UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	ANALIZE TVEGANJA
Course Title:	RISK ANALYSIS

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UŠP Tehniška varnost, 1. stopnja	**/**	**3.**	**5.**
USP Technical Safety, 1st Cycle	**/**	**3rd**	**5th**

Vrsta predmeta / Course Type	obvezni / Mandatory
Univerzitetna koda predmeta / University Course Code:	TV118

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individ. Work	ECTS
45	**/**	**30 LV**	**/**	**/**	**75**	**5**

Nosilec predmeta / Lecturer:	doc. dr. Sabina Huč / Dr. Sabina Huč, Assistant Professor
Jeziki / Languages:	**Predavanja / Lectures:** **Slovenski / Slovenian** **Vaje / Tutorial:** **Slovenski / Slovenian**

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):**
Kako sprejeti odločitev ali uporabiti kvantitativno varnostno analizo Pravilna ocena argumentov za izvedbo varnostne analize Izbor in uporaba kvantitativne varnostne analize, ter seznanitev z vsemi kvalitativnimi in kvantitativnimi elementi varnostne analize. Uporaba modelov za komponente sistemov in ugotavljanje podatkov za te modele. (Baze podatkov o posameznih pomembnih komponentah ter kvantitativne metode določanja parametrov zanesljivosti komponent) Induktivne metode • Failure Mode and Effect Analysis	How to take decision to use qualitative risk analysis Argument based decision to use risk analysis Selection and use of risk assessment, Acquaintance with all qualitative and quantitative elelements of risk assessment. Use of models for system components and data base collection for these models. (Quantitative methods for reliability model parameter determination) • Failure Mode and Effect Analysis (FMEA), Failure Mode Effect and Criticality Analysis (FMECA) • Hazard and Operability Study (HAZOP) Deductive methods

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(FMEA), Failure Mode Effect and Criticality Analysis (FMECA) (sistematične metode analize odpovedi sistemov)
- Hazard and Operability Study (HAZOP) (sistematične metode analize nevarnosti med obratovanjem)

Deduktivne metode
- Drevo dogodkov (analiza nezgodnih scenarijev in njihovo logično modeliranje)
- Drevo odpovedi (analiza odpovedi posameznih sistemov in njih logično modeliranje)

Analiza napak s skupnim vzrokom
Analiza človeške zanesljivosti
Analiza zunanjih dogodkov
Vrednotenje modelov s pomočjo računalniških programov ter interpretacija rezultatov. Definiranje meril pomembnosti in njihova vloga pri vrednotenju.
Merila, izračun in predstavitev ocen tveganja
- Mere tveganja
- Predstavitev tveganja
- Izračun tveganja
- Negotovosti občutljivosti in pomembnost pri tveganju

Uporaba rezultatov kvantitativne analize za upravljanje s tveganjem
Interpretacija kvantitativnih rezultatov v varnostni analizi in pomembnost predpostavk pri tem
Metode za oceno organizacijskih faktorjev
- Management Oversight and Risk Tree (MORT)
- Work Process Analysis Model (WPAM)

- Event tree (accident scenario analysis and their logical modeling
- Fault tree analysis (System logical modeling)

Common Cause Failures
Human reliability analysis
External event analysis
Quantitative evaluation of models using computer codes and interpretation of the results
Importance meassuers definition and their rolle within evaluation of risk
Risk meassures and representation of risk assessment
- Risk meassures
- Risk representation
- Risk calculation
- Uncertainties, sensitivity and importances within risk

Use of the results of quantitative analysis for risk management
Interpretation of qualitative results in risk assessment and importance of assumptions
Methods for organizational factors assessment
- Management Oversight and Risk Tree (MORT)
- Work Process Analysis Model (WPAM)

Temeljni literatura in viri / Readings:

Glavna literatura:
- Fault tree handbook, NUREG -0492, Nuclear Regulatory Commission, 1986 209 str. (70%)
- Ian Sutton: Process Reliability and Risk Management, Van Nostrand Reinhold, New York, 1992, 277 str. (30%)
- AIChE. Guidelines for Chemical Process Qunatitative Risk Analysis, New York 1989, 382 str. (20%)
- Rausand, M., Haugen, S. Risk Assessment: Theory, Methods, and Applications, Wiley, 2020 (70 %)

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Dopolnilna literatura:

- E.E.Lewis, Introduction to Reliability Engineering, Willey 1987 400 str.
- Gertman I.D., Blackman H.S.: Human Reliabilty and Safety Analysis Data Handbook, John Willey & Sons Inc. 1994, 448 str.
- Kletz T.A.:HAZOP and HAZAN, The institution of Chemical Enginers, Rugby 1986, 256 str.
- AIChE, Layer of Protection Analysis. Simplified Process Risk Assessment. AIChE, New York, 2001 (5 %)
- Macdonald, D. Practical Hazops, Trips and Alarms. Elsevier, 2004 (5 %)

Cilji in kompetence:	**Objectives and Competences:**
Namen predmeta je seznaniti študente z uporabo metod za analize tveganj. Teoretično bodo študenti spoznali metode na predavanjih praktično pa na vajah pri katerih bodo spoznali tudi računalniške programe za izvajanje takih analiz. S pomočjo seminarske naloge bodo znanje utrdili in s pomočjo ene od metod rešili praktični realni problem.	Aim of the course is to teach students with the use of risk assessment methods. Theoretically they will learn methods and practically during exercises. Students will learn how to use computer codes for risk analyses. During seminar work they will solve realistic problem.
Predvideni študijski rezultati:	**Intended Learning Outcomes:**
<u>Znanje in razumevanje</u> Študent bo pridobil osnovna teoretska in praktična znanja, ki so potrebna za razumevanje različnih analiznih postopkov, ki jih inženir nujno potrebuje pri vsakodnevnih odločitvah in je temeljni pogoj za izvedbo praktičnih analiz. Prav tako bodo sposobni kritično presoditi zmogljivosti nekaterih analiznih metod, primerjati kvalitativne in kvantitativne metode. Razen teoretskih temeljev bodo pridobili tudi praktična znanja.	<u>Knowledge and Comprehension</u> Student will obtain basic theoretical and practical skills, needed for understanding analitical practices that engineer needs in everyday decisions and is fundamental condition for performing analysis. Besides theoretical fundamentals students will obtain also practical skills.
<u>Uporaba</u> Analiza tveganj je usmerjena v reševanje praktičnih problemov, ki so nujni tako pri snovanju varnejših sistemov. Pri predmetu bodo študentje pridobili znanja, ki jim omogočajo izvedbo preprostih in zahtevnejših analiz. Poleg matematičnih osnov, ki so osnova razumevanje analiz bodo pridobili tudi praktična znanja, ki so potrebna pri zasnovi in izvedbi logičnih modelov ter interpretaciji podatkov in dobljenih rezultatov. Pomemben vidik predmeta je predstaviti študentu kritičen pogled na podajanje rezultatov in zmogljivosti različnih analiz.	<u>Application</u> Risk analysis is oriented towards solving of practical problem, which are needed for design of safer systems. The course will enable students to perform more basic and also more advanced analyses. Besides mathematical basiscs that are fundamental for analysis understanding students will obtain also pactical knowledge needed for making logical models and for interpretation of input data and the results. Important aspect of the course is to present to student critical view on results and on possibilities of different analyses.

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Refleksija Kritična presoja uporabnosti posameznih metod za oceno tveganja.	Reflection Critical judgement for use of different risk assessment methods.
Prenosljive spretnosti Pri predmetu bo študent pridobil intelektualne spretnosti, znal bo uporabljati podatke iz literature, izvajati izračune za pridobitev uporabnih podatkov, eksperimentalne podatke bo znal ustrezno obdelati ter primerno interpretirati.	Skill-transference Ability During the course will student obtain intelectual skills, he will be able to use data from literature, he will be able to calculate data needed for analysis based on experimental data and to process them and interpret them soundly.

Metode poučevanja in učenja:	**Learning and Teaching Methods:**
Predavanja Vaje	Lectures Exercises

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Način (pisni izpit, ustno izpraševanje, naloge, projekt) Izpit pisni in ustni. Ocene: 6-10 pozitivno Vaje: Opravljen kolokvij Pri vajah predstavlja delež ocene tudi uspešno delo na vajah (1/3).	**70%** **30%**	

Reference nosilca / Lecturer's References:

- **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.

- 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.

- **HUČ, Sabina**, SVENSSON, Staffan. Coupled two-dimensional modeling of viscoelastic creep of wood. *Wood Science and Technology*, ISSN 0043-7719, jan. 2018, letn. 52, št. 1, str. 29-43, ilustr., doi: 10.1007/s00226-017-0944-3.

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