

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet: KEMIJSKA IN PROCESNA VARNOST
Course Title: CHEMICAL AND PROCESS SAFETY

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UŠP Kemijsko inženirstvo, 1. stopnja	/	2.	4.
USP Chemical Engineering, 1 st Cycle	/	2 nd	4 th

Vrsta predmeta / Course Type:

obvezni / Mandatory

Univerzitetna koda predmeta / University Course Code: IN118

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

Nosilec predmeta / Lecturer: doc. dr. Barbara Novosel / Dr. Barbara Novosel, Assistant Professor

Jeziki / Languages:

Predavanja / Lectures: slovenski / Slovenian

Vaje / Tutorial: slovenski / Slovenian

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

Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.

Prerequisites:

The course has to be assigned to the student.

Vsebina:

Prepoznavanje, razumevanje delovanja in obvladovanje nevarnih kemikalij (eksplozivne, vnetljive, oksidativne, strupene, jedke in okolju nevarne kemikalije ter plini). Pregled evropskega sistema obvladovanja tveganja pri ravnanju s kemikalijami - REACH. 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.

Content (Syllabus outline):

Knowledge on recognition, understanding and management of hazardous chemicals (explosive, flammable, oxidizing, toxic, corrosive and environmentally hazardous chemicals and gases). Fundamentals of European system of risk management in handling the chemicals - REACH. 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 kemijskem procesu, začetni dogodki, širjenje izrednih dogodkov, zmanjševanje posledic izrednih dogodkov.

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.

Vaje: seznanjanje z možnim tveganjem v kemijskem procesu (podatki o nevarnih kemikalijah, vnetljive trdne snovi), določevanje snovnih lastnosti snovi (plamenišče, tališče), prašne eksplozije (določevanje minimalne vžigne energije), plini (nevarnosti, preprečevanje, označevanje tlačnih posod), možnosti in načini preprečevanja nastanka izrednih razmer.

Identification of potential risks in the chemical process, initiating events, the spread of incidents, reducing the consequences of exceptional events.

Analysis of industrial processes and the preparation of risk assessments. Capture important and critical process parameters and conditions that affect the security of the possible scenarios of emergencies. Qualitative and quantitative risk assessment.

Exercises: Students get knowledge of the risk in chemical process (information about hazardous chemicals, flammable solids), determination of material properties (flash point, melting point), dust explosion (determination of minimum ignition energy), gas (hazard prevention, identification of pressure vessels), possibilities and ways of preventing the occurrence of an emergency.

Temeljna literatura in viri / Readings:

- Burke R.: Hazardous materials chemistry for emergency responders, 3rd Ed. CRC Press, Boca Raton 2013, 527 str. (30 %)
- Brauer, R., L.: Safety and health for engineers, 3rd Ed., Wiley, cop. Hoboken (New Jersey), 2016 765 str. (30 %)
- Hauptmanns, U.: Process and plant safety, Springer, cop. Heidelberg [etc.] 2015 665 str. (40 %)

Cilji in kompetence:

Pri predmetu se študenti seznanijo z zagotavljanjem varnosti pri delu z različnimi kemikalijami v laboratoriju in v kemijskih ter procesnih industrijah. Spoznajo potrebo po natančnem poznavanju vseh lastnosti kemikalij, ki jih pri svojem delu uporabljajo. 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 ocena tveganja. Spoznajo, da je varnost procesa pogojena z mnogo dejavniki in da je za njegovo varno obratovanje potrebno tako optimalno delovanje posameznih procesnih

Objectives and Competences:

Students get knowledge to ensuring safety, health and loss prevention in chemical processes. Learn about the need of precise knowledge of the characteristics of chemicals they use at work. 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

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.

chemical and other related processes, identify potential critical points, preparation of risk assessment and risk reduction measures.

Predvideni študijski rezultati:

Znanje in razumevanje

Študentje se pri predmetu usposobijo za sistematičen pregled nevarnosti pri uporabi nevarnih kemikalij ter pri delu v kemijskih in sorodnih procesih, za zaznavanje potencialnih kritičnih mest, pripravo ocene tveganja in ukrepov za zmanjšanje tveganja.

Uporaba

Delo z nevarnimi kemikalijami. Vodenje in nadzor kemijskih procesov. Ocenjevanje tveganja kemijskih procesov. Analiza nazgod in določevanje ukrepov za preprečitev nezgod.

Refleksija

Študenta se usmeri v podrobnejši pregled lastnosti posamezne kemikalije z namenom, da ugotovi nevarnosti snovi za človeka in okolje. Na osnovi spoznanj mora določiti varnostne ukrepe za zmanjšanje ali celo eliminacijo tveganja pri rabi kemikalije. Glede na veljavno SI zakonodajo so podana znanja osnova za opravljanje izpita za svetovalce za kemikalije v različnih podjetjih, kakor tudi temelji za delo v carinski, komercialni ali inšpektorski službi.

Prenosljive spretnosti

Sistematičen, analitičen pristop do reševanja problema, več razumevanja in upoštevanja varnostne kulture.

Intended Learning Outcomes:

Knowledge and Comprehension

The subject makes students capable of a systematic review of the risks of using dangerous chemicals and work in the chemical and related processes for detecting potential critical points, risk assessment and risk reduction measures.

Application

Work with hazardous chemicals. Management and control of chemical processes. Risk assessment of chemical processes. Accident analysis and determination of measures to prevent accidents.

Analysis

A student will be directed to a more detailed examination of the properties of each chemical in order to identify the hazards of the substance for humans and the environment. Based on the findings should establish the security measures for the reduction or even elimination of risk in the use of chemicals.

According to the current SI legislation knowledge is the basis for the exam for counselors of chemicals in various companies, as well as it is basis for the job of customs, commerce or in the field of inspections.

Skill-transference Ability

Systematic, analytical approach to problem solving, more understanding and taking into account safety culture.

Metode poučevanja in učenja:

- Predavanja,
- seminarji,
- praktične vaje

Learning and Teaching Methods:

- lectures,
- Seminars,
- Practical exercises

Delež (v %) /

Načini ocenjevanja:

Weight (in %) **Assessment:**

Opravljenе vaje, pisni izpit (računske naloge), ustni izpit (15 min), ocenjevalna lestvica skladna s Statutom UL.		
Vaje. 20%	20 %	Laboratory practice
Pisni izpit. 50%	40 %	Written exam
Ustni izpit. 50%	40 %	Oral exam

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]