UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	RANLJIVOST SISTEMOV
Course Title:	VULNERABILITY OF SYSTEMS

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
MAG Tehniška varnost, 2. stopnja	/	1.	1.
USP Technical Safety, 2nd Cycle	/	1.	1.

Vrsta predmeta / Course Type: obvezni/ Mandatory

Univerzitetna koda predmeta / University Course Code: TV203

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
45	/	15 LV + 15 SV	/	/	75	5

Nosilec predmeta / Lecturer: doc. dr. Klementina Zupan / Dr. Klementina Zupan, 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:

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 z obstoječimi

Content (Syllabus outline):

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
3. Management of chemical and process systems

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	• Integration of protection chemical-process systems and SVA activities with existing environmental, health and safety programs • Following SVA recommendations and revalidation of SVA analyses • Interface between safety of dangerous substances in fixed systems and during transportation 4. 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:**
<u>Znanje in razumevanje</u> Teoretična znanja o zanesljivosti sistemov v povezavi s tveganjem. Razumevanje vplivnih pojavov na odpovedi sistemov in na nezgodne procese ob upoštevanju obnašanja človeka.	<u>Knowledge and Comprehension</u> 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.
<u>Uporaba</u> Varno in učinkovito uporabljanje z inženirskimi sistemi z namenom zmanjševati tveganje oz. upravljati s tveganjem ob spremljanju predpisov.	<u>Application</u> Safe and efficient management of engineering systems with aim to reduce risk or risk management in accordance with legislation
<u>Refleksija</u> Interpretacija izrednih stanj sistemov v prometu (procesna industrija, ladje, terminali, pristanišča, skladišča itd.). Iznajdljivost v mednarodnem prostoru in komunikacija z nadrejenimi upravnimi organi.	<u>Analysis</u> 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.
<u>Prenosljive spretnosti</u> 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.	<u>Skill-transference Ability</u> 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 (v %) / Weight (in %)	**Assessment:**
A) Seminarska naloga	**30**	A) Seminar work
B) Izvedba in predstavitev projekta	**30**	B) Project and presentation of project work
C) Pisni izpit	**40**	C) Written exam

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