ČLOVEŠKI IN ORGANIZACIJSKI FAKTORJI

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Človeški in organizacijski faktorji
Course title:	Human and organizational factors
Članica nosilka/UL Member:	UL FKKT

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Tehniška varnost, druga stopnja, magistrski	Ni členitve (študijski program)	1. letnik	2. semester	obvezni

Univerzitetna koda predmeta/University course code:	0072276
Koda učne enote na članici/UL Member course code:	TV205S

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
45	30				75	5

Nosilec predmeta/Lecturer:	doc. dr. Marija Molan
Vrsta predmeta/Course type:	obvezni/Mandatory

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	Content (Syllabus outline):
Snov predmeta "Človeški in organizacijski dejavniki" vsebuje temeljne informacije in znanja o človeških in organizacijskih dejavnikih. Vključene so naslednje teme: • analiza obratovalnih dogodkov in nezgod iz vidika človekovega vedenja • predstavitev metod za analizo človekovega vedenja • rezultati analiz in lekcije, ki iz njih izhajajo • predstavitve rezultatov analiz nezgod in vloge človeka • predstavitev modela Razpoložljivost – humanizacija • predstavitev elementov modela Razpoložljivost – humanizacija • predstavitev metod organizacijskih analiz	**Course "Human and organizational factors" contains basic information and knowledge about human and organizational factors in the system. Following topics are included:** • Root cause analysis of incident and accident from human factors experts • Presentation of human behaviour analysis methods • Results of analysis and lessons learned • Presentation of root cause analysis results from human aspects • Presentation of AH-model • Presentation of AH-model elements • Presentation of methods for organizational analysis • Human availability and performance

• človekova razpoložljivost, zanesljivost in učinkovitost • metode za analizo človekove razpoložljivosti • ukrepi za spreminjanje zanesljivosti (oblikovanje vmesnika človek – stroj) • metode za usposobitev za učinkovito vedenje • človek kot upravljavec in nadzornik procesa • človek kot vzdrževalec procesa • človek kot organizator in tehnolog procesa • odvisnost napak človeka od njegove vloge v sistemu • predstavitev metod za oceno človekove zanesljivosti in povezava z metodami za oceno razpoložljivosti • povezava metod za oceno razpoložljivosti z nekaterimi metodami, ki se uporabljajo v oceni tveganja • odpravljanje pomanjkljivosti v kompleksnem sistemu, ki so posledice neučinkovitega vedenja človeka • zagotavljanje ustrezne ravni varnostne kulture • postavitev ustrezne organizacijske kulture • spoznavanje komponent človekove razpoložljivosti in zagotavljanje njihove ustrezne ravni glede na vlogo v sistemu • implementacija rezultatov analiz obratovalnih dogodkov v organizacijsko kulturo sistema • oblikovanje zaupanja v okolju sistema • načini komunikacij v normalnem obratovanju in ob nezgodah • oblikovanje varnostnih skupin Vsebina seminarske naloge: Na osnovi znanj iz predavanj in znanj ter izkušenj iz dodiplomskega študija in na osnovi znanj predmeta "Človek v delovnem procesu" izdela študent analizo nezgode v realnem delovnem okolju, določi vzroke dogodka, predloge spreminjanja vedenjskih vzorcev vpletenih in ukrepe za preprečitev ponovitve. Seminarsko nalogo predstavijo pred avditorijem študentov.	• Methods for human availability analysis • Measures for human reliability adaptation (shaping of man-machine interface) • Methods for shaping of affective behaviour • Individual as operator and supervisor • Individual as maintainer in the process • Organizational and technological role of individual in the process • Dependence of human errors of his role in the system • Presentation of human reliability methods connected with human availability methods • Connection between human availability methods with risk assessment methods • Elimination of complex system malfunctions caused by human not effective behaviour • Shaping of adequate level of safety culture • Shaping of organizational culture • Identification of human availability components with assurance of correspondence to the role in the system • Root cause analysis results implementation in organisational culture in the system • Shaping of relation between system and environment • Communication patterns in normal operation and in accident • Shaping of safety groups The content of project seminar work: On the basis of obtained knowledge from lectures and on the basis of undergraduate course the student make root cause analysis of a real accident, identify root causes, suggest modification of behaviour patterns, and suggest preventive measure. Project work has to be presented in front of students' auditorium and written report has to be done.

Temeljna literatura in viri/Readings:

1. Molan M., Človekovo vedenje v Priročnik za varno in zdravo delo, Koselj V. (ur), Tehniška založba Slovenije, 2002 (40%)
2. Rasmussen J.: Cognitive Systems Engineering, Willey & Sons, 1994 (30%)
3. Leka S., Houdmont J, Occupational Health Psychology, Wiley-Blackwell, 1st edition, 2010 (30%

Cilji in kompetence:	**Objectives and competences:**
Pri predmetu "Človeški in organizacijski dejavniki" naj bi študentje dobili temeljna znanja o človeških in organizacijskih dejavnikih, ki vplivajo na delovanje sistema ter zagotavljajo varnost v sistemu in njegovi okolici. Dobili bodo temeljna metodološka znanja za identifikacijo ključnih elementov organizacijske in varnostne kulture.	Students will get basic knowledge about human and organizational factors influencing on system performance and affecting of system and environment safety. They will get basic methodological knowledge for identification of crucial elements of organization and safety culture.

Predvideni študijski rezultati:	Intended learning outcomes:
Znanje in razumevanje Študentje naj bi pridobil osnovna teoretska in praktična znanja, ki so potrebna za analizo dogajanj v sistemu iz vidika človeka in organizacijskih dejavnikov. Pridobijo tudi znanja za oblikovanje ustrezne organizacijske in varnostne kulture v sistemu ter zagotavljanje varnega delovanja in varovanja okolice. Uporaba Študentje bodo znali identificirati temeljne vedenjske vzorce človeka, ki povzročajo motnje v delovanju sistema ter povzročajo neobičajne dogodke. Usposobili se bodo za izdelavo analiz in implementacijo konkretnih ukrepov za varno in stabilno delovanje kateregakoli sistema. Na osnovi temeljnih metodoloških znanj bodo znali izdelati aplikativne modele za modeliranje konkretnih delovnih okolij. Naučili se bodo povezovati človekovo razpoložljivost z varnim in učinkovitim vedenjem. Naučili se bodo uporabljati nekatere metode za razbremenitev človeka v delovnem sistemu. Teoretično in praktično bodo usposobljeni za implementacijo dejavnikov, ki zagotavljajo varnost sistema in njegove okolice iz vidika človeka in organizacije. Refleksija Teoretska in praktične izkušnje iz seminarske naloge bo študent lahko uporabil pri reševanju praktičnih in teoretskih problemov. Vedenje o človeških in organizacijskih vplivih na varnost sistema bodo študentu omogočala sodelovanje pri zagotavljanju varnosti in preprečevanju neobičajnih dogodkov. Pridobljena znanja bodo lahko tudi osnova za razvojno raziskovalno delo. Prenosljive spretnosti Pri predmetu bodo študentje pridobili osnova znanja o človeških in organizacijskih dejavnikih, ki vplivajo na učinkovitost in varnost sistema in njegove okolice.	Knowledge and Comprehension Students will get basic theoretical and practical knowledge necessary for root cause analysis of incidents in the system from the human and organizational point of view. They will get knowledge for creation of adequate organizational safety culture in the system and for safe performance environment protection. Application Students will be able to identify basic human behaviour patterns causing disturbances in the system performance and accidents. They will be able to perform root-cause analyse and implement preventive measure necessary for stable and safe system performance. Obtained methodological knowledge will able to use in a real working environment. They will able to connect human availability with safe and effective behaviour. The will be able to use some methods for reduction of workers work load in the system. From the theoretical and practical point they will be able to implement preventive measures assuring safety of system and environment from human and organizational aspects. Analysis Students will be able to use theoretical and practical skills from project work in solving real problems. Knowledge about human and organizational impacts on system safety will support students to participate in safety assurance prevent accidents. Obtained knowledge should be also the basic for future research and development work. Skill-transference Ability Students will get basic knowledge about human and organizational factors affecting systems safety and performance and the safety of environment.

Metode poučevanja in učenja:	Learning and teaching methods:
• Predavanja • Seminar	• Lectures • Seminars with project work

Načini ocenjevanja:	Delež/Weight	Assessment:
Izpit pisni. Ocena seminarske naloge. Ocene: 6-10 pozitivno.		Written exam. Project. Passing rate: 6-10

Reference nosilca/Lecturer's references:

1. MOLAN, Gregor, **MOLAN, Marija**. Theoretical model for accident prevention based on root cause analysis with graph theory. Safety and health at work = : SH@W. 17 Sep 2020, vol. , iss. , str. [1-9], ilustr. ISSN 2093-7911, DOI: 10.1016/j.shaw.2020.09.004
2. **MOLAN, Marija**. Zagotavljanje dobrega počutja in razpoložljivosti v delovnem okolju - izziv od samoupravljanja do kapitalizma = Ensuring well-being and availability in the workplace - challenges from self-management to capitalism. Sanitas et labor, ISSN 1580-5972, št. 1, mar. 2012, str. 7-29. [COBISS.SI-ID 36503813]

3. **MOLAN, Marija**, MOLAN, Gregor. BFS human behaviour model for traffic safety. Promet, ISSN 0353-5320, 2011, vol. 23, no. 4, str. 205-213. [COBISS.SI-ID 35618821]

DELOVNE PRIPRAVE IN NAPRAVE II

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Delovne priprave in naprave II
Course title:	WORK APPLIANCES AND DEVICES II
Članica nosilka/UL Member:	UL FKKT

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Tehniška varnost, druga stopnja, magistrski (od študijskega leta 2023/2024 dalje)	Ni členitve (študijski program)	1. letnik, 2. letnik		izbirni

Univerzitetna koda predmeta/University course code:	0100769
Koda učne enote na članici/UL Member course code:	TV2B10

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
30		45 SV			75	5

Nosilec predmeta/Lecturer:	izr. prof. dr. Boris Jerman
Vrsta predmeta/Course type:	izbirni strokovni/Elective Professional
Jeziki/Languages:	Predavanja/Lectures: Angleščina, Slovenščina Vaje/Tutorial: Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	Content (Syllabus outline):
Snov zajema celovito predstavitev zakonskih zahtev ter zahtev standardov, na osnovi katerih se vrednoti varnost ter določi ustrezna zaščitna oprema pri določenem delovnem procesu. Omenjene zahteve so ustrezne teoretične utemeljene. Vključene so sledeče teme: - terminologija s področja varnosti strojev; - poglobljena obravnava teorije zaščite, ki vključuje strategijo zagotavljanja varnosti, načela zaščite ter načrtovanje zaščite delovnih sredstev,načine izbora zaščitne opreme, nevarnosti pri posameznih vrstah strojev in naprav); - poglobljena obravnava ocenjevanja tveganja in določanja potrebnega nivoja zaščite;	The contents of the course include a presentation of the basic requirements of lows and standards on basis of which the corresponding safety integrity level is estimated and appropriate protective equipment for specific work process is determined. Also included are the theoretical foundations on which each of the requirements is based. It includes the following topics: • terminology in the field of safety of machinery; • detailed theory of protection which include the strategy for providing the safety on work, principles of the protection and planning of the protection of occupational equipment, the principles for selection of protective equipment, the hazards at individual machines ;

- tehnike varovanja (sodobne tehnike varovanja,posebnosti varovanja pri posameznih vrstah strojev in naprav); - poglobljena obravnava ergonomskih vidikov varnosti pri delu na posameznih vrstah strojev in naprav; - kompleksni sistemi varovanja (mehanski, električni, hidravlični, pnevmatski, digitalni/programirani sistemi) - poglobljena teoretska in praktična obravnava primerov varnostnih ureditev. VSEBINA VAJ: Namen vaj je utrditev ter poglobitev razumevanja pridobljenih teoretskih osnov.Vaje potekajo v predavalnici, kjer slušatelji, razdeljeni v manjše skupine (5-6 oseb, do 5 skupin na enkrat) ocenjujejo tveganje in iščejo ustrezne zaščitne ureditve za konkretne primere strojev in postrojenj, s katerimi se seznanijo preko tekstovnega in slikovnega gradiva ter obiskov v podjetjih. Vključena je tudi predstavitev rezultatov ter njihov komentar s strani poslušalcev in učitelja ali asistenta.	• detailed risk assessment procedures and procedures for determination of necessary SIL (safety integrity level); • contemporary techniques of protection (particularities of the protection of the various types of machinery) ; • detailed consideration of the ergonomic aspects of safety at work; • complex protection systems (mechanical, electric, hydraulic, pneumatic, digital/programmable systems); • detailed theoretical and practical consideration of the safety arrangements . CONTENTS OF THE EXERCISES: The purpose of the exercises is to strengthen and deepen the comprehension of theoretical foundations. The work takes place in the classroom where students are divided into small groups (5-6 people up to 5 groups at once). They are assessing the risk and looking for appropriate protective arrangements of actual examples of machines and machinery. A presentation of the results and their comment is also included.

Temeljna literatura in viri/Readings:

- J. Ridley, D. Pearce. Safety With Machinery. Butterworth-Heinemann. Oxford, 2005.
- J. Ridley, J. Channing. Safety at Work. A Butterworth-Heinemann Title; 7 edition (10 Dec 2008).
- W. Humer, D. Price. Occupational Safety Management and Engineering (5th Edition).Prentice Hall International Series in Industrial and Systems Engineering. Prentice Hall, cop. 2001.

Additional reading:
- W. Kent Muhlbauer. Pipeline Risk Management Manual, Ideas, Techniques, and Resources. Elsevier. Oxford,2004.
- Zakon o splošni varnosti proizvodov. Ur. l. RS, 101/2003.
- Zakon o tehničnih zahtevah za proizvode in o ugotavljanju skladnosti. Ur. l. RS,59/1999;31/2000; 54/2000; 37/2004; 99/2004.
- Pravilnik o načinu izdelave izjave o varnosti z oceno tveganja. Ur. l. RS, 30/2000.
- SIST EN 61025:2008 - Analiza drevesa okvar (FTA) (IEC 61025:2006).
- SIST EN 60812:2007 - Analizne tehnike za sistemsko zanesljivost – Postopek za analiz vrste okvar in njihovih učinkov (FMEA) (IEC 60812-2006).
- Pravilnik o varnosti strojev. Ur. l. RS, 25/2006 in 75/2008.
- Seznam standardov, katerih uporaba ustvarja domnevo o skladnosti proizvoda s Pravilnikom o varnosti strojev. Ur. l. RS, 25/2009.
- SIST EN ISO 12100-1:2004 - Varnost strojev - Osnovni pojmi, splošna načela načrtovanja - 1. del: Osnovna terminologija, metodologija (ISO 12100-1:2003) z doplnili.
- SIST EN ISO 12100-2:2004 - Varnost strojev - Osnovni pojmi, splošna načela načrtovanja - 2. del: Tehnična načela (ISO 12100-2:2003) z dopolnili.
- oSIST prEN ISO 12100:2009 - Varnost strojev - Splošna načela načrtovanja, ocena tveganja in zmanjšanje tveganja (ISO/DIS 12100:2009)

Cilji in kompetence:	**Objectives and competences:**
Slušatelji razširijo in poglobijo znanje o principih varnostne tehnike. Globlje se seznanijo se z delovanjem zaščitne opreme in se usposobijo za njeno uporabo, analizo in za pomoč pri razvoju take opreme. V detajle se seznanijo z metodami za ocenjevanje tveganja in določevanja potrebnega	The aim of this course is to enable students to determine the hazards and risks in the working environment related to the use of occupational apparatus and equipment, and provide for measures to remove these hazards and threats or to reduce the associated risks. Students will gain knowledge of the

nivoja zaščite delovnih priprav in se usposobijo za uporabo, analizo in razvoj takih metod. Seznanijo se s slovensko zakonodajo ter slovenskimi in mednarodnimi standardi z obravanega področja in jih znajo samostojno uporabljati.	basic principles of safety techniques. They get acquainted with the operation of protective equipment and are trained to analyse such equipment. They get acquainted with the methods of risk assessment and determining the adequate safety integrity level, and the ability to apply such methods. They get acquainted with the most important Slovenian legislation and the most important Slovenian and international standards in the subject and know how to use them. They become familiar with the procedures for gaining and use of the CE marking.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje Pri predmetu bo slušatelj pridobil ustrezna teoretska in praktična znanja, potrebna za reševanje teoretičnih in praktičnih varnostnih problemov. Slušatelj bo po opravljenem izpitu: i. seznanjen s strategijo in taktikami varnostne tehnike ter s principi in metodami uporabe varnostne opreme. Predstavljene mu bodo dodatne naloge in izvedbe varovanja, povezane z zapletenimi sodobnimi stroji in napravami; ii. seznanjen z aktualnimi metodami za oceno tveganja in določevanje potrebnega nivoja zaščite strojev in naprav ter drugih delovnih priprav; iii. seznanjen z delovanjem sodobne zaščitne opreme; iv. seznanjen z metodami za presojo ustreznosti obstoječe zaščitne opreme in zaščitnih sistemov; v. seznanjen z vsebino slovenske zakonodaje ter slovenskih in mednarodnih standardov z obravnavanega področja; vi. seznanjen z možnostmi in načini sodelovanja pri nastajanju zakonodaje in standardov s področja varnosti in zdravja pri delu. Uporaba Predmet je usmerjen k reševanju praktičnih in teoretskih varnostnih problemov, s katerimi se varnostni inženir/magister srečuje vsakodnevno, bodisi v industrijski praksi ali v sklopu teoretskih in praktičnih raziskav. Slušatelj bo po opravljenem izpitu: i. usposobljen za uporabo, tolmačenje, proučevanje in razvoj osnovnih in njim sorodnih metod za oceno tveganja in določevanje potrebnega nivoja zaščite strojev, naprav ter drugih delovnih priprav; ii. usposobljen za uporabo, proučevanje in pomoč pri razvoju različnih vrst zaščitne opreme in sistemov; iii. usposobljen za uporabo in razvoj metod za presojo ustreznosti obstoječe zaščitne opreme in zaščitnih sistemov ter za podajanje predlogov o potrebnih izboljšavah; iv. usposobljen samostojno izbrati najprimernejše in najučinkovitejše načine za zagotovitev ustreznega nivoja zaščite strojev ter drugih delovnih priprav ter izbirati med različno na trgu ponujeno opremo brez dvomov, da taka izbira morda ne bi zagotovila	Knowledge and Comprehension In this course students will acquire basic theoretical and practical knowledge to solve practical safety problems. After the final exam the student will be: • familiar with the basic principles of safety techniques and methods of use of safety equipment. The contents from the basic techniques of protection against the simple hazards to comprehensive protection tasks associated with complex modern machines will be presented to him; • familiar with the basic methods for risk assessment and determination of the required safety integrity level of machinery and other occupational equipment; • familiar with the operation of the basic types of protective equipment; • familiar with the methods for assessment of adequacy of the existing safety equipment and protective systems; • familiar with the contents of the most important Slovenian legislation as well as the most important Slovenian and international standards in the subject. Application The course is oriented to solve safety problems, with which a safety engineer faces on a daily basis, either in practice (as a developer of protective equipment , or in the role of supervisor , who asses the adequacy of protective equipment, its current status and use of this equipment by operators) or in the context of research. After the final exam the student will be: i. Trained for the use and interpretation of the basic methods of risk assessment; ii. Trained in usage of the methods for assessing the adequacy of existing safety equipment and protective systems, determining the necessary machinery safety integrity level and other occupationally equipment as well as for advancing proposals about necessary improvements; iii. Trained to independently choose the most appropriate and most effective ways to ensure the appropriate level of protection of machinery and other working devices and appliances, and choose between different offers on the market;

nivoja zaščite, ki ga zahtevajo zakoni in družba ter ga omogoča trenutno stanje tehnike; v. usposobljen samostojno uporabljati slovensko zakonodajo ter slovenske in mednarodne standarde z obarvanega področja; vi. usposobljen samostojno širiti svoje znanje z obravnavanega področja in pridobivati potrebne dodatne informacije iz slovenskih, evropskih in mednarodnih standardov, iz ustrezne zakonodaje ter iz druge literature. Refleksija Teoretska in praktična znanja bodo uporabna pri reševanju realnih teoretskih in praktičnih problemov (pri zaščiti konkretnih strojev in naprav oz. pri razvijanju nove zaščitne opreme in zaščitnih sistemov). Spoznanja o uporabnosti in omejitvah posameznih metod varovanja ter posameznih varnostnih analiz predstavljajo trdni temelj za delovanje v praksi in na inštitutih. Prenosljive spretnosti V okviru predmeta si bo slušatelj utrdil in razširil sledeča znanja oz. spretnosti: iskanje literature, razumevanje zahtevnejših strokovnih in pravnih tekstov, uporaba standardov v tujih jezikih, metode ocenjevanja tveganja, tehnike izdelave poročil.	iv. Trained to independently apply the most important Slovenian legislation as well as the most important Slovenian and international standards in the subject. Analysis Theoretical and practical knowledge will be useful in solving real life theoretical and practical issues (for the protection of concrete machinery and equipment and in the development process of new protective equipment and protective systems). Insights on the applicability and limitations of individual methods of protection and individual safety analyses represent a solid foundation for working in practice and in institutes. Skill-transference Ability During the course students will acquire and deepen the following skills or knowledge respectively: searching for the literature, understanding of complex texts such as technical legislation and standards, the use of standards written in foreign languages, risk assessment methods, the principles of making technical reports.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, teoretske vaje, domače delo – izdelava individualnih seminarskih nalog	Written exam Seminar Grades: 6-10 positive, 1-5 negative

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Pisni izpit	70,00 %	Written exam
Seminarska naloga	30,00 %	Seminar
Ocene: 6-10 pozitivno, 1-5 negativno		Grades: 6-10 positive, 1-5 negative

Reference nosilca/Lecturer's references:

1. **JERMAN, Boris**, HRIBAR, Anton. Dynamics of the mathematical pendulum suspended from a moving mass. *Tehnički vjesnik*, ISSN 1330-3651, 2013, vol. 20, no. 1, str. 59-64.
2. MARINOVIĆ, Ivica, SPREČIĆ, Denijal, **JERMAN, Boris**. A slewing crane payload dynamics. *Tehnički vjesnik*, ISSN 1330-3651, Dec. 2012, vol. 19, no. 4, str. 907-916.
3. BOŠNJAK, Srđan, PETKOVIĆ, Zoran, GNJATOVIĆ B., Nebojša, MILENOVIĆ LJ., Ivan, **JERMAN, Boris**. Impact of the track wheel axles on the strength of the bucket wheel excavator two-wheel bogie. *Tehnički vjesnik*, ISSN 1330-3651, 2013, god. 20, br. 5, str. 803-810.

INŠTRUMENTALNA ANALIZA IN MONITORING

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Inštrumentalna analiza in monitoring
Course title:	Instrumental Analysis and Monitoring
Članica nosilka/UL Member:	UL FKKT

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Tehniška varnost, druga stopnja, magistrski (od študijskega leta 2023/2024 dalje)	Ni členitve (študijski program)	1. letnik, 2. letnik		izbirni

Univerzitetna koda predmeta/University course code:	0072277
Koda učne enote na članici/UL Member course code:	TV2B7

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
30	15	30			75	5

Nosilec predmeta/Lecturer:	prof. dr. Matevž Pompe
Vrsta predmeta/Course type:	izbirni strokovni/Elective Professional

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	Content (Syllabus outline):
Pri predmetu ¨Inštrumentalna analiza, monitoring, sistemi¨ bomo obravnavali naslednje teme: • Pregled instrumentalnih tehnik za analitiko nevarnih in toksičnih snovi • Pregled škodljivih snovi v delovnem okolju ali pri gorenju (posamezne organske snovi, kovine, prašni delci,...) • Pregled različnih načinov jemanja vzorcev za prašne delce ter onesnaževala v plinski fazi • pasivni vzorčevalniki (osebni dozimetri) • off-line jemanje vzorcev (filtri, izpiralke, kartuše, adsorpcijska sredstva,...). • on-line jemanje vzorcev • Osnove monitoring sistemov • Načrtovanje meritev ter eksperimentov	In this course "Instrumental analysis and monitoring", the following topics be discussed: • Overview of instrumental techniques for analysis of hazardous and toxic substances • Review of harmful substances in the workplace or during combustion (individual organic materials, metals, dust, ...) • Review of sampling procedures for determination of the dust particles and the gas phase pollutants. • Passive sampling (personal dosimeters) • off-line sampling (filters, impingers, cartridge, adsorption tubes ...). • on-line sampling • Basic monitoring systems • Planning of measurements and experiments design

• Vrednotenje dobljenih rezultatov in priprava poročil • Pregled metod določevanja pomembnejših onesnaževal (EU, OSHA standardi) VSEBINA VAJ (individualne vaje): Vaje bi obsegale praktične primere enostavnejših metod določevanja pomembnejših onesnaževal. Poudarek bi bil predvsem na rokovanju z osebnimi dozimetri.	• Evaluation of the results and the preparation of the reports • Review standard methods for determination of major pollutants (EU-OSHA standards) CONTENTS OF PRACTICALS (individual exercises): Practical should encompass practical examples of simple methods for determination of major pollutants. The focus would be primarily on the handling of personal dosimeters.

Temeljna literatura in viri/Readings:

- S.A. Ness, Air monitoring for Toxic Exposures,Van Nostrand Reinhold, New York. (10 %)
- J.P. Lodge, ed. Methods of Air Sampling and Analysis, Lewis Publishers, Chelsea, Michigan. (10 %)
- D. C. Harris, Quantitative Chemical Analysis, W.H. Freeman, New York. (10 %)
- D.A. Skoog, D.M. West, Holler, Analytical Chemistry an Introduction, Holt-Saunders Int. Ed. New York

Cilji in kompetence:	**Objectives and competences:**
Pri predmetu ¨Inštrumentalna analiza, monitoring, sistemi¨ naj bi študentje univerzitetnega programa varstva pri delu in požarne varnosti dobil znanje o osnovah jemanja vzorcev zraka v delovnem okolju, določevanju posameznih komponent v vzorcih zraka (monitoring sistemi) ter vrednotenju dobljenih rezultatov s povezavo z ustreznimi standardi in priporočili	In this course, "Instrumental analysis and monitoring", the students should gain knowledge about the basics of sampling of air in the work environment, determining the individual components in samples of air (monitoring systems), and the evaluation of the obtained results taking into account the relevant standards and recommendations.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje Študentje naj bi pridobili osnovna teoretska in praktična znanja, ki so potrebna za načrtovanje ter izvedbo meritev onesnaževal v delovnem okolju. Obenem bodo sposobni kritično presoditi primernost posameznih tehnik ter interpretirati dobljene rezultate. Uporaba Znanje, ki ga bo pridobil student je namenjeno reševanje praktičnih problemov tako pri načrtovanju in izvedbi monitoring sistemov kot tudi za oceno učinkovitosti ukrepov pri sanacija stanja. Pomemben vidik predmeta je predstaviti študentu kritičen pogled na podajanje rezultatov in zmogljivosti različniha naliznih postopkov. Refleksija Teoretska in praktična znanja bo lahko študent uporabil pri reševanju realni problemov načrtovanja meritev onesnaževal v delovnem okolju. Spoznanja o zmogljivostih in omejitvah posameznih metod v praksi pomenijo osnovo za mnoge pomembne odločitve. Prenosljive spretnosti Študenti bodo razumeli pomen validiranih analiznih postopkov. Sposobni bodo kritično ovrednotiti rezultate in jih predstaviti v pisni in ustni obliki, kar je	Knowledge and Comprehension Students will acquire basic theoretical knowledge and practical skills necessary for planning and execution of the measurements of pollutants in the work environment. At the same time they will be able to critically assess the suitability of particular techniques and interpret the obtained results. Application Obtained knowledge will enable students to solve practical problems in both the design and implementation of monitoring systems, as well as to assess the effectiveness of measures taken to improve working environment. An important aspect of this course is to provide students with a critical view on the reliability of the obtained results as well as the performance of the various analytical procedures. Analysis Theoretical and practical knowledge will be used by the student to implement the measurements of pollutants in the work environment. Knowledge about capability and limitation of each method in practice is the basis for many important decisions. Skill-transference Ability Students will understand the importance of validated analytical procedure. They are able to critically

ključnega pomena za nadaljnji proces odločanja za sanacijo stanja v delovnem okolju.	evaluate the results and present them in written and oral form, which is crucial for further decision making process for improving working environment.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja/seminarji/vaje	Lectures/Seminars/Practicals

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Pisni izpit po uspešno opravljenem praktičnem delu.		Written exam after successful completion of practical exercise.

Reference nosilca/Lecturer's references:

1. ARH, Gregor, KLASINC, Leo, VEBER, Marjan, **POMPE, Matevž**. Calibration of mass selective detector in non-target analysis of volatile organic compounds in the air. Journal of chromatography. A, ISSN 0021-9673, 2011, vol. 1218, issue 11, str. 1538-1543.
2. BUSZEWSKI, Bogusław, LIGOR, Tomasz, FILIPIAK, Wojciech, VASCONCELOS, Maria Teresa, **POMPE, Matevž,** VEBER, Marjan. Study of sorptive properties of trap systems for selective enrichment of volatile organic compounds from tobacco smoke samples. Toxicological and environmental chemistry, ISSN 0277-2248, 2008, vol. 90, no. 1, str. 51-64.
3. **POMPE, Matevž**, DAVIS, Joe M., SAMUEL, Clint D. Prediction of thermodinamic parameters in gas chromatography from molecular structure : hydrocarbons. Journal of chemical information and computer sciences, ISSN 0095-2338, 2004, vol. 44, no. 2, str. 399-409.

INTERVENCIJE IN REŠEVANJE

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Intervencije in reševanje
Course title:	Interventions and rescue
Članica nosilka/UL Member:	UL FKKT

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Tehniška varnost, druga stopnja, magistrski	Ni členitve (študijski program)	1. letnik	2. semester	obvezni

Univerzitetna koda predmeta/University course code:	0072278
Koda učne enote na članici/UL Member course code:	TV204S

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
60		15 SV			75	5

Nosilec predmeta/Lecturer:	doc. dr. Klementina Zupan
Vrsta predmeta/Course type:	obvezni/Mandatory

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	Content (Syllabus outline):
a) Organizacija ter sestava sil za interveniranje v RS b) Vloga lokalnih, občinskih in državnih ustanov c) Načrtovanje operacij d) Vodenje operacij e) Ključni elementi ukrepanja v sili in ob katastrofalnih dogodkih f) Ravnanje z nevarnimi snovmi v primeru intervencije ob potresu, požaru, porušitvi objektov itd. - hierarhija ukrepanja - sile za reševanje g) Analiza nekaterih intervencij in ukrepov (v povezavi z MNZ in MORS) h) Načini in metode reševanja v primeru nezgodnih dogodkov	a) The organization and structure of forces for intervention in RS b) The role of local, municipal and state institutions c) Planning of operations d) Conducting operations e) Key elements of the emergency response and the catastrophic events f) Handling of hazardous substances in the event of intervention by the earthquake, fire, collapse of buildings, etc.. - Hierarchy of action - Force rescue g) An analysis of some of the interventions and actions (in conjunction with the Ministry of Interior and Ministry of Defence)

i) Dostopne poti in delovne površine za gasilska intervencijska vozila - SIST DIN 14090 - dovozne poti za gasilska intervencijska vozila - delovne intervencijske površine - izvedba dostopov in stopnišč za gasilce v objektih - izvedba dvigal za gasilce j)Organiziranost in opremljenost gasilcev (poklicni in prostovoljni) - oblike organiziranosti gasilskih enot - merila za opremljanje gasilskih enot (poklicni, prostovoljnih) k) Načrtovanje poteka gašenja v primeru požara - kdo lahko gasi - kaj je osnova za načrtovanje gašenja - kako se gasijo začetni požari l) Ocenjevanje škod v primeru večjih nezgod m) Kazenske odgovornosti in pravne podlage n) Odprava posledic	h) The methods and procedures to solve the case of an accidental event i) Access routes and work areas for fire emergency vehicles - SIST DIN 14090 - Access routes for fire emergency vehicles - Working intervention area - Implementation of access and staircases for firefighters in buildings - Implementation of elevators for firefighters j) The organization and equipment of firefighters (professional and volunteer) - Forms of organization of fire brigades - Criteria for equipping fire brigades (professional, voluntary) k) Planning firefighting takes place - Who can be quenches - What is the basis for the design fire fighting - How to extinguish fires start l) Assessment of damages in case of major accidents m) The criminal liability and legal basis n) Elimination of the effects

Temeljna literatura in viri/Readings:

Cooper D., Fundamentals of Search and Rescue, NASAR, 2005 George S. Everly, Jr., Ph.D., F.A.P.M., and Jeffrey T. Mitchell, Ph.D., Critical Incident Stress Management: A New Era and Standard of Care in Crisis Intervention Revija Ujma Revija Industrial Fire Journal

Cilji in kompetence:	**Objectives and competences:**
Cilj predmeta je spoznati in usposobiti študente z osnovnimi operacijami vodenja in nadzorovanja intervencij ter reševanj ob večjih nezgodah. Poudarek pri predmetu bo na preučevanju nekaterih praktičnih primerov ter analiziranju kriznih situacij. Študenti se bodo v povezavi z Ministrstvom za obrambo - Izobraževalnim centrom za zaščito in reševanje, srečali tudi z praktičnimi prikazi posameznih vrst reševanja.	The aim of this course is to train students to meet the basic operations management and control interventions and bailouts during major incidents. The focus of the course will be on examining some practical examples and analysing crises. Students will be in conjunction with the Ministry of Defence - Training Centre for Civil Protection and Disaster Relief, also met with demonstrations of certain types of dispute.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje Študentje naj bi pridobil osnovna teoretska in praktična znanja, ki so potrebna za pripravo, organiziranje in vodenje postopkov zaščite in reševanja. Spoznali bodo tako nujne postopke, standardne operativne postopke in metode vodenja in postopke odločanja. Uporaba Študentje bodo spoznali temeljne osnove na področju akcij zaščite in reševanja. Refleksija Teoretska in praktična znanja bo lahko študent uporabil pri reševanju praktičnih in teoretskih problemov (študij in praksa).	Knowledge and Comprehension Students should acquire basic theoretical knowledge and practical skills that are necessary for the preparation, organization and management of emergency response procedures. They will learn so emergency procedures, standard operating procedures and methods of management and decision-making processes. Application Students will learn the fundamental basics in the field of protection and rescue actions. Analysis

Prenosljive spretnosti Potrebno je predznanje predmetov: - Analize tveganja - Vodenje tveganja - Človeški in organizacijski dejavniki - Nevarne snovi - Gorenje in dinamika požarov	The student in solving practical and theoretical problems (study and practice) will use theoretical and practical knowledge. Skill-transference Ability Required is knowledge of objects: - Risk Analysis - Management of Risk - Human and organizational factors - Dangerous substances - Combustion and fire dynamics

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja	lectures
Vaje	exercises

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Seminarske vaje	20,00 %	Seminar work
Pisni izpit	80,00 %	Written exam

Reference nosilca/Lecturer's references:

- **ZUPAN, Klementina**, MARINŠEK, Marjan. Combustion-derived La [sub] (1-x)Sr [sub] xMn [sub] 0.5Cr [sub] 0.5O [sub] (3[plus minus][delta]) (x = (0.20, 0.25)) perovskite : preparation, properties, characterization = Z zgorevalno sintezo pridobljen perovskit La [spodaj] (1-x)Sr [spodaj] xMn [spodaj] 0,5Cr [spodaj] 0,5O [spodaj] (3[plus minus][delta]) (x = (0,20, 0,25)) : priprava, lastnosti, karakterizacija. Materiali in tehnologije, ISSN 1580-2949. [Tiskana izd.], no. 6, 2014, str. 885-891, ilustr. [COBISS.SI-ID 1536154563]
- **ZUPAN, Klementina**, MARINŠEK, Marjan, NOVOSEL, Barbara. Combustible precursor behaviour in the lanthanum chromite formation process = Termične lastnosti reakcijskega gela za pripravo lantanovega kromita. Materiali in tehnologije, ISSN 1580-2949. [Tiskana izd.], 2011, vol. 45, no. 5, str. 439-445. [COBISS.SI-ID 35456261]
- MARINŠEK, Marjan, **ZUPAN, Klementina**. Microstructure evaluation of sintered combustion-derived fine powder NiO-YSZ. Ceramics international, ISSN 0272-8842. [Print ed.], 2010, vol. 36, no. 3, str. 1075-1082, doi: 10.1016/j.ceramint.2009.12.014. [COBISS.SI-ID 34080773]

MAGISTRSKO DELO

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Magistrsko delo
Course title:	Master's thesis
Članica nosilka/UL Member:	UL FKKT

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Tehniška varnost, druga stopnja, magistrski	Ni členitve (študijski program)	2. letnik	1. in 2. semester	obvezni

Univerzitetna koda predmeta/University course code:	0100765
Koda učne enote na članici/UL Member course code:	TV223

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
				450	450	30

Nosilec predmeta/Lecturer:	
Vrsta predmeta/Course type:	obvezni/Mandatory
Jeziki/Languages:	Predavanja/Lectures:
	Vaje/Tutorial:

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	Content (Syllabus outline):
Magistrsko delo se opravlja iz področja tehniške varnosti. Vsebina in naslov se določata v soglasju z izbranim mentorjem. Mentor je lahko učitelj na UL FKKT [t.j. zaposleni na fakulteti na učiteljskem delovnem mestu ali zaposleni na fakulteti na delovnem mestu asistenta, ki ima učiteljski naziv (docent, izredni ali redni profesor) ali nosilec predmeta na študijskem programu 1. ali 2. stopnje UL FKKT, ki ni zaposlen na fakulteti]. Mentor je praviloma učitelj na programu, ki ga je študent vpisal.	Master thesis should be made from the field of technical safety. The subject and title are chosen in accordance with the advisor. Advisor can be professor from faculty on UL FKKT [employed by the faculty on work place as a professor or assistant, who has teaching habilitation (assistant professor, associate professor or full professor]. Adviser is as a rule teacher in a programme selected by the student.

Temeljna literatura in viri/Readings:

Knjige in članki, ki so povezani z vsebino magistrskega dela.

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

Dokončno oblikovanje pričakovanega lika magistranta. Študent bodo ob izdelavi magistrske naloge pokazal sposobnosti iskanja in zaznavanja problemov varstva pri delu, požarne varnosti ali okoljske varnosti in znal poiskati rešitev za tak problem. Pri delu bodo pokazal, da je pridobil večino kompetenc navedenih v programu študija.	Final formulation of the expected master of science knowledge. Student will show during the master thesis work capability to sensing and solving of the safety at work, fire safety and environmental safety problems. During work he will exhibit that he attained most of the competences described in the programme.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje Pri izdelavi magistrskega dela bo slušatelj pridobil: • sposobnosti formuliranja problema, • sposobnosti samostojnega iskanja ustrezne literature, • sposobnosti obravnavanja problema v praksi, • sposobnosti iskanja kvantitativnih rešitev in utemeljevanja ustreznosti rešitev, sposobnosti predstavitve rezultatov svojega dela. Uporaba Znanje in pridobljene veščine bo magistrant lahko uporabil pri opravljanju poklica in nadaljnjem raziskovalnem delu. Refleksija Povezovanje vseh pridobljenih teoretičnih znanj z reševanjem problemov na področju tehniške, požarne in okoljske varnosti ter kritični pogled na uporabnost teh znanj. Prenosljive spretnosti Pri delu bo magistrant pridobil znanja o metodah reševanja kompleksnih problemov, o načinu predstavitev teh znanj v pisani in govorjeni obliki povezani z ostalimi metodami posredovanja raziskav, ugotovitev itd	Knowledge and Comprehension During the master thesis work student will get: • Skill how to formulate the problem • Skill of independent literature search • Skill of problem assessment in praxis • Skill of finding quantitative solutions and defending the appropriate solution Skill of presenting results of the work Application Knowledge and gathered skills will master student apply while working in his profession and further research work. Analysis Linking of the theoretical knowledge with problem solving in the field of technical safety, fire safety and environmental safety and critical view on applicability of the knowledge. Skill-transference Ability During work master student will acquire knowledge on methods for complex problem solving, on ways to present this knowledge in written and spoken words in connection with other methods for presenting research, conclusions etc.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Individualno raziskovalno delo študenta pod mentorstvom.	Independent research work supervised by mentor

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Ocenjuje se magistrsko delo (50 %) in zagovor magistrskega dela (50 %) Komisijo sestavljajo predsednik, mentor in član. Lestvica ocen vsakega dela je od 1 do 10. Ocene 1 do 5 so negativne, ocene 6 do 10 pa pozitivne in sicer: 6-¬-zadostno, 7-¬-dobro, 8 in 9-¬-prav dobro, 10-¬-odlično		Master's thesis and its presentation are graded separately by a three-member commission (chairman, mentor, additional member).

Reference nosilca/Lecturer's references:

MANAGEMENT IN EKONOMIKA PROJEKTOV

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Management in ekonomika projektov
Course title:	Management and process economics
Članica nosilka/UL Member:	UL FKKT

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Kemijsko inženirstvo, druga stopnja, magistrski	Ni členitve (študijski program)	2. letnik	1. semester	obvezni
Tehniška varnost, druga stopnja, magistrski	Ni členitve (študijski program)	2. letnik	1. semester	obvezni

Univerzitetna koda predmeta/University course code:	0072258
Koda učne enote na članici/UL Member course code:	IN222S

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
30	15	30 SV			75	5

Nosilec predmeta/Lecturer:	izr. prof. dr. Darija Aleksič, izr. prof. dr. Mojca Marc
Vrsta predmeta/Course type:	obvezni/Mandatory
Jeziki/Languages:	Predavanja/Lectures: Slovenščina Vaje/Tutorial: Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	Content (Syllabus outline):
Študenti bodo v okviru predmeta spoznali: • management projektov kot vodilo uspešne izvedbe delovnih procesov • projektni management in njegove posebnosti • pomen planiranja ter analiziranja v projektnem managementu • vodenje tima in posameznikov • projektno in razvojno delovanje skupin • zasnova ter organiziranje projektnih skupin • kadrovska sestava projektnih timov • delo v projektnih timih • vloga managerja projekta • kako sestaviti poslovni načrt in elaborat/plan projekta	Students in this course will learn: • project management as a guide of the successful execution of business processes • project management and its characteristics • the importance of planning and analysis in project management • how to lead team and individuals • project and development operation of groups • conception and organization of project teams • staffing of the project teams • work in project teams • the role of the project manager • how to prepare the project business case and the project plan

• kako projektno nalogo predstaviti ter verificirati, jo razstaviti v posamezne faze ter za njihovo realizacijo izbrati ustrezne izvajalce • sistemi projektnih ključev • delitev nalog in nagrajevanje pri projektnem načinu dela • finančna shema managementa projektov • doseganje končnega cilja projekta, vizija, nevarnosti • projektno načrtovanje, vsebina in način izdelave poslovnega načrta • kazalniki za vrednotenje uspešnosti projektov	• how to present a project task, how to verified it, structured it into phases, and select appropriate providers for tasks realization • a systems of project keys • the division of tasks and rewarding work in project • a financial scheme of project management • the achieving of the final project objective, the vision, and the risks • project planning, content and the way of a business plan preparation • indicators for evaluating the success of projects

Temeljna literatura in viri/Readings:

Temeljna literatura:

- Marc, Ponikvar in Tekavčič. (2020). Ekonomika projektov. Univerza v Ljubljani, Ekonomska fakulteta. (100%)
- Drnovšek, M. in Stritar, R.: Priročnik za pisanje poslovnega načrta. Ekonomska fakulteta, Ljubljana, 2007, 137 str. (100%)
- Stare, A.: Projektni management: teorija in praksa. Agencija Poti, Ljubljana, 2011, 340 str. (90%)

Dopolnilna literatura:

- Brigham E.F., Gapenski, L. C.: Financial management: Theory and Practice. The Dryden Press, New York, 1991, 995 str. (poglavje 9)
- Kerzner, H. Project management: a systems approach to planning, scheduling, and controlling. John Wiley & Sons, New York, 2009, 1094 str.
- Kosi, U., Marc, M. in Peljhan, D.: Uvod v poslovanje. Ekonomska fakulteta, Ljubljana, 2007, 95 str.
- Levy H., Sarnat M.: Capital Investment and Financial Decisions. Prentice Hall International, New York, 1994, 782 str. (poglavja od 1 do 6)
- PMBOK - A guide to the project management body of knowledge. Project management institute, Newtown Square, 2008, 467 str.
- Wysocki, R.K. Effective project management: traditional, agile, extreme. Wiley Publishing, Indianapolis, 2009, 734 str.

Cilji in kompetence:	**Objectives and competences:**
Cilj predmeta je študentom razvijati zavest o pomenu projektnega managementa v gospodarskih družbah, razvijati zmožnosti za timsko delo v podjetjih, razvijati sposobnosti za presojo poslovnih priložnosti, naučiti obvladovati metode in tehnike projektnega managementa ter pridobiti zmožnosti za samostojno vodenje. Študentje si pri predmetu pridobijo naslednje specifične kompetence: • vključevanje v poslovni proces • sistematičnost pristopa k načrtovanju poslovanja v podjetju • uporaba orodij za presojo uspešnosti projektnega managementa • sistematični pristop k ustvarjanju, pridobivanju in prenosu znanja v prakso • usposobljenost za samostojno izdelavo projektov, njihovo vrednotenje, presojo uspešnosti uvajanja v prakso • usposobljenost za management projektov	The objective of the course is to develop an awareness of the importance of project management in companies, to develop the capacity for teamwork in companies, to develop capacity to assess business opportunities, to learn to use the project management methods and techniques, and obtain the capacity for independently management. Students will gain the following specific competences: • the integration into the business process • a systematic approach to business planning in the company • the usage of tools to assess the effectiveness of project management • a systematic approach for the creation, acquisition and transfer of the knowledge into the practice • the ability to independently create projects, evaluate them, and assess of the successful introduction into practice • ability to manage projects

Predvideni študijski rezultati:	Intended learning outcomes:
Znanje in razumevanje Študentje bodo spoznali in razumeli: - pojme s področja ekonomija, podjetništvo, projektni management in organiziranje dela, v projektnih skupinah, vodenje projektnih timov, - osnovne zakonitosti projektnega managementa ter organizacije dela v gospodarskih družbah, s poudarkom na primerih iz prakse kakor tudi iz študentovih življenjskih potreb ter izkušenj Uporaba Predmet je usmerjen v razumevanje in prepoznavanje značilnosti projektnih podvigov v različnih fazah rasti, analizi podatkov in informacij za management projektov, izdelavi poslovnega načrta za presojo izbrane poslovne ideje, v načrtovanje organizacije enostavnejših in manj zahtevnih projektov, določitev matrike odgovornosti, načrtovanju časa, virov sredstev, dela , stroškov, ozkih grl, analizi in učinkovitosti projektov. Refleksija Študentje bodo interpretirali ter pred kolegi analizirali lastno razumevanje projektnega dela, izbranih zahtevni ter manj zahtevnih projektov s področja kemijske stroke. Pri tem bodo uporabili pridobljena teoretična znanja ter jih vrednotili s predstavljenimi praktičnimi problemi oziroma izkušnjami. Prenosljive spretnosti Pri predmetu bo študent pridobil sposobnosti razumevanja projektnega dela, dela v skupinah, pomena projektnega managementa za uspešen management poslovnega procesa v gospodarskih družbah ter v zavodih, za razumevanje strokovne literature. Pridobljene spretnosti bodo študentje znali uporabljati pri organizaciji timskega dela .	Knowledge and Comprehension Students will learn and understand: • terms from economics, entrepreneurship, project management and work organization, project teams, basic principles of project management and work organization in companies with emphasis on case studies and the student needs and experiences Application The course is focused on understanding and identifying the characteristics of projects in various stages of growth, data analysis and information for project management, preparing the business plan for the assessment of selected business ideas, in the organization planning of simpler and less complex projects, the determination of the responsibility matrix, the planning of time, resources, work, costs, bottlenecks, the analyses and the efficiency of projects. Analysis Students will interpret colleagues their own understanding of project work, selected demanding and less demanding projects in the field of chemistry. In this they will use the acquired knowledge and will evaluate them with the presented practical problems or experiences. Skill-transference Ability Student will acquire skills for understanding of project work, work in teams, the importance of project management for the successful management of the business process in companies and institutions, for understanding the scientific literature. Students will be able to use the acquired skills for the organization of teamwork.

Metode poučevanja in učenja:	Learning and teaching methods:
Predavanja s pomočjo različnih AV sredstev. Študentom podamo uvod v obravnavano snov, jih napotimo na obravnavo uspešno rešenih projektov v praksi, tudi s pomočjo strokovnjakov iz prakse. Izdelava poslovnega načrta za primer iz kemijske stroke, skupinska obravnava dobljenih rezultatov.	Lectures with AV. We give students an introduction of the topic, assign them to deal the successfully solved projects from practice, also with the help of practitioners. Creating a business plan for the chemistry case, group discussion of the obtained results.

Načini ocenjevanja:	Delež/Weight	Assessment:
Pisni izpit	70,00 %	Written exam
Projektna naloga	30,00 %	Project work

Reference nosilca/Lecturer's references:

JAVORNIK, Samo, TEKAVČIČ, Metka, **MARC, Mojca**. The efficiency of intellectual capital investments as a potential leading indicator. International business & economics research journal.
TEKAVČIČ, Metka, ŠOBOTA, Aleksandra, PELJHAN, Darja, **MARC, Mojca**, PONIKVAR, Nina. Spremljanje uspešnosti poslovanja v velikih slovenskih podjetjih. IB revija.

MARC, Mojca, PELJHAN, Darja, PONIKVAR, Nina, ŠOBOTA, Aleksandra, TEKAVČIČ, Metka. Performance measurement in large Slovenian companies: an assessment of progress. International journal of management & information systems.

ALEKSIĆ, Darija, MIHELIČ, Katarina Katja, ČERNE, Matej, ŠKERLAVAJ, Miha. Interactive effects of perceived time pressure, work-family balance satisfaction (SWFB), and leader-member exchange (LMX) on creativity. Personnel review, ISSN 0048-3486, 2017, vol.46, iss. 3, str. 667-679.

ALEKSIĆ, Darija, ČERNE, Matej, DYSVIK, Anders, ŠKERLAVAJ, Miha. I want to be creative, but ... : preference for creativity, perceived clear outcome goals, work enjoyment, and creative performance. European journal of work and organizational psychology, ISSN 1359-432X, 2016, vol. 25, iss. 3, str. 363-383.

ALEKSIĆ, Darija, ŠKERLAVAJ, Miha, DYSVIK, Anders. The flow of creativity for idea implementation. V: ŠKERLAVAJ, Miha (ur.), et al. Capitalizing on creativity at work : fostering the implementation of creative ideas in organizations. Cheltenham; Northampton: Edward Elgar. 2016, str. 29-38.

ALEKSIĆ, Darija, BOGILOVIĆ, Sabina, ČERNE, Matej. Mikro temelji inovativnosti : položaj Slovenije v primerjavi s sedmimi državami v Jadranski regiji = Micro-foundations of innovation : the position of Slovenia compared with seven countries in the Adriatic region. V: DOUCEK, Petr (ur.), NOVAK, Aleš (ur.), PAAPE, Björn (ur.). Internacionalizacija in sodelovanje : zbornik 34. mednarodne konference o razvoju organizacijskih znanosti = Internationalization and cooperation : proceedings of the 34th International Conference on Organizational Science Development, 34. Mednarodna konferenca o razvoju organizacijskih znanosti, Portorož, 25.-27. marec 2015. Kranj: Moderna organizacija, 2015, str. 13-24.

ALEKSIĆ, Darija, ČERNE, Matej, ŠKERLAVAJ, Miha. Hi-tech innovation through circuits of knowledge. V: SITAR, Aleša Saša (ur.), et al. Knowledge management and organizational learning : conference papers, 3rd International Conference on Management and Organisation, Brdo pri Kranju, 12-13 June 2014. Ljubljana: The Slovenian Academy of Management, 2014, str. 170-187.

NUMERIČNE METODE V VARNOSTI II

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Numerične metode v varnosti II
Course title:	NUMERICAL METHODS IN SAFETY II
Članica nosilka/UL Member:	UL FKKT

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Tehniška varnost, druga stopnja, magistrski	Ni členitve (študijski program)	1. letnik	1. semester	obvezni

Univerzitetna koda predmeta/University course code:	0072279
Koda učne enote na članici/UL Member course code:	TV201S

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
45		30 LV			75	5

Nosilec predmeta/Lecturer:	prof. dr. Jurij Reščič
Vrsta predmeta/Course type:	obvezni/Mandatory
Jeziki/Languages:	Predavanja/Lectures: Slovenščina Vaje/Tutorial: Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	Content (Syllabus outline):
Numerične metode v raziskovalnem delu: • Reševanje navadnih diferencialnih enačb z aplikacijami v varnosti in požarni varnosti (Eulerjeva metoda, Metoda Runge-Kutta • Fourierova vrsta • Transportna enačba (metoda končnih diferenc), reševanje problema prenosa toplote pri požarih • Metode s slučajnim izborom podatkov. Monte Carlo metode. Statistične metode v raziskovalnem delu: • Regresija • Tehnike za enostransko analizo variance (ANOVA) • ANOVA za modele in različne zasnove • Analiza kovariance • Multipla regresija in korelacije	Numerical methods in research work: • Solving ordinary differential equations with applications in safety and fire safety (Euler's method, Runge-Kutta method) • Fourier series • The transport equation (finite difference method), solving the problem of heat transfer in fires • Methods for a randomized data. Monte Carlo methods. Statistical methods in research work: • Regression • Techniques for one-sided analysis of variance (ANOVA) • ANOVA models for various design • Analysis of covariance

Strukturni modeli enačb	• Multiple regression and correlation Structural Equation Models

Temeljna literatura in viri/Readings:

Glavna literatura:
- S. Dowdy, S. Wearden, D. Chilko: Statistics for Research, Third edition, Wiley, New Yersey, 2004, str. 211-511
- K. Atkinson, W. Han: Elementary Numerical Analysis, Third edition, Wiley, New York, 2004 str. 368-491

Dopolnilna literatura:
- P. I. Good, J. W. Hardin, Common Errors in Statistics, Wiley, 2003, str. 127-217
- K. W. Morton, D. F. Mayers, Numerical Solution of Partial Differential Equations, Cambridge UP, 2005, 273 str.
- Dopolnilna literatura: REŠČIČ, Jurij, URBIČ, Tomaž. Numerične metode – praktikum. 1. izd. Ljubljana: Fakulteta za kemijo in kemijsko tehnologijo, 2015.

Cilji in kompetence:	**Objectives and competences:**
Študentje bodo spoznali matematične in statistične metode, ki jih je mogoče uporabiti pri strokovnem in raziskovalnem delu na področju varnosti in pridobivali sposobnosti za uporabo teh metod.	Students will learn mathematical and statistical methods that can be used in professional and research work in the field of safety and acquire the ability to use these methods.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje Študentje naj bi pridobili specialna znanja iz področja numeričnih metod in statistike, ki so potrebna za razvoj in reševanje modelov iz področja varnosti. Uporaba Metode, ki jih bodo študentje spoznali , so orodja za raziskave in preverjanje realnih situacij v varnostni in tehniški praksi. Refleksija Vsebine navajajo študenta k razmišljanju o pomenu računanja o nedosegljivosti eksaktnih rezultatov in o natančnosti rešitev v tehniki. Prenosljive spretnosti Logično razmišljanje in logično povezovanje informacij iz prakse s teoretičnimi modeli in prenos teoretičnih rešitev v prakso.	Knowledge and Comprehension Students should gain special knowledge in the field of numerical methods and statistics that are needed to develop and solve models in the field of safety. Application The methods used by the students will learn the tools for research and verification of real situations in the safety and technical practice. Analysis Contents indicate the student to think about the importance of calculating the unavailability of exact results and the accuracy of the solution in engineering. Skill-transference Ability Logical thinking and logical linking of information from practice with theoretical models and theoretical transfer the solution into practice.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanje Seminar	Lectures Seminar

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Pisni izpit.		Written exam

Reference nosilca/Lecturer's references:

1. Soavtor računalniškega programa MOLSIM za simulacijo molekularnih sistemov (avtor je prof. Per Linse, Univerza v Lundu, Švedska)
2. **REŠČIČ, Jurij**, VLACHY, Vojko, HAYMET, A. D. J. Highly asymmetric electrolytes: beyond the hypernetted chain integral equation. Journal of the American Chemical Society, ISSN 0002-7863, 1990, vol. 112, no. 9, str. 3398-3401. [COBISS.SI-ID 23495173]

3. **REŠČIČ, Jurij**, LINSE, Per. Potential of mean force between charged colloids : effect of dielectric discontinuities. The Journal of chemical physics, ISSN 0021-9606, 2008, vol. 129, no. 11, art. no. 114505 (9 str.), graf. prikazi. [COBISS.SI-ID 29795333]

OKOLJSKA TVEGANJA

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Okoljska tveganja
Course title:	Environmental Risks
Članica nosilka/UL Member:	UL FKKT

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Tehniška varnost, druga stopnja, magistrski	Ni členitve (študijski program)	2. letnik	1. semester	obvezni

Univerzitetna koda predmeta/University course code:	0072291
Koda učne enote na članici/UL Member course code:	TV2A3

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
45	15	15 SV			75	5

Nosilec predmeta/Lecturer:	prof. dr. Andreja Žgajnar Gotvajn
Vrsta predmeta/Course type:	obvezni/Mandatory
Jeziki/Languages:	Predavanja/Lectures: Slovenščina Vaje/Tutorial: Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	Content (Syllabus outline):
Evropska in slovenska zakonodaja na področju voda, zraka, tal, odpadkov. Zakonodaja na področju okolju prijaznih tehnologij, okoljski ISO standardi, IPPC smernica. Seveso smernice. Veliki industrijski sistemi. Okoljska tveganja ter metodologije za identifikacijo in vrednotenje okoljskih tveganj. Ocenjevanje življenjskih ciklov procesov, okoljska tveganja povezana z zelenimi tehnologijami. Okoljske nezgode in njihove posledice ter možnosti sanacij. Lokalni, regionalni in globalni problemi stanja okolja. Scenariji in primeri okoljskih nezgod. Tveganje posameznika in skupinsko tveganje, obvladovanje tveganj. Obstoječa računalniška orodja in njihova uporaba. Izdelava varnostnih poročil, interpretacija rezultatov varnostnih analiz, upravljanje z okoljskimi tveganji.	European and Slovene legislation for water, air, soil pollution and solid wastes. Legislation in the field of environmental friendly technologies, environmental ISO standards, IPPC Directive, Seveso directives. Large industrial systems. Environmental risks and methodologies for identification of environmental risks. Assessment of environmetal risk of green technologies. Environmental accidents, their consequences and mitigation possibilities. Local, regional and global environmental problems. Scenarios of environmental accidents, case studies of environmental accidents. Assessing risk of individuals and group. Computer tools and their application. Safety reports, interpretation of the results of safety analyses, management of environmental risks.

Temeljna literatura in viri/Readings:

Lerche, I; Glaesser, W.: Environmental Risk Assessment: Quantitative measures, anthropogenic influences, human impact, Springer, 2006, 341 str. (40%) AIChE: Guidelines for Tecnical Management of Chemical Process Safety, New York 1989 (10%). Sutton, I: Process Reliability and Risk Mangement, Van Nostrand New York, 1992 (10%).

Cilji in kompetence:	**Objectives and competences:**
Študentje naj bi spoznali, kako zbrati informacije o okoljskih tveganjih ter kako te informacije lahko koristijo pri načrtovanju preventivnih ukrepov za zagotavljanje varnosti v okolju in kako lahko s pomočjo vedenja o okoljskih tveganjih lahko načrtujemo svoje dejavnosti, da bodo varne in tudi prijazne do okolja ter da bodo ob morebitnih okoljskih nezgodah posledice čim manjše.	Students should learn how to gather information on environmental risks and how this information can be useful in planning preventive measures to ensure the safety of the environment and how you can use knowledge about environmental risks can plan their activities to a safe and friendly environment and to will be minimized the potential environmental consequences of accidents.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje Študentje naj bi pridobil osnovna teoretska in praktična znanja, ki so potrebna za razumevanje okoljskih problemov in tveganj, ki so z njimi povezana. Razumel bo kako so posamezni elementi tveganj vpeti v odločitveni proces glede tehnoloških pristopov k okoljskim tveganjem. Uporaba Znal bo uporabljati tako zakonodajo kot tudi teoretične in praktične pristope k reševanju problemov okoljskih tveganj in se na njihovi osnovi odločati o obrambnih in blažilnih mehanizmih, ki se jih za konkreten primer uporabi. Refleksija Teoretska in praktična znanja bo lahko študent uporabil pri reševanju praktičnih in teoretskih problemov. Spoznanja o zmogljivostih in omejitvah metod za oceno okoljskih tveganja ter kritično uporabo numeričnih modelov za oceno okoljskih posledic za dobro odločanje. Prenosljive spretnosti Študent bo pridobil analitične spretnosti in logično razmišljanje kot tudi spretnosti za učinkovito identifikacijo nezgodnih	Knowledge and Comprehension Students should acquire basic theoretical and practical knowledge necessary for understanding environmental problems and risks that are associated with them. They will understand how the individual elements of risk embedded in the decision-making process with respect to technological approaches to environmental risks. Application He will be able to use both the law as well as theoretical and practical approaches to solving the problems of environmental risks and to decide based on their defense and mitigation mechanisms, which are for the specific application. Analysis The student in solving practical and theoretical problems will use theoretical and practical knowledge. Knowledge of the capabilities and limitations of methods to assess environmental risks and critical use of numerical models to assess the environmental consequences of good decision-making. Skill-transference Ability Students will gain analytical skills and logical thinking as well as skills for effective identification of accident scenarios.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja Seminarske vaje Seminarska naloga s področja okoljskih tveganj	Lectures Tutorials Coursework in the field of environmental risks

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Pisni izpit	70,00 %	Written exam
Seminarska naloga	30,00 %	Coursework

Reference nosilca/Lecturer's references:

KORICA, Predrag, POŽGAJ, Đurđica, CIRMAN, Andreja, ŽGAJNAR GOTVAJN, Andreja. Decomposition analyses of the municipal waste generation and management in Croatian and

Slovenian regions. *Journal of material cycles and waste management : official journal of the Japan Society of Waste Management Experts*. Jan. 2018, vol. 20, iss. 1, str. 254-265.
RAČIČ KOZMUS, Aleksandra, ŽGAJNAR GOTVAJN, Andreja, LOBNIK, Aleksandra, NOVAK, Nina, KLASINC, Aljaž, ZUPANČIČ, Gregor Drago. Anaerobic treatment to improve sludge recovery at a deinked fiber pulp and paper mill. *Tappi journal*. **Feb. 2016, vol. 15, no. 2, str. 127-137, ilustr.**
MARQUES, Susana, MESTRE, Ana S., MACHUQUEIRO, Miguel, ŽGAJNAR GOTVAJN, Andreja, MARINŠEK, Marjan, CARVALHO, Ana Paula. Apple tree branches derived activated carbons for the removal of ß-blocker atenolol. *Chemical engineering journal*. **Aug. 2018, vol. 345, str. 669-678, ilustr.**

POŽARNA VARNOST

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Požarna varnost
Course title:	Fire Safety
Članica nosilka/UL Member:	UL FKKT

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Tehniška varnost, druga stopnja, magistrski	Ni členitve (študijski program)	2. letnik	1. semester	obvezni

Univerzitetna koda predmeta/University course code:	0072292
Koda učne enote na članici/UL Member course code:	TV2A2

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
45		30 LV			75	5

Nosilec predmeta/Lecturer:	prof. dr. Simon Schnabl
Vrsta predmeta/Course type:	obvezni/Mandatory
Jeziki/Languages:	Predavanja/Lectures: Slovenščina Vaje/Tutorial: Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	Content (Syllabus outline):
Aktivna in pasivna požarna zaščita Ukrepi za preprečevanje širjenja požara po objektu Obnašanje materialov in konstrukcij ob požaru Izbor požarnih scenarijev, napoved razvoja požara po fazah. Izbor in izračun projektnih požarov Ocena požarne nevarnosti Izdelava koncepta požarne varnosti Način projektiranja požarne varnosti s klasičnimi in alternativnimi predpisi Postopek projektiranja požarne varnosti s požarnovarnostnim inženirstvom Analiza rezultatov izračunov projektnih požarov Metode požarnovarnostnega inženirstva Uporaba računalniških programov v požarnem projektiranju.	Active and passive fire protection Measures to prevent the spread of fire by the building Behaviour of materials and structures during fire Selection of fire scenarios, forecast the development of a fire in stages. Selection and calculation of design fires Assessment of the fire hazard A concept of fire safety Method of fire safety design with traditional and alternative regulations The process of designing fire safety with fire safety engineering Analysis of the results of calculations of project fires Methods of fire protection engineering The use of computer programs in fire design.

Vsebina vaj: Račun požarne obtežba Račun razvoja požara v prostoru, uporaba enoconskih in dvoconskih modelov (računalniški program) Simulacije evakuacije Izdelava koncepta požarne varnosti za enostaven objekt, izbira ustrezne pasivne in aktivne zaščite	Tutorial: Calculation of design fire load Development of fire in fire compartment with help of one and two zone models (software) Simulations of evacuations Development of fire assessment for simple building, choose the appropriate passive an active fire measures

Temeljna literatura in viri/Readings:

- An Introduction to Fire Dynamics, D. Drysdale, Wiley, 2. izdaja (1998)
- Enclosure Fire Dynamics, B. Karlsson, J. Quintere, 2002
- The SFPE Handbook - Fire Protection Engineering, 2nd Edition, Boston, Massachusetts, 1995;

Dodatna literatura:

- Fire Engineering Design Guide, Centre for Advanced Engineering, University of Canterbury, New Zealand, 1994;
- Custer, L.P., Meacham, B.J. Introduction to Performance – Based Fire Safety, NFPA, 1997
- Alpert, R. L., »Calculation of Response Time of Ceiling-Mounted Fire Detectors,« Fire Technology, Vol 8:(3), National Fire Protection Association, Quincy, MA, pp. 181-195 (1972).
- Principles of Fire Protection Chemistry and Physics, R. Friedman, NFPA, 3. izdaja (1998)
- DD 240: Part 1: 1997; BSI, Fire Safety Engineering in Buildings, Part 1. Guide to the application of fire safety engineering principles;
- Draft British Standard Code of Practice for the Application of Fire Safety Engineering Principles to Fire Safety in Buildings, Working Draft 1993;
- Evans, D. D. and Stroup, D. W., »Methods to Calculate the Response of Heat and Smoke Detectors Installed Below Large Unobstructed Ceilings,« Natl. Bur. Stand. (U.S.), NBSIR 85- 3167 (1985).
- Tehnična smernica TSG - 1 - 001: 2010. Požarna varnost v stavbah. Ministrstvo za okolje in prostor: 60 str Smernice SZPV

Cilji in kompetence:	**Objectives and competences:**
Pri predmetu bodo študenti spoznali več načinov načrtovanja požarne varnosti v objektu, postopke za izdelavo ocene požarne varnosti ter metode za ovrednotenje ustreznega koncepta požarne varnosti. Predmet je zastavljen tako, da sledi sodobnim trendom razvoja požarnega inženiringa in tako ponuja študentom spoznavanje in delo z nekaterimi uveljavljenimi požarnimi računalniškimi modeli ter postopki za napovedi razvoja požara v prostoru nastanka požara.	In this course students will learn several ways to design fire safety in the facility, procedures for assessment of fire safety and the proper methods to evaluate the concept of fire safety. The course is designed in a way that follows the modern trends in the development of fire engineering and also offers students learn about and work with some of the established fire computer models and procedures for the prediction of fire in the room of origin.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje Študentje naj bi pridobil osnovna teoretska in praktična znanja, ki so potrebna za razumevanje različnih postopkov, ki jih inženir, ki se ukvarja s požarno varnostjo nujno potrebuje pri vsakodnevnih odločitvah. Uporaba Študentje bodo spoznali tako osnovna znanja na področju teorije gorenja in gašenja, metode za oceno požarnih nevarnosti ter izdelavo koncepta požarne varnosti in temeljne inženirske metode (matematične modele, enostavne računske metode in računalniške	Knowledge and Comprehension Students should acquire basic theoretical knowledge and practical skills that are needed to understand the various processes by an engineer who deals with fire safety indispensable for daily decisions. Application Students will also learn basic skills in the theory of burning and extinguishing methods for assessing fire hazards and making the concept of fire safety and basic engineering methods (mathematical models, numerical methods and computer models) by an engineer in his work requires planning for fire safety the facility.

modele), ki jih inženir pri svojem delu potrebuje za načrtovanje požarne varnosti v objektu. Refleksija Teoretska in praktična znanja bo lahko študent uporabil pri reševanju praktičnih in teoretskih problemov (študij in praksa). Spoznanja o zmogljivostih in omejitvah posameznih metod v praksi pomenijo osnovo za mnoge pomembne odločitve. Prenosljive spretnosti Pri predmetu bo študent pridobil kompleksna znanja, uporabna pri zahtevnih	Analysis Theoretical and practical knowledge will be used by the student in solving practical and theoretical problems (study and practice). Knowledge of the capabilities and limitations of each method in practice is the basis for many important decisions. Skill-transference Ability In this course the student will acquire complex knowledge useful with difficult decisions in the field of fire safety.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja Seminar Vaje	Lectures Seminar Tutorial

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Pisni izpit	50,00 %	written exam
Seminarska naloga	50,00 %	coursework

Reference nosilca/Lecturer's references:

- **SCHNABL, Simon**, PLANINC, Igor, TURK, Goran, SRPČIČ, Stane. Fire analysis of timber composite beams with interlayer slip. Fire safety journal, ISSN 0379-7112. [Print ed.], 2009, letn. 44, št. 5, str. 770-778, ilustr., doi: 10.1016/j.firesaf.2009.03.007. [COBISS.SI-ID 4598369]
- **SCHNABL, Simon**, SAJE, Miran, TURK, Goran, PLANINC, Igor. Fire analysis of wooden composite beams with interlayer slip. V: ATTARD, Thomas (ur.). Applied Mechanics in the Americas. Vol. 12 : Proceedings of the Tenth Pan American Congress of Applied Mechanics : PACAM X, Grand Oasis Resort, Cancun, Mexico, 7.-11. January 2008. Fresno: California State University, 2008, str. 41-44, ilustr. [COBISS.SI-ID 3866977]
- **SCHNABL, Simon**, PLANINC, Igor, TURK, Goran. Thermomechanical fire analysis of timber composite beams with interlayer slip. V: WCTE 2008 : conference proceedings. Miyazaki, Japan: s.n., 2008, str. 1-8, graf. prikazi. [COBISS.SI-ID 4205665]

POŽARNI PRAKTIKUM

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Požarni praktikum
Course title:	Fire's practicum
Članica nosilka/UL Member:	UL FKKT

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Tehniška varnost, druga stopnja, magistrski (od študijskega leta 2023/2024 dalje)	Ni členitve (študijski program)	1. letnik, 2. letnik		izbirni

Univerzitetna koda predmeta/University course code:	0072280
Koda učne enote na članici/UL Member course code:	TV2B4

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
		75			75	5

Nosilec predmeta/Lecturer:	izr. prof. dr. Janez Cerkovnik, prof. dr. Simon Schnabl
Vrsta predmeta/Course type:	izbirni strokovni/Elective Professional
Jeziki/Languages:	Predavanja/Lectures:
	Vaje/Tutorial: Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	Content (Syllabus outline):
1. Varnost v požarnem laboratoriju - pregled opreme - varnostna navodila 2. Vrste požarnih preskusov - preskusi v majhnem merilu i. potrebna oprema ter metode za izvajanje preskusov ii. standardi iii. pregled stanja v svetu - preskusi v naravnem merilu i. potrebna oprema ter metode za izvajanje preskusov ii. standardi iii. pregled stanja v svetu 3. Požarni preskusi v majhnem merilu –	1. Safety in fire testing laboratory - equipment - safety instructions 2. Types of fire tests - small-scale tests i. testing equipment and methods ii. standards iii. global picture - full-scale tests i. testing equipment and methods ii. standards iii. global picture 3. Small-scale fire tests–calorimeter i. plastic materials ii. wood

Kalotimeter i. plastični materiali ii. les iii. kompozitni materiali - čas, potreben za vžig materiala ob pilotnem plamenu ali iskri - analiziranje toplotnega toka - princip porabe kisika - izvajanje meritev ob vertikalnem vzorcu - obdelava podatkov - statistično vrednotenje podatkov - zanesljivost meritev 4. Požarni preskusi v naravnem merilu - analiziranje podatkov - primerjava izsledkov preskusa z preskusom v majhnem merilu 5. Preučevanje obnašanja materialov pri požaru z metodami termične analize - določevanje učinkovitosti požarno-zaščitnih intumescentnih premazov - termična stabilnost nekaterih toplotno-izolacijskih materialov (kamena volna, steklena volna, stiropor) - kvalitativno določevanje plinskih zvrsti, ki nastanejo pri požaru stiropora in poliuretana	iii. composites - time to ignition with pilot flame or spark - heat flux analysis - principle of oxygen consumption - implementing measurements with vertical sample - data processing - statististical analysis of data - reliability of measurements 4. Real-scale fire tests - data analysis - comparison of test results with small-scale tests 5. Studying materials behaviour on fire using methods of thermal analysis - efficiency determination of fire-protective intumescent coatings, - thermal stability of some thermal-insulating materials (glass wool stone wool, polystyrene) - qualitative determination of gases species, formed during combustion of polystyrene and polyurethane

Temeljna literatura in viri/Readings:

- ASTM E 1354-99; Standard Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter, ASTM, West Conshohocken, PA, 1999
- ISO 5660-1:1993; Fire tests – Reaction to fire – Part 1: Rate of heat release from building products (Cone calorimeter method); ISO; Geneve, Switzerland, 1993
- Hilado C.J., Flammability Handbook for Plastics – Fourth Edition, Technomic Publishing Company, Lancaster PA, 1990
- D. Hopkins Jr.; J.G. Quintiere; Material Fire Properties and Predictions for Thermoplastics; Fire Safety Journal 26 p.241-268, Elsevier Science Limited, 1996
- Mulholland W.G., Croarkin C., Specific Extinction Coefficient of Flame Generated Smoke, Fire and Materials, 24,227-230, John Wiley and Sons, Ltd. 2000
- Rhodes, B.T., Burning Rate and Flame Heat Flux for PMMA in the Cone Calorimeter, Thesis, U.S. Department of Commerce, 1994
- The SFPE Handbook of Fire Protection Engineering, 2nd edition, SFPE, 1995
- Taylor, J.R., An Introduction to Error Analysis – The Study of Uncertainties in Physical Measurements, University Science Books, Sausalito, CA (1982) Chapter 3
- Patrick A. Enright and Charles M. Fleischmann, Uncertainty of Heat Release Rate Calculation of the ISO 5660-1 Cone Calorimeter Standard Test Method,1999

Cilji in kompetence:	**Objectives and competences:**
Predmet je namenjen poglabljanju znanj o dinamiki požara ter teoriji gorenja. V sklopu predmeta je zajeto delo v laboratoriju, izvedba analiz posameznih materialov ter njihovega obnašanja med gorenjem. Študenti spoznajo praktične metode izvajanja meritev na področju požarnega inženiringa ter se srečajo predvsem z stožčastim kalorimetrom.	The course is intended for deepening knowledge about fire dynamics and combustion theory. Students work in laboratories, carry out analyses of different materials and study their behaviour during burning and learn different practical measurement methods related to fire engineering, and learn how to use cone calorimeter.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje	**Knowledge and Comprehension**

Študentje naj bi razširil osnovna teoretska in praktična znanja. Prav tako bodo sposobni kritično presoditi zmogljivosti nekaterih standardnih metod, jih ovrednotiti in interpretirati. **Uporaba** Požarni praktikum je usmerjen v reševanje praktičnih problemov, ki so nujni tako pri snovanju novih učinkovin, kot tudi pri njihovi uporabi. Pri predmetu naj bi študentje pridobili znanja, ki jim omogočajo izvedbo temeljnih požarnih preizkusov. Poleg fizikalno- kemijskih osnov, ki so osnova razumevanje teorije gorenja pri požarnem preizkusu bodo študenti pridobili tudi praktična znanja, ki so potrebna pri zasnovi in izvedbi meritev ter interpretaciji podatkov in dobljenih rezultatov. Pomemben vidik predmeta je predstaviti študentu kritičen pogled na podajanje rezultatov in zmogljivosti različnih preizkusnih postopkov. **Refleksija** Teoretska in praktična znanja bo lahko študent uporabil pri reševanju praktičnih in teoretskih problemov (študij in praksa). Spoznanja o zmogljivostih in omejitvah posameznih metod v praksi pomenijo osnovo za mnoge obdelati ter primerno interpretirati. **Prenosljive spretnosti** Pri predmetu bo študent pridobil laboratorijske spretnosti, znal bo uporabljati podatke, izvajati nekatere fizikalne meritve, eksperimentalne podatke bo znal ustrezno obdelati ter primerno interpretirati.	Students should upgrade basic theoretical and practical knowledge. They will also be able to critically estimate the performance of some standard methods, evaluate and interpret them. **Application** Fire practicum is focused on solving practical problems, important in design of new materials as well as in their use. In this course students should acquire skills that enable them to perform basic fire tests. In addition to the physico-chemical properties, which are base for understanding fire theory during fire-test performance, students will also gain practical skills. The letter is needed for setting-up and performing measurement, for data evaluation and interpretation of the results. An important aspect is to present a critical view on the interpretation of results and performance of different testing procedures. **Analysis** Theoretical and practical skills can be used to solve practical and theoretical problems (study and practice). Awareness about capabilities and limits of individual methods in practice is the basis for many important decisions. **Skill-transference Ability** In this course, students will gain laboratory skills will be able to use data, perform some physical measurements, will be able to manipulate with experimental data and interpret them in a right way

Metode poučevanja in učenja:	**Learning and teaching methods:**
Laboratorijske vaje	Laboratory practice.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Izpit pisni in ustni. Ocene: 6-10 pozitivno Vaje: Opravljen kolokvij Pri vajah predstavlja delež ocene tudi uspešno laboratorijsko delo.		Written and oral exam. Positive grades from 6 - 10 Practice: completed colloquium. Part of the final grade is also laboratory work.

Reference nosilca/Lecturer's references:

- **SCHNABL, Simon**, TURK, Goran, PLANINC, Igor. Buckling of timber columns exposed to fire. *Fire safety journal*, ISSN 0379-7112. [Print ed.], 2011, letn. 46, št. 7, str. 431-439, ilustr., doi: 10.1016/j.firesaf.2011.07.003. [COBISS.SI-ID 5504097]
- **SCHNABL, Simon**, PLANINC, Igor, TURK, Goran, SRPČIČ, Stane. Fire analysis of timber composite beams with interlayer slip. *Fire safety journal*, ISSN 0379-7112. [Print ed.], 2009, letn. 44, št. 5, str. 770-778, ilustr., doi: 10.1016/j.firesaf.2009.03.007. [COBISS.SI-ID 4598369]
- TORATTI, Tomi, **SCHNABL, Simon**, TURK, Goran. Reliability analysis of a glulam beam. *Structural safety*, ISSN 0167-4730. [Print ed.], 2007, letn. 29, št. 4, str. 279-293, ilustr., doi: 10.1016/j.strusafe.2006.07.011. [COBISS.SI-ID 3588961]
- **SCHNABL, Simon**, TURK, Goran, PLANINC, Igor. Fire resistance of timber columns. V: CECCOTTI, Ario (ur.), KUILEN, Jan-Willem van de (ur.). *WCTE 2010 : conference proceedings*. Riva del Garda [Italy]: s.n., 2010, str. 1-7, ilustr. [COBISS.SI-ID 5069409]

- **SCHNABL, Simon**, TURK, Goran, PLANINC, Igor. Uklon lesenih stebrov pri požaru = Buckling of timber columns subjected to fire. V: ŠIROK, Brane (ur.), EBERLINC, Matjaž (ur.). *Zbornik del*, Kuhljevi dnevi, 23. september 2010, Ljubljana. Ljubljana: SDM - Slovensko društvo za mehaniko, 2010, str. 207-214, graf. prikazi. [COBISS.SI-ID 5132385]
- **SCHNABL, Simon**, SAJE, Miran, TURK, Goran, PLANINC, Igor. Fire analysis of wooden composite beams with interlayer slip. V: ATTARD, Thomas (ur.). *Applied Mechanics in the Americas. Vol. 12 : Proceedings of the Tenth Pan American Congress of Applied Mechanics : PACAM X, Grand Oasis Resort, Cancun, Mexico, 7.-11. January 2008*. Fresno: California State University, 2008, str. 41-44, ilustr. [COBISS.SI-ID 3866977]
- PLANINC, Igor, HOZJAN, Tomaž, TURK, Goran, **SCHNABL, Simon**. Fire analysis of timber composite beams with interlayer slip : paper no. 045. V: GAD, Emad (ur.), WONG, Bill (ur.). *Australasian Structural Engineering Conference : ASEC 2008 : 26-27 June 2008, Melbourne, Australia : conference proceedings*. Collingwood [VIC]: The meeting planners, 2008, str. 1-6, ilustr. [COBISS.SI-ID 4122977]
- **SCHNABL, Simon**, HOZJAN, Tomaž, TURK, Goran, PLANINC, Igor. Finite analysis of composite beams with interlayer slip : paper no. 046. V: GAD, Emad (ur.), WONG, Bill (ur.). *Australasian Structural Engineering Conference : ASEC 2008 : 26-27 June 2008, Melbourne, Australia : conference proceedings*. Collingwood [VIC]: The meeting planners, 2008, str. 1-9, ilustr. [COBISS.SI-ID 4123489]
- **SCHNABL, Simon**, PLANINC, Igor, TURK, Goran. Thermomechanical fire analysis of timber composite beams with interlayer slip. V: *WCTE 2008 : conference proceedings*. Miyazaki, Japan: s.n., 2008, str. 1-8, graf. prikazi. [COBISS.SI-ID 4205665], [Scopus do 21. 5. 2013: št. citatov (TC): 0, čistih citatov (CI): 0, čistih citatov na avtorja (CIAu): 0]
- **SCHNABL, Simon**, SAJE, Miran, PLANINC, Igor, TURK, Goran. Fire analysis of wooden composite beams with interlayer slip : paper 157. V: TOPPING, Barry H. V. (ur.). *Proceedings of the Eleventh International Conference on Civil, Structural and Environmental Engineering Computing, St. Julians - Malta 18.-21. September 2007*. Stirling [Scotland]: Civil-Comp Press, 2007, 15 str., ilustr. [COBISS.SI-ID 3706209]
- **SCHNABL, Simon**, PLANINC, Igor, SAJE, Miran, TURK, Goran. Leseni kompozitni nosilci pri požaru = Timber composite beams exposed to fire. V: KORELC, Jože (ur.), ZUPAN, Dejan (ur.). *Zbornik del*, Kuhljevi dnevi 2007, Snovik, 20.-21. september 2007. Ljubljana: Slovensko društvo za mehaniko, 2007, str. 215-223, graf. prikazi. [COBISS.SI-ID 3708513]

- KROFLIČ, Ana, ŠARAC, Bojan, **CERKOVNIK, Janez**, BEŠTER-ROGAČ, Marija. Hydrophobicity of counterions as a driving force in the self-assembly process : dodecyltrimethylammonium chloride and parabens. Colloids and surfaces. A, Physicochemical and Engineering Aspects, ISSN 0927-7757. [Print ed.], 2014, vol. 460, no. 1, str. 108-117, ilustr. http://ac.els-cdn.com/S0927775714001307/1-s2.0-S0927775714001307-main. pdf?_tid=f7c6d39e-9487-11e3-afba-00000aacb35d&acdnat=1392279925_3dfd41bedb545e0b24bcdcd53eb2335e, doi: 10.1016/j.colsurfa.2014.02.002. [COBISS.SI-ID 1679407]
- ŠARAC, Bojan, **CERKOVNIK, Janez**, ANCIAN, Bernard, MÉRIGUET, Guillaume, ROGER, G., DURAND-VIDAL, S., BEŠTER-ROGAČ, Marija. Thermodynamic and NMR study of aggregation of dodecyltrimethylammonium chloride in aqueous sodium salicylate solution. Colloid and polymer science, ISSN 0303-402X, 2011, vol. 289, no. 14, str. 1597-1607, doi: 10.1007/s00396-011-2480-2. [COBISS.SI-ID 35268613]
- TUTTLE, Tell, **CERKOVNIK, Janez**, KOLLER, Jože, PLESNIČAR, Božo. The search for protonated dihydrogen trioxide (HOOOH) : insights from theory and experiment. The journal of physical chemistry. A, Molecules, spectroscopy, kinetics, environment, & general theory, ISSN 1089-5639, 2010, vol. 114, no. 30, str. 8003-8008, doi: 10.1021/jp103882e. [COBISS.SI-ID 34295813]

POŽARNOVARNOSTNA ANALIZA OBJEKTOV

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Požarnovarnostna analiza objektov
Course title:	FIRE SAFETY ANALYSIS OF BUILDINGS
Članica nosilka/UL Member:	UL FKKT

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Tehniška varnost, druga stopnja, magistrski (od študijskega leta 2023/2024 dalje)	Ni členitve (študijski program)	1. letnik, 2. letnik		izbirni

Univerzitetna koda predmeta/University course code:	0100770
Koda učne enote na članici/UL Member course code:	TV2B9

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
60		15 SV			75	5

Nosilec predmeta/Lecturer:	prof. dr. Simon Schnabl
Vrsta predmeta/Course type:	izbirni strokovni/Elective Professional
Jeziki/Languages:	Predavanja/Lectures: Angleščina, Slovenščina Vaje/Tutorial: Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	Content (Syllabus outline):
Splošno o požarnem inženirstvu. Pregled osnovnih pojmov. Evropski standardi in predpisi. Ukrepi aktivne in pasivne požarne zaščite za preprečevanje širjenja požara po objektu glede na namembnost objekta. Požarna obtežba. Modeli standardnih in realnih požarov. Evakuacijske poti, sistemi za javljanje in gašenje. Vpliv visoke temperature na lastnosti materialov. Temperaturno polje konstrukcije. Računsko ugotavljanje požarne odpornosti lesenih, armiranobetonskih in jeklenih nosilnih konstrukcij po poenostavljenih postopkih skladno s Standardi Evrokod.	General information about fire engineering. Overview of basic concepts. European standards and regulations. The measures of active and passive fire protection to prevent the spread of fire by the building depending on the intended use of the building. Fire load. Models of standard and natural fires. Evacuation routes, fire detection and fire fighting. Influence of high temperatures on material behavior. Temperature field of a structure. Computing determination of the fire resistance of timber, reinforced concrete and steel structures. Analysis of the structure after the fire, the assessment of damage to the building.

Analiza konstrukcije po požaru, ocena poškodovanosti objekta. Vaje: Računsko reševanje osnovnih nalog, z uporabo naprednejših računalniških programov. Obisk požarnega laboratorija . Izdelava požarnega elaborata za enostavnejše objekte.	Tutorial: Solving of basic tasks using advanced computer programs., Visit of the fire laboratory Design of fire study for simple buildings.

Temeljna literatura in viri/Readings:

- A. H. Buchanan, Structural Design for Fire Safety, John Wiley & Sons Ltd, 2005;
- An Introduction to Fire Dynamics, D. Drysdale, Wiley, 2. izdaja (1998)
- Wang, Y., Burgess, I.,Wald, F., Gillie, M. Performance-Based Fire Engineering of Structures. Boca Raton, CRC Press: 369 str. (2013)

Dodatna Literatura:

- Eurokod EN 1991-1-2 in požarni deli Eurokodov za lesene, armiranobetonske in jeklene konstrukcije
- IZS MST 01/2010. Smernica za izdelavo zasnove požarne varnosti. Inženirska zbornica Slovenije, Matična sekcija inženirjev tehnologov in drugih inženirjev: 8 str.
- Tehnična smernica TSG - 1 - 001: 2010. Požarna varnost v stavbah. Ministrstvo za okolje in prostor: 60 str.
- The SFPE Handbook - Fire Protection Engineering, 2nd Edition, Boston, Massachusetts, 1995;
- Rein, G., Empis, A. C., Carvel, R (ur.). 2007. The Dalmarnock Fire Test: Experiments and Modelling. Edinburgh, University of Edinburgh, School of Engineering and Electronics: p. 193-210.
- Fire Engineering Design Guide, Centre for Advanced Engineering, University of Canterbury, New Zealand, 1994;
- Fire Design in Europe. 2010. http://people.fsv.cvut.cz/~wald/COST_C26_Prague/pdf/5-1_Fire%20design%20in%20Europe_sm.pdf
- Glavnik, A., Jug, A. 2010. Priročnik o načrtovanju požarne varnosti. Ljubljana, Inženirska zbornica Slovenije: 289 str.
- Direktiva o gradbenih proizvodih, CPD 89/106, Bistvena zahteva št.2 "Požarna varnost".
- McGrattan, K., Hostikka, S., Floyd, J., idr. 2010. Fire Dynamics Simulator (Version 5). Technical Reference Guide. NIST Special Publication 1018-5.
- Validation of Fire Dynamics Simulator (FDS) for forced and natural convection flows. 2006. http://www.cfd.cad.pl/Thesis_P_Smardz_Rev_B.pdf.

Cilji in kompetence:	**Objectives and competences:**
Cilji: Podati osnovne ugotovitve o nastanku, razvoju in poteku požarov v zgradbah in naravnem okolju. Seznaniti študente z modeli požarne obtežbe skladno z Evrokodom EN 1991-1-2 in z ukrepi aktivne in pasivne požarne zaščite. Privzgojiti občutek za pomen ukrepov požarne zaščite v luči sociooloških, naselitvenih, ekonomskih in drugih faktorjev. Povezati znanja iz drugih predmetov s požarnimi problemi, varnost sistemov. Vpeljati osnovna načela požarno varnega projektiranja lesenih, armiranobetonskih in jeklenih konstrukcij. Spoznavanje vpliva izvedenih požarnovarnostnih ukrepov na objekte. Analiza izvedenih požarnih ukrepov in pomenu le teh na varnost uporabnikov objekta in objekt v celoti. Pridobljene kompetence:	Objectives: To provide the basic findings on the growth, development and the progress of fires in buildings and natural environment. To familiarize students with models of fire load in accordance with EN 1991-1-2 standard and measures of active and passive fire protection. To impart a sense of the importance of fire safety measures in the light of sociological, urban, economic and other factors. Relate knowledge from other courses with fire problems and safety of the systems. To introduce the basic principles of fire safety design of timber, reinforced concrete and steel structures. Understanding of the impacts of fire-safety measures on structures. Analysis of fire measures and their role in personal safety of the users as well as the buildings. Acquired competences:

- Sposobnost ocene požarne ogroženosti objekta ter načrtovanja ukrepov požarne zaščite. - Sposobnost izbire primernega modela požarne obtežbe. Sposobnost uporabe poenostavljenih računskih metod za oceno požarne odpornosti enostavnih nosilnih konstrukcij. - Sposobnost izdelave	- Ability to determine fire safety assessment of the building and design of fire protection measures - Ability of selecting an appropriate fire load model. Ability to use the simplified calculation methods for assessment of the fire resistance of simple load-bearing structures. - Ability to design fire study for simple objects.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje Razumevanje pomena požarnega inženirstva. Razumevanje fizikalnih osnov nastanka in razvoja požara ter vpliva visokih temperatur na materiale in konstrukcije. Znanje osnovnih metod in ukrepov aktivne in pasivne požarne zaščite. Uporaba Uporaba pridobljenega znanja pri pripravi magistrskega dela in pri samostojnem ali skupinskem reševanju požarnih problemov na delovnem mestu v praksi. Refleksija Povezava pridobljenega znanja z različnih področij naravoslovja in tehnike s problemi požarnega inženirstva. Kritično ovrednotenje računskih modelov in poenostavitev v okviru standardov in predpisov. Prenosljive spretnosti Uporaba domače in tuje literature ter evropskih standardov in predpisov s področja požarnega inženirstva. Pridobivanje podatkov s svetovnega spleta, uporaba domačih in tujih baz podatkov. Izdelava in uporaba preprostih računalniških orodij za reševanje požarnih problemov. Uporaba razpoložljive programske opreme.	Knowledge and Comprehension Understanding the importance of fire safety engineering. Understanding the physical basis of the growth and evolution of fire and impact of high temperatures on materials and structures. Knowledge of basic methods and measures of active and passive fire protection. Application Using the knowledge gained at this course in the preparation of the master's work and when solving practical fire issue problems individually or in a group in practice. Analysis Link acquired knowledge from different fields of science and technology with the problems of fire engineering. Critical evaluation of computational models and simplification in the context of standards and regulations. Skill-transference Ability Use of a domestic and foreign literature and European standards and regulations in the field of fire engineering. Obtaining information from the World Wide Web, the use of domestic and foreign databases. Development and use of simple computational tools for solving fire problems. Usage of the available software.

Metode poučevanja in učenja:	**Learning and teaching methods:**
- predavanja - seminarske vaje	- Lectures - Seminars

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
- Pisni izpit	50,00 %	- Written exam
- Seminarska naloga Ocene: pozitivno 6-10; negativno 1-5.	50,00 %	- Seminar work Grades: 6-10 pass, 1-5 fail.

Reference nosilca/Lecturer's references:

SCHNABL, Simon, SAJE, Miran, TURK, Goran, PLANINC, Igor. Fire analysis of wooden composite beams with interlayer slip. V: ATTARD, Thomas (ur.). Applied Mechanics in the Americas. Vol. 12 : Proceedings of the Tenth Pan American Congress of Applied Mechanics : PACAM X, Grand Oasis Resort, Cancun, Mexico, 7.-11. January 2008. Fresno: California State University, 2008, str. 41-44, ilustr. [COBISS.SI-ID 3866977]

PROCESI V TEHNOLOGIJAH VARSTVA OKOLJA

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Procesi v tehnologijah varstva okolja
Course title:	Processes in Environment Protection Technologies
Članica nosilka/UL Member:	UL FKKT

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Tehniška varnost, druga stopnja, magistrski (od študijskega leta 2023/2024 dalje)	Ni členitve (študijski program)	1. letnik, 2. letnik		izbirni

Univerzitetna koda predmeta/University course code:	0100771
Koda učne enote na članici/UL Member course code:	IN214

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
45	15	15			75	5

Nosilec predmeta/Lecturer:	prof. dr. Andreja Žgajnar Gotvajn
Vrsta predmeta/Course type:	obvezni/Mandatory
Jeziki/Languages:	Predavanja/Lectures: Angleščina, Slovenščina
	Vaje/Tutorial: Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	Content (Syllabus outline):
Onesnaženje: vrste in viri onesnaženja, mehanizmi transporta, pretvorb in vplivi v okolju (voda, zrak, tla). Čiščenje onesnaženja: sodobni postopki in smeri razvoja pri čiščenju odpadnih vod, pregled konvencionalnih (koagulacija, flokulacija, adsorpcija, biološko čiščenje) in naprednih (oksidacijski procesi, katalitske in membranske tehnike) čistilnih naprav za čiščenje odpadnih vod, postopki in pregled čistilnih naprav za zrak (usedalniki, cikloni, elektrostatski precipitatorji, adsorberji, katalitski procesi), procesi remediacije in bioremediacije za čiščenje onesnaženih tal in podtalnice, tehnološki/ekonomski vzvodi	Pollution: Types and sources, mechanisms of transport, environmental fate and impacts (water, soil, air). Pollution reduction: overwiev of up-to-date processes and methods of wastewater treatment, review of conventional (coagulation, flocculation, adsorption, biological treatment) and advanced (oxidation processes, catalytic, membrane techniques) wastewater treatment systems, processes and treatment devices for air pollution control (settling chambers, cyclones, electrostatic precipitators, scrubbers, adsorbers, catalytic combustion). Remediation and bioremediation processes (ground

vodenja in nadzora čistilnih naprav/procesov, postopki optimizacije. Okoljska ocena industrijskih procesov: politika in strategija varovanja okolja, dodatno in procesno integrirano varovanje okolja, IPPC (Integrated Pollution Prevention) direktiva, moderno upravljanje industrijskih izpustov, najboljša dostopna tehnologija BAT (Best Available Technology) - kombinacija objekta in okolja z optimalno in ekonomsko najbolj učinkovito kontrolo onesnaženja. Zakonodaja. Zmanjševanje vplivov na okolje: načini ocenjevanja vplivov procesov na okolje, pregled globalnih problemov (vzroki, ekonomske in socialne posledice, perspektive, možne rešitve), ravnanje z odpadki in načini njihove predelave, odpadek kot surovina in energent, koncept čistejše proizvodnje. Problematika fosilnih in obnovljivih virov energije.	waters, contaminated soils). Proces controll, monitoring and optimization. Environmental Evaluation of Industrial Processes: policy and strategies of environmental protection, end-of-pipe measures and production-integrated environmental protection, IPPC Directive), the concepts of BAT (Best Available Technology processes, technical and economical measures to reduction of environmental impacts. Legislation. Environmental Impact Reduction: environmental impact assessmenrt approaches, global environmental problems (sources, consequences, perspectives, solutions), solid waste management and processing, waste as material and energy source, concepts of cleaner and sustainable technologies and production. Fossil and renewable sources of energy: drawbacks ans benefits.

Temeljna literatura in viri/Readings:

G. Burke, B.R. Singh, L. Theodore: Handbook of Environmental Management and Technology, Wiley, 2005, 800 pages (25%).
C.C. Lee, S.D. Lin (Eds.): Handbook of Environmental Engineering Calculations, 2nd Ed., McGraw Hill, New York, 2007, 3297 pages (15%).
Žgajnar Gotvajn, A., Kalčikova G., Zagorc-Končan, A.: Procesi v tehnologijah varstva okolja, UL FKKT, 2017 (100%)

Dodatna literatura:

G. Tchobanoglous: Wastewater Engineering: Treatment and Reuse , 4th Ed.McGraw-Hill Science/Engineering/Math, 2003, 1570 pages
J. Zagorc-Končan, A. Žgajnar Gotvajn: Zbirka nalog iz ekološkega inženirstva, UL, FKKT, 2008, 45 pages (50%).
D.T. Allen, D.R. Shonnard:Green Engineering: Environmentally Conscious Design of Chemical Processes , Prentice Hall, Englewood Cliffs, 2001, 552 pages.

Cilji in kompetence:	**Objectives and competences:**
Pridobitev poglobljenih znanj, potrebnih za aplikativno inženirsko reševanje okoljskih problemov na področju celovitega Znanje o načinih za identifikacijo in oceno škodljivih na okolje okolje, znanje za sodobno upravljanje industrijskih izpustov s kombinacijo ovrednotenja tehnologije, vpliva na okolje in ocene nevarnosti za okolje. Sposobnost integracije koncepta trajnostne zaščite okolja v proizvodne, ekonomske in vodstvene odločitve.	Objectives: To acquire deep knowledge on engineering tools for solving complex environmental problems. Ability to understand and apply the principles of environmental management, science and engineering. Competences: Knowledge on identification and determination of hazardous environmental impact assessment. Knowledge on complex management of industrial emissions and cost-effective processes which minimize pollution at a source, and/or reduce impact on health and the environment. Ability to understand integrated pollution prevention practices

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje	Knowledge and Comprehension Ability to apply engineering approach to solve various complex environmental problems in cost-effective

Samostojna uporaba inženirskih orodij in znanj za ekonomsko indružbeno sprejemljivo reševanje okoljskih problemov. Uporaba Uporaba pridobljenih znanj pri reševanju kompleksnih inženirskih problemov. Sposobnost načrtovanja zahtevnih pristopov in eksperimentov ter ovrednotenja rezultatov, na podlagi katerih lahko načrtuje inženirske rešitve problemov. Refleksija Razumeti svojo etično odgovornost. Kritično vrednotiti vpliv svojega dela na lokalni in globalni ravni. Prenosljive spretnosti Spretnost uporabe domače in tuje literature. Spretnost identifikacije problema in pristopa k njegovemu učinkovitemu reševanju. Spretnost izvedbe in ovrednotenje zahtevnih meritev. Uporaba ustnega in pisnega načina poročanja. Delo v skupinah.	manner with ethical responsibility within social context. Application Ability of quantification of problems and solving more complex environmental problems. Design of complex approaches and experiments and evaluation of results for design or optimisation of adequate solutions of actual problems. Analysis Understand the environmental, economic and ethic consequences of technical decisions. Evaluate the work critically. Skill-transference Ability Ability to search, select and apply different types of literature. Ability to independently identify various environmental problems and search for solution. The ability to design, perform and evaluate complex measurements. Development of oral and literate skills.

Metode poučevanja in učenja:	**Learning and teaching methods:**
- Predavanja - Laboratorijske vaje - Projektno delo	Lectures Lab courses Project work

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Opravljene obveznosti pri vajah.	10,00 %	Accomplished lab course.
Pisni in ustni izpit.	70,00 %	Written and oral exam.
Projektna naloga z ustnim poročanjem.	20,00 %	Presentation of the project.

Reference nosilca/Lecturer's references:

- DERCO, Ján, **ŽGAJNAR GOTVAJN, Andreja**, MENCÁKOVÁ, Angelika. Oxidative treatment of landfill leachate. V: CABRAL, Gustavo B. C. (ur.), BOTELHO, Beatriz A. E. (ur.). *Landfills : waste management, regional practices and environmental impact*, (Waste and waste management). New York: Nova Science, cop. 2012, str. 1-82.
- NAKRST, Jana, BISTAN, Mirjana, TIŠLER, Tatjana, ZAGORC-KONČAN, Jana, DERCO, Ján, **ŽGAJNAR GOTVAJN, Andreja**. Comparison of Fenton's oxidation and ozonation for removal of estrogens. *Water science and technology*, ISSN 0273-1223, 2011, vol. 63, no. 10, str. 2131-2137.
- **ŽGAJNAR GOTVAJN, Andreja**, ZAGORC-KONČAN, Jana. Combination of Fenton and biological oxidation for treatment of heavily polluted fermentation waste broth. *Acta chimica slovenica*, ISSN 1318-0207. [Tiskana izd.], 2005, vol. 52, no. 2, str. 131-137.

PROCESNA VARNOST

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Procesna varnost
Course title:	Process Safety
Članica nosilka/UL Member:	UL FKKT

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Tehniška varnost, druga stopnja, magistrski	Ni členitve (študijski program)	1. letnik	1. semester	obvezni

Univerzitetna koda predmeta/University course code:	0072282
Koda učne enote na članici/UL Member course code:	TV207

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
45		15 LV + 15 SV			75	5

Nosilec predmeta/Lecturer:	doc. dr. Barbara Novosel
Vrsta predmeta/Course type:	obvezni/Mandatory
Jeziki/Languages:	Predavanja/Lectures: Slovenščina Vaje/Tutorial: Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	Content (Syllabus outline):
Tipični industrijski procesi (znižana ali povišana temperatura in tlak, katalitski, elektrokatalitski procesi, elektrotermični). Analiza industrijskih procesov in priprava ocen tveganja. Zajemanje pomembnih in kritičnih parametrov ter pogojev procesa, ki vplivajo na njegovo varnost, možni scenariji izrednih dogodkov. Kvalitativna in kvantitativna ocena tveganja. Varnost pri delu v laboratoriju, kemijskih in drugih procesnih industrijah. Kompleksnost delovanja industrijskega procesa, tehnološki režim in standardni proizvodni postopki, ustreznega vzdrževanja posameznih naprav in celotnega sistema. Ocena verjetnost za nastanek izrednih situacij v kemijskih procesih ter preprečevanje in ukrepanje.	Typical chemical and industrial processes (reduced or elevated temperature, high pressure, catalytic, electrocatalytic, and electrothermal processes). Analysis of industrial processes and the preparation of risk assessments. Determinations of important and critical process parameters and conditions that affect the security of the possible scenarios of emergencies. Qualitative and quantitative risk assessment. Safety, Health and Loss Prevention at work in a laboratory, chemical and other process industries. The complexity of the operation of industrial processes, technological regime and the standard manufacturing procedures, proper maintenance of individual devices and the entire system. Estimate the probability of accidents in chemical processes, prevention and response.

Identifikacija potencialnih nevarnosti v procesu, začetni dogodki, razvoj nezgodnih scenarijev. Načrtovanje varnostnih sistemov za blaženje posledic izrednih dogodkov. Uporaba različnih metod za identifikacijo in oceno tveganj. Določitev procesnih, varnostnih indikatorjev. Modeli in orodja za oceno posledic. Modeliranje posledic različnih nezgodnih dogodkov za potrebe ocene tveganja in prostorskega načrtovanja. Seminar: računska obravnava kemijskih procesov, predstavitev in poglobljena analiza večje industrijske nezgode. Uporaba modelov in orodij za napoved posledic, določitev vpliva posameznih vhodnih podatkov. Vaje: Prašna eksplozija, • karakterizacija gorljivega granulata (določevanje velikosti in porazdelitve velikosti delcev, termična analiza, določitev specifične površine, vrstična elektronska mikroskopija, • priprava gorljivega prahu (sejanje, mletje, sušenje), • Določevanje minimalne vžigne energije, Določevanje eksplozijskih kazalnikov.	Identification of of potential risks in the chemical process, initiating events, the spread of incidents, reducing the consequences of exceptional events. Models and tools for assessment of the consequences. Modeling certain accident scenarios and their consequences, simple and complex computer programs of individual physical phenomena: Seminar: calculations in chemical processes, presentation and analysis of major industrial accident. The use of models and tools for predicting the consequences, determine the influence of input data. Exercises: dust explosion, • combustible granulate characterization (determination of size and particle size distribution, thermal analysis, the determination of the specific surface area, scanning electron microscopy, • Preparation of combustible dust (sieving, grinding, drying) • Determination of the minimum ignition energy, • Determination of explosion indices.

Temeljna literatura in viri/Readings:

- Hauptmanns, U.: Process and plant safety,: Springer, cop. (Heidelberg [etc.]) 2015 665 str. (40 %)
- Brauer, R., L.: Safety and health for engineers, 3rd Ed., Wiley, cop. Hoboken (New Jersey), 2016 765 str. (30 %)
- Ogle, R. A: .Dust explosion dynamics, Elsevier : Butterworth-Heinemann, cop. 2017 (Oxford [etc.]) 639 str. (30 %)

Cilji in kompetence:	**Objectives and competences:**
Pri predmetu se študenti seznanijo z zagotavljanjem varnosti pri delu v kemijskih ter procesnih industrijah. Pridobljeno znanje omogoča razumevanje in presojanje nevarnosti oziroma stopnje tveganja ter določitev ukrepov za varno in zdravo delo. Študentje spoznajo, da je za varno delo v industriji osnovni pogoj natančno poznavanje vseh faz procesa in podrobna analiza delovanja na osnovi katere se izvede ocene tveganja. Spoznajo, da je varnost procesa pogojena z mnogo dejavniki in da je za njegovo varno obratovanje potrebno tako optimalno delovanje posameznih procesnih operacij kot tudi usklajeno delovanje sistema kot celote. Študentje se pri predmetu usposobijo za sistematičen pregled kemijskih in drugih sorodnih procesov, zaznavanje potencialnih kritičnih mest, priprave ocene tveganja in ukrepov za zmanjšanje tveganja.	Students get knowledge to ensuring safety, health and loss prevention in chemical processes. The knowledge enables the students to understand and assess the level of danger or risk and to establish measures to ensure the safe handling of hazardous chemicals. Students learn that basic conditions for safe work in industry are exact knowledge of all phases of the process and the importance of a risk assessment. Students learn that process safety depends on many factors. For safe operation is necessary so optimize the performance of individual part of the process operation as well as the system as a whole. Students are trained for a systematic review of chemical and other related processes, identify potential critical points, preparation of risk assessment and risk reduction measures.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje Študentje se pri predmetu usposobijo za sistematičen pregled nevarnosti v kemijskih in sorodnih procesih,	Knowledge and Comprehension The subject makes students capable of a systematic review of the risks in the chemical and related

za zaznavanje potencialnih kritičnih mest, pripravo ocene tveganja in ukrepov za zmanjšanje tveganja. Uporaba Ocenjevanje tveganja kemijskih procesov. Analiza nazgod in določevanje ukrepov za preprečitev nezgod. Refleksija Teoretična in praktična znanja bo lahko študent uporabil za sistematičen in analitičen pregled posameznih faz kemijskih in drugih procesov, na osnovi pregleda ugotoviti kritična mesta ter določiti ukrepe za zmanjšanje tveganja, Prenosljive spretnosti Sistematičen, analitičen pristop do reševanja problema, več razumevanja in upoštevanja varnostne kulture.	processes for detecting potential critical points, risk assessment and risk reduction measures. Application Management and control of chemical processes. Risk assessment of chemical processes. Accident analysis and determination of measures to prevent accidents. Analysis Theoretical and practical knowledge will be used by the student for a systematic and analytical overview of the various stages of chemical and other processes, based on a review to identify critical points and determine risk reduction measures. Skill-transference Ability Systematic, analytical approach to problem solving, more understanding and taking into account safety culture.

Metode poučevanja in učenja:	**Learning and teaching methods:**
• Predavanja, • seminarji, • praktične vaje	• lectures, • Seminars, • Practical exercises

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Seminarska naloga	20,00 %	Course work
Pisni izpit,	50,00 %	Written exam
Ustni izpit.	30,00 %	Oral examination.

Reference nosilca/Lecturer's references:

1. BALANTIČ, Janez, SKOBIR BALANTIČ, Danijela Anica, **NOVOSEL, Barbara**. Investigation of the explosion-related parameters and their influence on the severity of an explosion involving aluminum dust. Process safety progress. Dec. 2019, vol. 38, no. 4, str. 1-9, ilustr. ISSN 1547-5913. https://onlinelibrary.wiley.com/doi/abs/10.1002/prs.12047, DOI: 10.1002/prs.12047. [COBISS.SI-ID 1466794]
2. LU, Wei, RUAN, Gedeng, GENORIO, Boštjan, ZHU, Yu, **NOVOSEL, Barbara**, PENG, Zhiwei, TOUR, James M. Functionalized graphene nanoribbons via anionic polymerization initiated by alkali metal-intercalated carbon nanotubes. ACS nano. 2013, vol. 7, no. 3, str. 2669-2675, ilustr. ISSN 1936-0851. DOI: 10.1021/nn400054t. [COBISS.SI-ID 36526597]
3. TRATAR-PIRC, Elizabeta, **NOVOSEL, Barbara**, BUKOVEC, Peter. Comparison of GC and OxiTop analysis of biogas composition produced by anaerobic digestion of glucose in cyanide inhibited systems. Acta chimica slovenica. [Tiskana izd.]. 2012, vol. 59, no. 2, str. 398-404. ISSN 1318-0207. http://acta.chem-soc.si/59/59-2-398.pdf. [COBISS.SI-ID 36027653]

PROFESIONALNA PATOLOGIJA

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Profesionalna patologija
Course title:	OCCUPATIONAL PATHOLOGY
Članica nosilka/UL Member:	UL FKKT

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Tehniška varnost, druga stopnja, magistrski (od študijskega leta 2023/2024 dalje)	Ni členitve (študijski program)	1. letnik, 2. letnik		izbirni

Univerzitetna koda predmeta/University course code:	0100768
Koda učne enote na članici/UL Member course code:	TV2B3

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
25	20	30 SV			75	5

Nosilec predmeta/Lecturer:	prof. dr. Alenka Franko
Vrsta predmeta/Course type:	izbirni strokovni/Elective Professional
Jeziki/Languages:	Predavanja/Lectures: Angleščina, Slovenščina Vaje/Tutorial: Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	**Content (Syllabus outline):**
Predavanja: 1. sklop: Uvod - pravni pojmi, mesto in vloga predmeta…Poklicne bolezni. Invalidnost. Poklicna rehabilitacija 2. sklop: Etične dileme v ocenjevanju delazmožnosti in verifikaciji poklicnih bolezni. 3. sklop: Analize delovnih mest z vidika poklicne izpostavljenosti, kvalitativne in kvantitativne metode.. 4. sklop: Najpogostejše poklicne bolezni 5. Sklop: Epidemiologija delovnega okolja. **Seminarji**: področje patologije dela. Vsak študent pripravi seminar določene dolžine in določenega števila literaturnih virov, ga odda v pisni obliki ter predstavi študentom	Lectures: Section 1: Introduction – legal concepts, context and role of the subject ... Occupational diseases. Disability. Occupational rehabilitation. Section 2: Ethic dilemmas in working ability assessment and verification of occupational diseases. Section 3: Workplace analysis regarding occupational exposure using qualitative and quantitative methods. Section 4: Common occupational diseases. Section 5: Epidemiology of the workplace. **Seminars:** In the field of labor pathology. Every student writes a paper with the specified number of words and

Vaje: praktično usposabljanje za računaje izpostavljenosti, verjetnosti in tveganja	number of references, turns it in in writing and gives a presentation to other students. **Practical work:** Practical training in exposure, probability and risk calculation.

Temeljna literatura in viri/Readings:

1. Kermavnar T, (avtor, ilustrator), Dodič Fikfak M. Oblikovanje po meri človeka, Ilustrirani učbenik iz ergonomije. 1. izd. Ljubljana: Univerzitetni klinični center Ljubljana, Klinični inštitut za medicino dela, prometa in športa: Akademija za likovno umetnost in oblikovanje, 2013. (30%)
2. Hammitt JK. Risk Assessment and Economic Evaluation. In: Rom WN, ed. Environmental and Occupational Medicine. 4th ed. Philadelphia, Baltimore, New York, London, Buenos Aires, Hong Kong, Sydney, Tokyo: Lippincott Williams & Wilkins, 2007: 1697-1711. (30%)
3. Rom WN, Markowitz SB, eds. Environmental and occupational medicine. 4th ed. Philadelphia, Baltimore, New York, London, Buenos Aires, Hong Kong, Sydney, Tokyo: Wolters Kluwer, Lippincott Williams&Wilkins, 2007 (20%)
4. Rosenstock L, Cullen MR, Brodkin CA, Redlich CA, eds. Textbook of Clinical Occupational and Environmental Medicine. 2nd ed. Philadelphia, Edinburgh, London, New York, St Luis, Sydney, Toronto: Elsevier Saunders; 2005 (20%)

Cilji in kompetence:	**Objectives and competences:**
Študent spozna: - oblike in metode ter načine proučevanj tveganj na delu (obremenitve in škodljivosti); - oblike, metode in načine jemanja delovne anamneze; – oblike, metode in načine ocenjevanja izpostavljenosti – kvalitativne in kvantitativne metode (kumulativna izpostavljenost); - epidemiološke metode v medicini dela - vplive delovnega okolja na zmogljivosti posameznih organov in organskih sistemov ter človeka kot celote; - vplive delovnega okolja na zdravje in delazmožnost (zdravstveni, pravno-upravni, tehnični, organizacijski vidik); - obremenitve (ekološki monitoring) in zgodnje učinke obremenjenosti na zdravje in delazmožnost (biološki monitoring); - vplive delovnega okolja na specifične kazalce negativnega zdravja posameznika ali skupine poklicne bolezni in boleznim povezane z delom (epidemiološki monitoring); - osnove humanizacije dela oziroma ergonomije v najširšem smislu; - osnove promocije zdravja v delovnem okolju;	The student will familiarize himself with: - forms, methods and procedures used to research risks present at the workplace (causes of strain and harm); - forms, methods and procedures of taking occupational medical history; - forms, methods and procedures of exposure assessment – qualitative and quantitative methods (cumulative exposure); - epidemiologic methods in occupational medicine; - effects of the workplace on the capacity of individual organs and organ systems, as well as of the person as a whole; - effects of the workplace on health and ability to work (medical, legal-administrative, technical and organizational aspects); - types of strain (ecological monitoring) and early effects of stress on health and ability to work (biomonitoring); - effects of the workplace on specific negative health indicators of groups and individuals; - occupational and work-related diseases (epidemiological monitoring); - basics of the humanization of labor or ergonomics in its broadest sense; - basics of health promotion at the workplace.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje - praktične in teoretične oblike analiz delovnega okolja z zdravstvenega vidika; - principe in postopke preprečevanja poklicnih tveganj v delovnem okolju;	**Intended Learning Outcomes:** Knowledge and Comprehension - practical and theoretical forms of workplace analysis from the medical perspective;

- osvoji vrednotenje ekološkega in biološkega monitoringa ter principe epidemiologije delovnega okolja; - osvoji načine in postopke izdelave celovite delovne enamneza (anamneza ekspozicije); - osvoji osnove ocenjevanja začasne in trajne delanezmožnosti, poklicne orientacije, selekcije in rehabilitacije; - osvoji osnovne oblike, metode in načine izvedbe različnih oblik promocije zdravja v delovnem okolju; Uporaba Varovanje in izboljšanje zdravja zaposlenih; Preprečevanje in obvladovanje poklicnih bolezni, poškodb pri delu… Odpravljanje poklicnih tveganj in pogojev dela, ki ogrožajo varnost in zdravje pri delu; Razvoj in napredek varstva pri delu, organizacije dela, pogojev dela… Izboljšanje poklicnega in socialnega statusa zaposlenih, fizičnega in materialnega statusa zaposlenih; Ohranjanje in razvoj delazmožnosti zaposlenih; Omogočanje socialno in ekonomsko produktivnega življenja… Refleksija Spoznati osnove in pomembnosti proučevanj tveganj, obremenitev in škodljivosti v delovnem okolju, njihov vpliv na zmogljivosti posameznih organov, organskih sistemov in človeka v celoti, na njegovo zdravje in delazmožnost. Spoznali naj bi tudi osnovne principe epidemiologije delovnega okolja, ergonomije in humanizacije dela v najširšem smislu in promocije zdravja v delovnem okolju… Prenosljive spretnosti Povezovanje z ergonomijo, medicino dela, statistiko…	- principles and procedures of work-related risk mitigation at the workplace; - evaluation of ecological monitoring and biomonitoring, as well as basic principles of epidemiology of the workplace; - methods and procedures of a complete workplace anamnesis (exposition anamnesis); - basics of assessment of temporary and permanent inability to work, basics of occupational orientation, selection and rehabilitation; - basic forms, methods and procedures of various types of health promotion at the workplace; Application - protection and improvement of employee health; - prevention and management of occupational diseases, work-related injuries …; - mitigation of occupational hazards and work conditions that present a danger to occupational health and safety; - development and advancement of occupational safety, work organization, work conditions …; - improvement of the occupational, social, physical and material status of employees; - protection and development of the employees' ability to work; - fostering a socially and financially productive life … Analysis To know the basics and the importance of researching risks, stressors and hazards of the workplace, their effect on the capacities of individual organs, organ system and on the person as a whole, on his health and ability to work. Students are also supposed to familiarize themselves with the basic principles of workplace epidemiology, ergonomics and the humanization of labor in its broadest sense, as well as with health promotion at the workplace. Skill-transference Ability Connections with ergonomics, occupational medicine, statistics …

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja Vaje – obvezna prisotnost in sodelovanje Seminarji – obvezna prisotnost, priprava seminarja, izvedba : ocena izdelka in predstavitve	Lectures Practical work – required attendance and participation Seminars – required attendance, preparation of paper, execution: marks given for the paper as well as presentation

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Pisni izpit	50,00 %	Written examination
Seminarska naloga	50,00 %	Seminar paper

Reference nosilca/Lecturer's references:

1. GORIČAR, Katja, KOVAČ, Viljem, **FRANKO, Alenka**, DODIČ-FIKFAK, Metoda, DOLŽAN, Vita. Serum survivin levels and outcome of chemotherapy in patients with malignant mesothelioma. Disease markers, ISSN 1875-8630, 2015, vol. 2015, str. 1-8. http://www.hindawi.com/journals/dm/2015/316739/,

doi: 10.1155/2015/316739. [COBISS.SI-ID 32176857], [JCR, SNIP, WoS do 24. 10. 2015: št. citatov (TC): 0, čistih citatov (CI): 0, Scopus do 10. 10. 2015: št. citatov (TC): 0, čistih citatov (CI): 0]
2. KOVAČ, Viljem, DODIČ-FIKFAK, Metoda, ARNERIĆ, Niko, DOLŽAN, Vita, **FRANKO, Alenka**. Fibulin-3 as a biomarker of response to treatment in malignant mesothelioma. Radiology and oncology, ISSN 1318-2099. [Print ed.], Sep. 2015, vol. 49, no. 3, str. 279-285, doi: 10.1515/raon-2015-0019. [COBISS.SI-ID 2427564], [JCR, SNIP, WoS do 19. 4. 2017: št. citatov (TC): 3, čistih citatov (CI): 2, Scopus do 30. 3. 2017: št. citatov (TC): 3, čistih citatov (CI): 2]
3. **FRANKO, Alenka**, DOLŽAN, Vita, ARNERIĆ, Niko, DODIČ-FIKFAK, Metoda. The influence of gene-gene and gene-environment interactions on the risk of asbestosis. BioMed research international, ISSN 2314-6141, 2013, vol. 2013. http://www.hindawi.com/journals/bmri/2013/405743/, doi: 10.1155/2013/405743. [COBISS.SI-ID 30775769], [JCR, SNIP, WoS do 3. 4. 2015: št. citatov (TC): 1, čistih citatov (CI): 1, Scopus do 3. 7. 2015: št. citatov (TC): 2, čistih citatov (CI): 2]
4. **FRANKO, Alenka**, DOLŽAN, Vita, KOVAČ, Viljem, ARNERIĆ, Niko, DODIČ-FIKFAK, Metoda. Soluble mesothelin-related peptides levels in patients with malignant mesothelioma. Disease markers, ISSN 0278-0240, 2012, vol. 32, no. 2, str. 123-131, doi: 10.3233/DMA-2011-0866. [COBISS.SI-ID 29611737], [JCR, SNIP, WoS do 19. 4. 2017: št. citatov (TC): 7, čistih citatov (CI): 4, Scopus do 25. 4. 2017: št. citatov (TC): 8, čistih citatov (CI): 5]
5. ERČULJ, Nina, KOVAČ, Viljem, HMELJAK, Julija, **FRANKO, Alenka**, DODIČ-FIKFAK, Metoda, DOLŽAN, Vita. DNA Repair Polymorphisms and Treatment Outcomes of Patients with Malignant Mesothelioma Treated with Gemcitabine-Platinum Combination Chemotherapy. Journal of thoracic oncology, ISSN 1556-0864, October 2012, vol. 7, no. 10, str. 1609-1617. [COBISS.SI-ID 512300345], [JCR, SNIP, WoS do 17. 11. 2016: št. citatov (TC): 6, čistih citatov (CI): 2, Scopus do 5. 2. 2016: št. citatov (TC): 7, čistih citatov (CI): 4]

RANLJIVOST SISTEMOV

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Ranljivost sistemov
Course title:	Vulnerability of systems
Članica nosilka/UL Member:	UL FKKT

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Tehniška varnost, druga stopnja, magistrski	Ni členitve (študijski program)	1. letnik	1. semester	obvezni

Univerzitetna koda predmeta/University course code:	0072283
Koda učne enote na članici/UL Member course code:	TV208

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
45		15 LV + 15 SV			75	5

Nosilec predmeta/Lecturer:	doc. dr. Klementina Zupan
Vrsta predmeta/Course type:	obvezni/Mandatory
Jeziki/Languages:	Predavanja/Lectures: Slovenščina Vaje/Tutorial: Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	Content (Syllabus outline):
1. UVOD in zahteve za varnost kemijsko-procesnih sistemov 2. Koncept analiz varnosti in ranljivosti (SVA analize) • Definicija metode SVA (• Protiukrepi in upravljanje s tveganji, varnosti in varovanja • Kriteriji SVA in pripadajoče utemeljitve • Kriteriji analiz varnosti in ranljivosti • Postopki nadziranja podjetij • Inšpekcija postopkov analiz ranljivosti 3. Upravljanje varnosti kemijsko-procesnih sistemov • Integracija varovanja kemijsko-procesnih sistemov in aktivnosti SVA	1. Introduction and demands for chemical process systems 2. Concept of safety and vulnerability analysis • Definition of SVA methodology • Counter measures and Risk management safety and security • SVA criteria and associated rationale • Criteria for security and vulnerability • Procedures for company monitoring • Review of procedures of the vulnerability analysis 1. Management of chemical and process systems • Integration of protection chemical-process systems and SVA activities with existing environmental, health and safety programs • Following SVA recommendations and revalidation of SVA analyses

z obstoječimi okoljskimi, zdravstvenimi in varnostnimi programi • Sledenje priporočil SVA in revalidacija analiz SV Povezave med varnostjo nevarnih snovi v fiksnih sistemih in med transportom 4. Zanesljivost sistemov • Namen in metodologije verjetnostnih varnostnih analiz • Načini odpovedi sistemov • Odpovedi s skupnim vzrokom • Verjetnostni koncept analize odpovedi • Zanesljivost elementov sistema - ocena verjetnosti odpovedi • Zanesljivost sistemov - ocena verjetnosti odpovedi, meje prvega in drugega reda • Zanesljivost in razpoložljivost popravljivih sistemov • Zanesljivost in razpoložljivost sistemov v stanju pripravljenosti • Zanesljivost in gospodarnost • Zanesljivost in razpoložljivost sistema med popravilom, vzdrževanjem ali testiranjem • Koncept tveganja z upoštevanjem resnosti odpovedi in verjetnosti odpovedi • Preventivno in korektivno vzdrževanje inženirskih sistemov: večkratno in neodvisno nadzorovanje	• Interface between safety of dangerous substances in fixed systems and during transportation 1. Reliability of the systems • Purpose of probability safety assessment • Failure modes of the systems • Common cause failures • Reliability of component - failure probability estimation • Reliability analyses of the systems - failure probability estimation, first and second order bounds • Reliability and availability of the repairable systems • Reliability and availability of stand-by systems • Reliability and economy • Reliability and availability of systems during maintenance and testing • Concept of risk with taking into account of failure seriousness of failure and probability of failure Preventive and corrective maintenance of engineering systems: multiple and independent control

Temeljna literatura in viri/Readings:

- Rao, S.S., »Probability-Based Design«, McGraw-Hill, new York, 1992.
- M.L. Garcia 2008. The Design and Evaluation of Physical Protection Systems, Second Edition. Amsterdam: Butterworth Heinemann.
- M.L. Garcia 2003. Vulnerability Assessment of Physical Protection Systems. Amsterdam: Elsevier.

Dodatna Literatura:

- J R, Cornell, C A Benjamin, Probability, Statistics, and Decisions for Civil Engineers, 1970.
- Layer of Protection Analysis, Simplified Process Risk Assessment, Center for Chemical Process Safety, American Institute of Chemical Engineers, 2001.
- Guidelines for Technical Planning for On-Site Emergencies, Center for Chemical Process Safety, American Institute of Chemical Engineers, 1996.
- Bowers, Dan M., "Security Fundamentals for the Safety Engineer", Professional Safety, American Society of Safety Engineers, December, 2001, pgs. 31-33.
- Chemical Process Safety, American Institute of Chemical Engineers, 2000.
- Center for Chemical Process Safety, Guidelines for Analyzing and Managing the Security Vulnerabilities of Fixed Chemical Sites. New York: AIChE.
- Dalton, Dennis. Security Management: Business Strategies for Success. Newton, MA: Butterworth-Heinemann Publishing, 1995.
- Guidelines for Chemical Process Quantitative Risk Analysis, Second Ed., Center for Chemical Process Safety, American Institute of Chemical Engineers, 2000.

Cilji in kompetence:	**Objectives and competences:**
Program predmeta usmerja študenta v kritično in logično presojo varnosti in ranljivosti posameznih sistemov v povezavi z vsemi napravami ter zahtevami. Študenti se usposabljajo za določanje pomembnosti posameznih komponent sistemov v smislu varnosti in stroškov za vzdrževanje načrtovanega nivoja varnosti.	Program of the course leads student to critical and logical assessment of safety and vulnerability in connection with all of devices and demands. Students are being thought for importance assessment od system components in sense of safety and maintenance costs.

Predvideni študijski rezultati:	Intended learning outcomes:
Znanje in razumevanje Teoretična znanja o zanesljivosti sistemov v povezavi s tveganjem. Razumevanje vplivnih pojavov na odpovedi sistemov in na nezgodne procese ob upoštevanju obnašanja človeka. Uporaba Varno in učinkovito uporabljanje z inženirskimi sistemi z namenom zmanjševati tveganje oz. upravljati s tveganjem ob spremljanju predpisov. Refleksija Interpretacija izrednih stanj sistemov v prometu (procesna industrija, ladje, terminali, pristanišča, skladišča itd.). Iznajdljivost v mednarodnem prostoru in komunikacija z nadrejenimi upravnimi organi. Prenosljive spretnosti S pridobljenim temeljnim znanjem in veščino uporabe domače in tuje tehnične literature, priročnikov ter standardov, pa tudi računalniških modelov pridobi študent zmožnost razumevanja in delnega obvladovanja sistemov. Pomembno je razumevanje tveganja, načini zmanjševanja tveganja ob upoštevanju stroškov, ki pri tem nastajajo.	Knowledge and Comprehension Theoretical knowledge about reliability of the systems in connection with risk. Understanding important phenomena on the risk of the systems and on accident processes by taking into account human behaviour. Application Safe and efficient management of engineering systems with aim to reduce risk or risk management in accordance with legislation Analysis Interpretation of incident events of the systems in transportation (process industry, ships, terminals, ports warehouses etc). Inventiveness on international level and communication with superior legislative bodies. Skill-transference Ability With gathered basic knowledge and skill to use domestic and foreign literature, handbooks and standards, as well as computer models student gets ability to understand and partially managing systems. Important is understanding the risks, reducing the risks by taking into account the costs the arise during the process.

Metode poučevanja in učenja:	Learning and teaching methods:
Na predavanjih pridobi študent temeljna teoretična znanja. S seminarsko nalogo samostojno pod mentorstvom visokošolskega učitelja rešuje problematiko teh sistemov v obliki seminarske ali projektne naloge.	Through the lectures student gather basic theoretical knowledge. With seminar work he solves problems of seminar or project work under supervision of professor.

Načini ocenjevanja:	Delež/Weight	Assessment:
A) Seminarska naloga	40,00 %	A) Seminar work
B) Pisni izpit	40,00 %	B) Written exam
C) Laboratorijske vaje	20,00 %	C) Laboratory work

Reference nosilca/Lecturer's references:

ZUPAN, Klementina. Požari v obratih za upravljanje z nevarnimi odpadki = Fires in hazardous waste management companies. V: 36. strokovni posvet o poklicni, procesni in požarni varnosti : dvodnevni posvet, Portorož 2018, 15.-16. 5. 2018. Ljubljana: Fakulteta za kemijo in kemijsko tehnologijo, Katedra za poklicno, procesno in požarno varnost. 2018, str. 1-9.
ZUPAN, Klementina, MARINŠEK, Marjan. Microstructure development of the Ni-GDC anode material for IT-SOFC. Materiali in tehnologije, ISSN 1580-2949. sep.-okt. 2012, letn. 46, št. 5, str. 445-451.
SKALAR, Tina, ZUPAN, Klementina, MARINŠEK, Marjan. Microstructure tailoring of combustion-derived Ni-GDC and Ni-SDC composites as anode materials for intermediate temperature solid oxide fuel cells. Journal of the Australian Ceramic Society, ISSN 2510-1579, Mar. 2019, vol. 55, iss. 1, str. 123-133
MAKOVEC, Darko, GORŠAK, Tanja, ZUPAN, Klementina, LISJAK, Darja. Hydrothermal synthesis of La1−XSrXMnO3La1−XSrXMnO3 dendrites. Journal of crystal growth, ISSN 0022-0248. 2013, vol. 375, no. 1, str. 78-83

RAZISKOVALNO DELO

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Raziskovalno delo
Course title:	Research work
Članica nosilka/UL Member:	UL FKKT

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Tehniška varnost, druga stopnja, magistrski	Ni členitve (študijski program)	1. letnik	1. in 2. semester	obvezni

Univerzitetna koda predmeta/University course code:	0072284
Koda učne enote na članici/UL Member course code:	TV206S

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
				300	300	20

Nosilec predmeta/Lecturer:	
Vrsta predmeta/Course type:	obvezni/Mandatory
Jeziki/Languages:	Predavanja/Lectures:
	Vaje/Tutorial:

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	Content (Syllabus outline):
Raziskovalno delo se opravlja iz področja tehniške varnosti, požarne varnosti in okoljske varnosti. Vsebina in naslov se določata v soglasju z izbranim mentorjem – nosilcem ene izmed vsebin v programu.	Research work has to be done from the field of technical safety, fire safety and environmental safety. The subject and title are chosen in accordance with the advisor – lecturer of one of the subjects from programme.

Temeljna literatura in viri/Readings:

Knjige in članki, ki so povezani z vsebino raziskovalnega dela.

Cilji in kompetence:	Objectives and competences:
Cilj predmeta je, da študentje s pomočjo laboratorijskega in praktičnega dela uporabijo osvojena teoretična znanja in v praksi spoznajo sistem tehniške in požarne varnosti, potek in vodenje procesov vzdrževanja in dviganja stopnje varnosti na	The aim of the subject is that students with help of laboratory and practical work use attained theoretical knowledge and to understand in praxis system of technical and fire safety and how to manage maintenance and safety improvements on work

delovnih mestih. Pri tem uporabijo in osvojijo potrebne instrumentalne in druge tehnike oz. metode. Dobljene rezultate z uporabo modernih programskih paketov kvantitativno obravnavajo v skladu s teoretičnimi napovedmi. Študentje pri predmetu pridobijo naslednje specifične kompetence: - uporaba pridobljenih znanj na specifičnem področju delovanja sistema varnosti in zdravja ali požarne varnosti; - samostojno opravljanje raziskovalnega in razvojnega dela.	places. During process they achieve knowledge of instrumental and other techniques needed. They process gathered data with the use of state of the art computer codes in accordance with theoretical forecasts. Students get following specific competences within the subject: • Use of the knowledge in the specific field of occupational safety and health and fire safety Independent research and development work

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje Med opravljanjem raziskovalnega dela bo študent pridobil: • sposobnosti formuliranja problema, • sposobnosti samostojnega iskanja ustrezne literature, • sposobnosti obravnavanja problema v praksi, • sposobnosti iskanja kvantitativnih rešitev in utemeljevanja ustreznosti rešitev, sposobnosti predstavitve rezultatov svojega dela. Uporaba Znanje in pridobljene veščine bo študent lahko uporabil pri opravljanju poklica in opravljanju magistrskega dela. Refleksija Pri povezovanje vseh pridobljenih teoretičnih znanj z reševanjem problemov na področju tehniške varnosti, požarne varnosti in okoljske varnosti študent pridobi kritični pogled na uporabnost teh znanj. Prenosljive spretnosti Pri delu bo študent pridobil znanja o metodah reševanja kompleksnih problemov, o načinu predstavitve teh znanj v pisani in govorjeni obliki povezani z ostalimi metodami posredovanja raziskav, ugotovitev itd.	Knowledge and Comprehension During the research work will student get: • Skill how to formulate the problem • Skill of independent literature search • Skill of problem assessment in praxis • Skill of finding quantitative solutions and defending the appropriate solution • Skill of presenting results of the work Application Knowledge and gathered skills will student apply while working on his master's thesis Analysis During linking of the theoretical knowledge with problem solving in the field of technical safety, fire safety and environmental safety student gathers critical view on applicability of the knowledge. Skill-transference Ability During work student will acquire knowledge on methods for complex problem solving, on ways to present this knowledge in written and spoken words in connection with other methods for presenting research, conclusions etc.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Individualno raziskovalno delo študenta pod mentorstvom.	Independent research work supervised by mentor.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Opravljen projekt. Ocene: 6-10 pozitivno		Finished project.

Reference nosilca/Lecturer's references:

TEHNIŠKA VARNOST

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Tehniška varnost
Course title:	Technical Safety
Članica nosilka/UL Member:	UL FKKT

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Tehniška varnost, druga stopnja, magistrski	Ni členitve (študijski program)	2. letnik	2. semester	obvezni

Univerzitetna koda predmeta/University course code:	0072295
Koda učne enote na članici/UL Member course code:	TV2A1

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
45		15 LV + 15 SV			75	5

Nosilec predmeta/Lecturer:	doc. dr. Sabina Huč
Vrsta predmeta/Course type:	obvezni/Mandatory
Jeziki/Languages:	Predavanja/Lectures: Slovenščina Vaje/Tutorial: Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	Content (Syllabus outline):
Principi tehniške varnosti	Principles of Technical Safety
Zakonodaja na področju tehniške varnosti	Legislation on the field of technical safety
Kvalitativne metode in njih uporaba	Qualitative methods and their use
Kvantitativne metode za oceno tveganj	Quantitative methods for risk assessment
Uporaba računalniških programov za oceno tveganj	Use of computer codes for risk assessment
Tveganja na delovnem mestu	Work place risks
Analize vzrokov nezgod Root cause analize	Root cause analysis
Tveganje posameznika	Individual risk
Skupinsko tveganje	Societal risk
Izdelava varnostnih poročil	Safety reports
Interpretacija rezultatov varnostnih analiz	Interpretation of the safety assessment results

Temeljna literatura in viri/Readings:

Glavna literatura:

- AIChE: Guidelines for Tecnical Management of Chemical Process Safety, New York 1989 (30%)

- Ian Sutton: Process Reliability and Risk Mangement, Van Nostrand New York, 1992 (20%)

Pomožna literatura:
- J.X.Wang, M.L.Roush: What Every Engineer should know about Risk Engineering and Management, Marcel Decker INC. , New York 2000
- ACSNI: Organizing For Safety, Health and Safety Commission, April 1993,
- Lloyd's Register The Engineering Council: Guidelines on Risk Issues, UK 1993
- Perrow C.: Normal Accidents, Living with High-Risk Technologies, Basic Books, New York, 1985
- Arendt et al:Evaluating Process Safety in the Chemical Industry, A Manager's Guide to Quantitative Risk Assessment, Chemical Manufacturers Association, Washington, USA, 1989
- Clemen, Reilly: Making Hard Decisions, PWS- Kent Publishing Company, 1991

Cilji in kompetence:	**Objectives and competences:**
Študentje naj bi spoznali, kako zbrati informacije o tveganjih ter kako te informacije lahko koristijo pri načrtovanju preventivnih ukrepov za zagotavljanje varnosti in kako lahko s pomočjo vedenja o tveganjih lahko načrtujemo svoje dejavnosti, da bodo varne in tudi prijazne do zaposlenih ter da bodo ob morebitnih nezgodah posledice čim manjše.	Students will learn how to gather information on risks and how this information can be used for planning of preventive measures for safety assurance and how can we by knowledge about risks plan activities to be safe and employee friendly and in the case of accidents to have as small as possible consequences.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje Študentje naj bi pridobil osnovna teoretska in praktična znanja, ki so potrebna za razumevanje tveganja različnih vrst. Razumeli bodo kateri so elementi tveganj. Kako lahko zmanjšujemo tveganja in s kakšnimi uktrepi povečujemo varnost. Razumel bo vlogo človeka v socio-tehnoloških sistemih in razumel zakaj je tako pomembna povezava človek stroj. Uporaba Znanja bo lahko uporabi pri problemih nevarnih postopkov in sistemov iz različnih področij človeškega delovanja. Refleksija Teoretska in praktična znanja bo lahko študent uporabil pri reševanju praktičnih in teoretskih problemov. Spoznanja o zmogljivostih in omejitvah metod tehniške varnosti mu bodo koristila pri sprejemanju tako operativnih, taktičnih in tudi pri strateških odločitvah Prenosljive spretnosti Pridobil si bo tako analitske spretnosti za reševanje problemov kot tudi komunikacijske spretnosti, ki jih bo potreboval pri vsakdanjem delu.	Knowledge and Comprehension Students will acquire the basic theoretical and practical skills to understand different risks. They will understand the elements of the risks. How can we reduce the risks and with what meassures we can enhance safety. He will understand the role of human in the socio-technological systems and understand why the connection between the man and mashine is so important. Application Knowledge will be used during problems of dangerous procedures and systems in different areas of human activity Analysis Theoretical and practical skills student will use during practical and theoretical problems solving. His recognition of capabilities and limitations of technical safety methods will enable him while taking strategic, tactical and l operational decisions. Skill-transference Ability He will get analytical skills as well as communication skills needed during every day work.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja Seminarske vaje Seminarska naloga s področja tveganj	Lectures Seminar exercises Seminar work from the field of risks

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
A) Seminarska naloga	30,00 %	A) Seminar work
B) Izvedba in predstavitev projekta	30,00 %	B) Project and its presentation
C) Pisni izpit	40,00 %	C) Written exam

Skupna ocena mora biti 6 ali več (uspešno).		Grade should be 6 or higher (successful)

Reference nosilca/Lecturer's references:

SEBERA, Václav, PEČNIK, Jaka Gašper, AZINOVIĆ, Boris, MILCH, Jaromír, **HUČ, Sabina**. Wood-adhesive bond loaded in mode II : experimental and numerical analysis using elasto-plastic and fracture mechanics models. *Holzforschung*, ISSN 1437-434X. [Online ed.], 2020, str. 1-13. https://www.degruyter.com/view/journals/hfsg/ahead-of-print/issue.xml, doi: 10.1515/hf-2020-0141.

HOZJAN, Tomaž, KARLOVŠEK, Jurij, HANŽIČ, Lucija, **HUČ, Sabina**, PLANINC, Igor. Analytical method for determination of crack development in concrete ring due to restrained shrinkage. V: KAHYA, Volkan (ur.). *Advancements in civil engineering and architecture. Volume 1, Civil engineering*. Trabzon: Golden light publishing; Dynamic academy. 2019, str. 1381-1389, ilustr.

HUČ, Sabina, SVENSSON, Staffan, HOZJAN, Tomaž. Hygro-mechanical analysis of wood subjected to constant mechanical load and varying relative humidity. *Holzforschung : International Journal of the Biology, Chemistry, Physics and Technology of Wood*, ISSN 0018-3830. Tiskana izdaja, 2018, letn. 72, št. 10, str. 863-870, ilustr., doi: 10.1515/hf-2018-0035.

UPORABA IN OSNOVE PROPADA GRADIV

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Uporaba in osnove propada gradiv
Course title:	Use of Materials and Materials Decomposition
Članica nosilka/UL Member:	UL FKKT

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Tehniška varnost, druga stopnja, magistrski (od študijskega leta 2023/2024 dalje)	Ni členitve (študijski program)	1. letnik, 2. letnik		izbirni

Univerzitetna koda predmeta/University course code:	0072286
Koda učne enote na članici/UL Member course code:	TV2B2

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
45	15	15 SV			75	5

Nosilec predmeta/Lecturer:	izr. prof. dr. Boštjan Genorio
Vrsta predmeta/Course type:	izbirni strokovni/Elective Professional
Jeziki/Languages:	Predavanja/Lectures: Angleščina, Slovenščina Vaje/Tutorial: Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	Content (Syllabus outline):
Predmet obsega naslednja poglavja: • vpliv lastnosti materiala na trajnost in zanesljivost delovanja • mehanizem nastanka poškodb pri obremenitvi, kemijskih procesih , vplivu okolja, bioloških vplivih in pri slabem ravnanju uporabnikov z napravami in objekti • osnovni mehanizem utrujanja • osnovni mehanizmi elektrokemijske korozije in korozije v plinih, elektrodni procesi, termodinamika in kinetika elektrokemijske korozije, lastnosti korozijsko odpornih materialov • mehanizmi mehanske in kemične obrabe, lastnosti obrabno odpornih materialov • mehanizmi biološkega propadanja	

• metode za spremljanje poškodb, vzdrževanje in načini sanacije	

Temeljna literatura in viri/Readings:

Batchelor, A. W., Loh N. L. Chandrasekaran, M.: Materials degradation and its control by surface engineering, 2nd Ed., London, Imperial College Press, 2002
Trethewey, K. R., Chamberlain, J.: Corrosion for science and engineering, 2nd Ed., Harlow, Longman, 1995
Mangonon, P. L.: The principles of materials selection for engineering design, Upper Saddle River, Prentice Hall, 1999

Cilji in kompetence:	**Objectives and competences:**
Študentje se seznanijo z vplivi obremenitve in okolja na življenjsko dobo materialov v obratovanju. Spoznajo mehanizem nastajanja utrujanja, korozije in obrabe materialov na makro in mikro nivoju. Seznanijo se s pomenom propadanja materialov za trajnost in zanesljivost delovanja sistemov, naprav in objektov glede na gospodarske in družbene posledice. Spoznajo osnovne postopke sprotnega spremljanja, nastanka in napredovanja propada ter osvojijo postopke vzdrževanja in sanacije.	Students understand degradation mechanisms in different materials (metallic, ceramic, polymer, composites) and common practical solutions. Subject specific competences include: - understanding the principles of thermodynamics which lead to corrosion - understanding corrosion kinetics, based on the concept of mixed potentials - understanding chemical degradation processes, - acquiring methods for determining the rate of corrosion - acquiring control methods for material degradation and its prevention - using appropriate engineering approaches to prevent corrosion.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje Pridobil bo celovita znanja o lastnostih materialov s poudarkom na kemijskih, fizikalnih in mehanskih lastnostih. Razumel bo zakaj in katere lastnosti so neodvisne od priprave, katere lastnosti pa so v bistvu odvisne od izbire procesa priprave in z njim določene mikrostrukture. Ob tem bo spoznal konkretne materiale (kovine, polimerne snovi, keramiko, kompozite idr.), ki se uporabljajo v industrijskih in drugih aplikacijah ter pridobil znanja potrebna za pravilno tolmačenje podatkov v priročnikih in bazah podatkov. To je še posebej pomembno kadar je gradivo izpostavljeno korozivni sredini ali drugim pogojem in obremenitvam, kjer prihaja do interakcije kemijskih, fizikalnih in mehanskih vplivov. Uporaba V okviru predmeta bo študent pridobil znanja potrebna za sodelovanje z drugimi strokovnjaki pri izboru primernega materiala za določeno aplikacijo ter za analizo tveganja in nevarnosti odpovedi pod normalnimi pogoji obratovanja in možnosti, da bo pri dodatnih obremenitvah materialov, zaostrenih ali izrednih razmerah prišlo do sprememb, ki povečajo tveganja do mere, nesprejemljive za varno obratovanje. Refleksija Kritična uporaba teoretičnih znanj pri interpretaciji praktičnih meritev;	Knowledge and Comprehension Student will the relation between materials properties and chemical and physical properties. The question why some materials properties depend on processing and some do not will be answered. Microstructure as important variable will be elaborated. The most important properties of materials (metals, ceramics, polymers and composites) used in industrial processes will be given and compared. Application Student will get the knowledge needed for cooperation with experts from other disciplines in selection of appropriate material for given application. Furthermore risk assessment for work under normal and extreme working conditions will be elaborated. Student must be able to define why changes in material occur and when they don't allow anymore safe operation. Analysis Rational use of theory in interpretation of real corrosion tests. Coherent evaluation of results obtained by various experimental techniques. Skill-transference Ability Ability for work in laboratory, identification and solution of corrosion problems related to materials properties.

Kritična presoja rezultatov, pridobljenih z različnimi metodologijami Prenosljive spretnosti Pri predmetu bo študent pridobil laboratorijske spretnosti, znal bo uporabljati literaturne podatke, izvajati kemijske in nekatere fizikalne meritve, eksperimentalne podatke bo znal ustrezno obdelati ter primerno interpretirati.	Ability to collect and categorize literature (web) information and ability to present acquired knowledge in written and oral form.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja	Lectures.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Ustni izpit (40%)	40,00 %	Oral exam (40%)
Seminarska naloga (60%) Ocene: 6-10 pozitivno, 1-5 negativno	60,00 %	Seminar (60%)

Reference nosilca/Lecturer's references:

Strmcnik, D.; Lopes, P. P.; Genorio, B.; Stamenkovic, V. R.; Markovic, N. M. Design Principles for Hydrogen Evolution Reaction Catalyst Materials. Nano Energy 2016, 29, 29–36. https://doi.org/10.1016/j.nanoen.2016.04.017.

Staszak-Jirkovský, J.; Malliakas, C. D. D.; Lopes, P. P. P.; Danilovic, N.; Kota, S. S. S.; Chang, K.-C.; Genorio, B.; Strmcnik, D.; Stamenkovic, V. R. R.; Kanatzidis, M. G.; et al. Design of Active and Stable Co-Mo-Sx Chalcogels as PH-Universal Catalysts for the Hydrogen Evolution Reaction. Nat. Mater. 2016, 15 (November), 197–203. https://doi.org/10.1038/nmat4481.

Vizintin, A.; Genorio, B.; Dominko, R. CHAPTER 8: Application of Graphene Derivatives in Lithium-Sulfur Batteries; 2018; Vol. 2018–Janua. https://doi.org/10.1039/9781788012829-00222.

Bobnar, J.; Lozinšek, M.; Kapun, G.; Njel, C.; Dedryvère, R.; Genorio, B.; Dominko, R. Fluorinated Reduced Graphene Oxide as a Protective Layer on the Metallic Lithium for Application in the High Energy Batteries. Sci. Rep. 2018, 8 (1), 5819. https://doi.org/10.1038/s41598-018-23991-2.

S.-Jirkovsky, J.; Subbaraman, R.; Strmcnik, D.; Harrison, K. L.; Diesendruck, C. E.; Assary, R. S.; Frank, O.; Kobr, L.; Wiberg, G. K. H.; Genorio, B.; et al. Water as a Promoter and Catalyst for Dioxygen Electrochemistry in Aqueous and Organic Media. ACS Catal. 2015, 5, 6600–6607. https://doi.org/10.1021/acscatal.5b01779.

Strmcnik, D.; Castelli, I. E.; Connell, J. G.; Haering, D.; Zorko, M.; Martins, P.; Lopes, P. P.; Genorio, B.; Østergaard, T.; Gasteiger, H. A.; et al. Electrocatalytic Transformation of HF Impurity to H2 and LiF in Lithium-Ion Batteries. Nat. Catal. 2018. https://doi.org/10.1038/s41929-018-0047-z.

Šest, E.; Dražič, G.; Genorio, B.; Jerman, I. Graphene Nanoplatelets as an Anticorrosion Additive for Solar Absorber Coatings. Sol. Energy Mater. Sol. Cells 2018, 176. https://doi.org/10.1016/j.solmat.2017.11.016.

VODENJE TVEGANJA

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Vodenje tveganja
Course title:	Risk management
Članica nosilka/UL Member:	UL FKKT

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Tehniška varnost, druga stopnja, magistrski	Ni členitve (študijski program)	1. letnik	1. semester	obvezni

Univerzitetna koda predmeta/University course code:	0072287
Koda učne enote na članici/UL Member course code:	TV206

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
45		15 LV + 15 SV			75	5

Nosilec predmeta/Lecturer:	doc. dr. Sabina Huč
Vrsta predmeta/Course type:	obvezni/Mandatory
Jeziki/Languages:	Predavanja/Lectures: Slovenščina; Vaje/Tutorial: Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	Content (Syllabus outline):
1. Sistemi vodenja tveganja, osnovni elementi vodenja tveganja. 2. Odgovornost: nameni in cilji, elementi odgovornosti: avtoriteta, odgovornost, podpora, informacije. 3. Vedenje o procesu in dokumentacija: definicija procesa, projektni kriteriji, načrtovanje procesa in opreme, varnostni sistemi. 4. Navodila za varnostni pregled velikih projektov: varnostni pregled, pregled projekta in varnostnih navodil, navodila za izvajanje projekta in nadzor 5. Vodenje procesnega tveganja: identifikacija nevarnosti, analiza tveganja med obratovanjem, upravljanje z ostalimi tveganji, vodenje procesa med nezgodami.	1. Risk management systems, basic elements 2. Accountability: objectives and goals, Elements of accountability: authority, responsibility, support and information 3. Process Knowledge and documentation, Definition of process, design basis criteria Process and equipment design, safety systems 4. Process safety review procedures for capital projects: safety reviews process design and review procedures, process management procedures and controls 5. Process risk management: Hazard identification: HAZOP, residual risk management Process management during emergencies

6. Vodenje sprememb v procesu: sprememba naprave, sprememba organizacije, sprememba navodil, stalne spremembe, začasne spremembe. 7. Integriteta procesa in opreme: zanesljivostno inženirstvo, obratovalna navodila, preventivno vzdrževanje in navodila. 8. Človeški faktor: analiza človeških napak 9. Usposabljanje in izvrševanje: izbira in razvoj programov za usposabljanje 10. Preiskava nezgod: velike nezgode, vključevanje zunanjih ekspertov, komunikacija, zbiranje podatkov in analiza. 11. Pregledi in popravne akcije: pregledi, ugotavljanje spoštovanja obveznosti, notranji in zunanji pregledovalci	6. Management of change Change of technology, change of organization, change of procedures, permanent changes, temporary changes 7. Process and Equipment integrityReliability engineering, Maintenance procedures Testing procedures 1. Human factors,Human error analysis 2. Training and Performance,Selection and development of training programs 3. Accident investigation,Major accidents, inclusion of third party experts, communication, data acquisition and analysis 4. Audits and Corrective Actions,Compliance reviews,Internal /External Auditors

Temeljna literatura in viri/Readings:

Glavna literatura:

- AIChE: Guidelines for Tecnical Management of Chemical Process Safety, New York 1989 (30%)
- Ian Sutton: Process Reliability and Risk Mangement, Van Nostrand New York, 1992 (30%)
- Guidelines for Chemical Process Quantitative Risk Analysis, Second Ed., Center for Chemical Process Safety, American Institute of Chemical Engineers, 2000. (10%)
- Guidelines for Analyzing and Managing the Security Vulnerabilities of Fixed Chemical Sites (10%)

Pomožna literatura:

- J.X.Wang, M.L.Roush: What Every Engineer should know about Risk Engineering and Management, Marcel Decker INC. , New York 2000
- ACSNI: Organizing For Safety, Health and Safety Commission, April 1993,
- Lloyd's Register The Engineering Council: Guidelines on Risk Issues, UK 1993
- Perrow C.: Normal Accidents, Living with High-Risk Technologies, Basic Books, New York, 1985
- Arendt et al:Evaluating Process Safety in the Chemical Industry, A Manager's Guide to Quantitative Risk Assessment, Chemical Manufacturers Association, Washington, USA, 1989

Cilji in kompetence:	**Objectives and competences:**
Študentje naj bi spoznali, kako informacije o tveganju lahko koristijo pri načrtovanju preventivnih ukrepov za zagotavljanje varnosti in kako lahko s pomočjo vedenja o tveganju optimiramo svoje dejavnosti, da bodo varne in da bodo tudi prijazne do okolja.	Students should learn how they can benefit by information on risk for designing preventive measures assuring safety and how we can optimize our activities to be safe and environmental friendly.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje Študentje naj bi pridobili osnovna teoretska in praktična znanja, ki so potrebna za vodenje tveganja. Spoznali bodo vse elemente vodenja tveganja in tudi kako se odloča v pogojih negotovosti. Uporaba Znanja, ki jih bodo študentje osvojili jim bodo pomagala pri odločanju glede vseh vrst tveganj. Znali bodo uporabiti rezultate varnostnih analiz in jih tudi kritično oceniti ter se na njihovi osnovi tudi odločiti kako se nevarnostim izogniti in kako zmanjšati posledice. Refleksija Teoretska in praktična znanja bo lahko študent uporabil pri reševanju praktičnih in teoretskih problemov (študij in praksa). S pomočjo spoznanj o	Knowledge and Comprehension Student should gathered basic theoretical and practical skills needed for risk management and also how to make decisions in uncertainty Application Knowledge, which will students gather will help them when making decisions on variety of risks. They will be able to use the results of safety analyses in to judge them critically and to decide how to avoid the hazards and to reduce the consequences. Analysis Theoretical and practical knowledge will be used for solving theoretical and practical problems. With knowledge about the capabilities and limitations of the risk assessment methods students will find out

zmogljivostih in omejitvah posameznih metod za oceno tveganj bo lahko študent ocenil kaj v praksi pomenijo in to mu bo dalo osnovo za mnoge pomembne kasnejše odločitve. Prenosljive spretnosti Logično razmišljanje in logično povezovanje nepopolnih informacij v celoto na osnovi katere se vrši proces odločanja so spretnosti, ki bodo študentu koristile povsod.	their use in praxis which will enable them later making important decisions. Skill-transference Ability Logical thinking and logical linking imperfect information into the whole based on which decision process is taking place are skills from which will students benefit in all professional areas.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja Laboratorijske vaje	Lectures Exercises

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Izpit pisni in ustni. Ocene: 6-10 pozitivno		Exam written and oral. Grades 6-10 positive

Reference nosilca/Lecturer's references:

HUČ, Sabina, PEČENKO, Robert, HOZJAN, Tomaž. Predicting the thickness of zero-strength layer in timber beam exposed to parametric fires. *Engineering structures*, ISSN 0141-0296. [Print ed.], feb. 2021, št. 111608, letn. 229, str. 1-11, ilustr. https://www.sciencedirect.com/science/article/pii/S0141029620342097?via%3Dihub, https://doi.org/10.1016/j.engstruct.2020.111608, https://repozitorij.uni-lj.si, doi: 10.1016/j.engstruct.2020.111608

HUČ, Sabina, SVENSSON, Staffan, HOZJAN, Tomaž. Numerical analysis of moisture induced strains and stresses in glued-laminated timber. *Holzforschung : International Journal of the Biology, Chemistry, Physics and Technology of Wood*, ISSN 0018-3830. Tiskana izdaja, 2019, str. 1-13, ilustr. https://www.degruyter.com/view/j/hfsg.ahead-of-print/hf-2019-0025/hf-2019-0025.xml?format=INT, doi: 10.1515/hf-2019-0025.

HUČ, Sabina, SVENSSON, Staffan. Influence of grain direction on the time-dependent behavior of wood analyzed by a 3D rheological model. A mathematical consideration. *Holzforschung : International Journal of the Biology, Chemistry, Physics and Technology of Wood*, ISSN 0018-3830. Tiskana izdaja, 2018, letn. 72, št. 10, str. 889-897, ilustr., doi: 10.1515/hf-2017-0180.