih preduzetničkih priča
- Steći znanje o tome kako investitori ocjenjuju nove poslovne ideje
- Prenosive / ključne vještine i drugi atributi:
- Poboljšane mogućnosti rješavanja problema i prezentacijske vještine
- Uspostavljena i izgrađena čvrsta preduzetnička mreža za unapređenje sopstvenog poslovanja i karijere
- Komercijalna svijest
- Samostalno upravljanje
- Grupni rad
- Komunikacijske vještine

Oblici provjere znanja i ocjenjivanje:

-Diskusija
-Esej
-Timski rad i usmena prezentacija
-Pisani zadatak

Ime i prezime nastavnika i saradnika:

Specifičnosti koje je potrebno naglasiti za predmet:

Predmet se preporučuje i za niži oblik studija, MSc, uz određene modifikacije

Napomena (ukoliko je potrebno):

Table S2.6.4 (en). The template for preparation course info lists				
SUBJECT TITLE	**Technological entrepreneurship**			
SUBJECT CODE	**SUBJECT STATUS**	**SEMESTER**	**NUMBER OF ECTS CREDITS**	**CLASS LOAD**
	Elective	II	*5 ECTS*	2+0+2

STUDY PROGRAMMES FOR WHICH IT IS ORGANIZED: *PhD study in sustainable development*

ADMISSION REQUIREMENT: There is no pre-conditions for this course

GOALS OF STUDY: The course presents an intermediate level in technology entrepreneurship. The goal is to bring together PhD students of various profiles in order to develop strategies, techniques and skills for the commercialization of academic and scientific knowledge in the real economy and services. The course deals with the concept of technological entrepreneurship, models and tools that can be used to transfer technology from academy to industry. Also it considers case studies and good practice of known transfer and already achieved sustainability. It points to pre -conditions for successful technological entrepreneurship, as well as the most common mistakes, which someone can make.

SUBJECT CONTENT:

Preparatory weeks	Interview and survey of interested PhD students, checking their level of entrepreneurial knowledge as well as area of interest, transferable and soft skills etc
I week	Entrepreneurship and technological entrepreneurship, similarities and differences. Principles of entrepreneurship vs principles of technological entrepreneurship.
II week	An innovative approach to entrepreneurship.
III week	PhD transferable skills and soft skills for the purpose of technological entrepreneurship (analysis and problem solving, leadership skills, organizational skills, research management, self-management, work habits, the concept of usable excellence, written and oral communication, perception of individual, group, market ..).
IV week	Approaches-models of technological entrepreneurship (Stanford Technology Ventures Program (STVP), ETECH Projects at the University of Cambridge, The Berkeley Method of Entrepreneurship (BMoE), Dan Shechtman model, Japanian-east models).
V week	Analysis and development of technology entrepreneurship market and technological mapping.
VI week	Open discussion on different topics related to entrepreneurship , "brainstorming" within the team
VII week	Open discussion on topics related to entrepreneurship , "brainstorming" within the team
VIII week	Business models and planning in technology entrepreneurship, examples of teachers / instructors
IX week	Business models and planning in technology entrepreneurship, examples of teachers / instructors
X week	Lessons from successful local / regional stories in technology entrepreneurship
XI week	Lessons from successful local / regional stories in technology entrepreneurship
XII week	Mistakes that lead to the failure of technology entrepreneurs
XIII week	Project task. Definition of the project task in groups.
XIV week	Project task. Discussion.
XV week	Project task. Discussion.

TEACHING METHODS:

Lectures.
Interactive exercises
Guest lectures.
Team and individual project.
Presentation of acquired knowledge.

STUDENTS' WORKLOAD PER SUBJECT

Per week	**During semester**
5 credits x 40/30 = 6 hours and 40 minutes	**Lectures and final exam:**

Structure: **2** hours of **lectures** **0** hours of **exercises** **1** hours of **practical work** **3** hours and **40** minutes of **individual work, including consultation**	(6 hours and 40 minutes) x 16 = 106 hours and 40 minutes **Necessary preparations before the start of the semester:** *(administration, enrolment, verification)* 2 x (6 hours and 40 minutes) = 13 hours and 20 minutes **Total subject load:** 5 x 30 = 150 hours **Additional hours for preparing correction of final exam, including the taking of the exam:** 150h - (120h) = 30h **Load structure:** 106 hours and 40 minutes (Lectures) + 13 hours and 20 minutes (Preparation) + 30 hours (Remedial classes)

THE OBLIGATIONS OF THE STUDENTS DURING COURSE:

- regularly attends classes and exercises,
- conscientiously and independently realize seminars or homework,
- works in a team,
- scientifically and methodologically performs course obligations and systematizes appropriate material,
- independently completes the practical part of the exam, with the help of literature
- presents the acquired knowledge and achieved results.

LITERATURE:

1. *Clayton M. Christensen, The Innovator's Dilemma, HarperBusiness; Reprint edition (October 4, 2011), ISBN-10: 9780062060242.*
2. *Eric Ries, The Lean Startup, Currency; 1 edition (September 13, 2011), ISBN-10: 9780307887894.*
3. *Clayton M. Christensen, The Innovator's Solution: Creating and Sustaining Successful Growth, Harvard Business Review Press; 1 edition (November 19, 2013), ISBN-10: 1422196577.*
4. *Dan Shechtman, Why Should We Teach Technological Entrepreneurship in Universities, Technion, Haifa, Israel, ISU, Ames, Iowa, USA, utorizovane prezentacija i video.*
5. *Agne Kazakeviciute, Renata Urbone and Monika Petraite, Curriculum development for technology-based entrepreneurship education: A cross-disciplinary and cross-cultural approach, Industry and Higher Education, 2016, Vol. 30(3) 202–214*

EXPECTED LEARNING OUTCOMES:

- Identify and assess the market opportunities of academic / university / scientific technology.
- Develop a comprehensive offer and design an appropriate business model for the transfer of academic / university / scientific technology.
- Formulate a strategy for the development of the local high-tech market and customer formation, based on pushed needs and customer needs.
- Identify key sources for short-term and long-term sustainability of the solution.
- Select and define the IPR model
- Define short-term and long-term business plan.
- Define the main elements of maintaining innovative solutions.
- Develop a teamwork model.
- Identify the basic mistakes in technological entrepreneurship.

METHODS OF KNOWLEDGE ASSESSMENT AND MARKING:

- Seminar-colloquial work / project, after series of lectures and exercises.
- Seminar-colloquial papers will be performed in groups, which will be formed respecting the principle of heterogeneity (interdisciplinary).
- The final grade will contain two criteria:
    a. assessment of group work 50%,
    b. assessment of individual contribution of 50%. Individual contribution is assessed according to the description of each author's contribution to the overall project and the thematic interview with the candidate..
- The above items of knowledge assessment can be replaced by publishing a paperpresented at doctoral colloquium (the paper should briefly describe the content of the paper / project)

DATA PREPARED BY (NAME AND SURNAME OF PROFESSOR AND ASSISTANT IF DEFINED):

Prof. dr Radovan Stojanović

SPECIAL NOTE FOR THE SUBJECT: The course is also recommended for a lower form of study, MSc, with certain modifications
ANY OTHER NOTE:

OBRAZAC

Tabela S2.6.4. Forma za pripremu informacionih lista predmeta

Naziv predmeta: Tehnološko preduzetništvo

Šifra predmeta	Status predmeta	Semestar	Broj ECTS kredita	Fond časova
	Izborni	II	*5 ECTS*	2+0+2

Studijski programi za koje se organizuje: *Doktorske studije u održivom razvoju, MARDS*

Uslovljenost drugim predmetima: *Ne postoji uslovljenosti drugim predmetima*

Ciljevi izučavanja predmeta: *Kurs predstavlja srednji nivo u tehnološkom preduzetništvu. Cilj je da okupiti PhD studente različitih profila, kako bi kod njih razvio strategije, tehnike i vještine komercijalizacije akademskih i naučnih znanja u realnoj privredi i realnim uslugama. Kurs se bavi konceptom tehnološkog preduzetništva, modelima i alatima koji se mogu koristiti u cilju transfera tehnologija iz akadmije u industriju, kao i studijama slučaja i dobre prakse ostvarenog transfera i postignute održivosti. Takodje, ukazuje na mnoge preduslove za uspješno tehnološko preduzetništvo, kao i na najčešće greške koje se čine.*

Sadržaj predmeta (nastavne cjeline, oblici individualnog rada studenata, oblici provjere znanja) prikazan prema radnim nedjeljama u akademskom kalendaru:

Pripremna nedjelja	Intervju i anketa zainteresovanih PhD studenata, nivo njihovog preduzetničkog znanja, oblast interesovanja, prenosive i delikatne vještine kojima raspolažu itd...
I nedjelja	Preduzetništvo i tehnološko preduzetništvo, sličnosti i razlike. Principi preduzetništva vs principi tehnološkog preduzetništva.
II nedjelja	Inovativni pristup preduzetništvu.
III nedjelja	PhD prenosive vještine i delikatne vještine u svrhu tehnološkog preduzetništva (analiza i rešavanje problema, liderske vještine, organizacione vještine, upravljanje istraživanjima, self-managment, radne navike, pojam upotrebljive ekselentnosti, pisana i oralna komunikacija, percepcija pojedinca, grupe, tržišta..)
IV nedjelja	Pristupi-modeli tehnološkog preduzetništva (Stanford Technology Ventures Programme (STVP), ETECH Projects at the University of Cambridge, The Berkeley Method of Entrepreneurship (BMoE), Dan Shechtman model, Japanian-east modeli)
V nedjelja	Analiza i razvoj tržišta tehnološkog preduzetništva, tehnološko mapiranje
VI nedjelja	Otvorena diskusija na temu, „brainstorming“ unutar tima
VII nedjelja	Otvorena diskusija na temu, „brainstorming“ unutar tima
VIII nedjelja	Biznis modeli i planiranje u tehnološkom preduzetništvu, primjeri učitelja/instruktora
IX nedjelja	IPR (Za[tita prava itelektualne svojine kod tehnoloških inovacija)
X nedjelja	Lekcije poznatih lokalnih/regionalnih priča u tehnološkom preduzetništvu.
XI nedjelja	Lekcije poznatih lokalnih/regionalnih priča u tehnološkom preduzetništvu.
XII nedjelja	Greške koje dovode do neuspjeha tehnoloških preduzetnika.
XIII nedjelja	Projektni zadatak. Definicija projektnog zadatka u grupama.
XIV nedjelja	Projektni zadatak. Diskusija.
XV nedjelja	Projektni zadatak. Konsultacije.

Metode obrazovanja:

- Predavanja
- Interaktivne vježbe
- Gostujuća predvanja.
- Timski i induvidualni projekat.
- Prezentovanje stečenih znanja.

Opterećenje studenata

OBRAZAC

Nedjeljno:	**U semestru:**
5 kredita x 40/30 = 6 sati i 40 minuta Struktura: 2 sata predavanja 2 sata vježbi 1 sat i 20 minuta samostalnog rada uključujući konsultacije	Nastava i završni ispit: (6 sati 40 minuta) x 15 = 99 sati i 45 minuta Neophodne pripreme prije početka semestra (administracija, upis, ovjera): 2 x (6 sati i 40 minuta) = 13 sati i 20 minuta Ukupno opterećenje za predmet:5x30 = 150 sati Dopunski rad za pripremu ispita u popravnom ispitnom roku, uključujući i polaganje popravnog ispita:36 sati i 55 minuta Struktura opterećenja: 99 sati i 45 min.(nastava)+13 sati i 20 min. (priprema)+36 sati i 55 min (dopunski rad)

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- radi u timu,
- naučno-metodološki odradjuje ispitne obaveze i sistematizuje odgovarajući material,
- samostalno odradjuje praktični dio ispita, uz pomoć literature
- prezentuje stečena znanja i postignute rezultate.

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- Eric Ries, The Lean Startup, Currency; 1 edition (September 13, 2011), ISBN-10: 9780307887894.
- Clayton M. Christensen, The Innovator's Solution: Creating and Sustaining Successful Growth, Harvard Business Review Press; 1 edition (November 19, 2013), ISBN-10: 1422196577.
- Dan Shechtman, Why Should We Teach Technological Entrepreneurship in Universities, Technion, Haifa, Israel, ISU, Ames, Iowa, USA, utorizovane prezentacija i video.
- Agne Kazakeviciute, Renata Urbone and Monika Petraite, Curriculum development for technology-based entrepreneurship education: A cross-disciplinary and cross-cultural approach, Industry and Higher Education, 2016, Vol. 30(3) 202–214

Ishodi učenja (usklađeni sa ishodima za studijski program):

- Identifikovati i procijeniti tržišne mogućnosti akademske/univerzitetske/naučne tehnologije.
- Razviti sveobuhvatnu ponudu i osmisliti odgovarajući poslovni model transfera akademske/univerzitetske/naučne tehnologije.
- Formulisati strategiju razvoja lokalnog high-tech trzišta i formiranja kupca, zasnovanu na diktiranim potrebama i potrebama kupca.
- Odrediti ključne izvore za kratkoročnu i dugoročnu održivost rešenja.
- Izabrati i definisati IPR model
- Definisati kratkoročni i dugoročni poslovni plan.
- Definisati glavne elemente održanja inovativnosti rešenja.
- Razraditi model timskog rada.
- Uočiti osnovne greške u tehnološkom preduzetništvu.

Oblici provjere znanja i ocjenjivanje:

- Seminarski-kolokvijalni rad/projekat, nakon serije predavanja i vježbi.
- Seminarski-kolokvijalni radovi će se obaviti u grupama, koje će biti formirane uvažavajući princip heterogenosti (interdisciplinarnosti).
- Konačna ocena će sadržati dva kriterijuma:
  a) ocjenu grupnog rada 50%,
  b) ocjenu induvidualnog doprinosa 50%. Individualni doprinos se procjenjuje prema opisu doprinosa svakog autora ukupnom projektu i tematskog razgovora sa kandidatom. Specifikacija individualnog udjela mora biti sastavni dio predatog kolokvijalnog-seminarskog rada.

OBRAZAC

- Gornje stavke provjere znanja se mogu nadomjestiti publikovanjem rada na dokotorskom kolokvijumu (rad sažeto treba da opiše sadržaj rada/projekta)
Ime i prezime nastavnika i saradnika: Prof. dr Radovan Stojanović
Specifičnosti koje je potrebno naglasiti za predmet: Predmet se preporucuje i za nizi oblik studija, MSc, uz odredjene modifikacije
Napomena (ukoliko je potrebno):