

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet: OSNOVE PROCESNE TEHNIKE
Course Title: FUNDAMENTALS OF PROCESS ENGINEERING

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UŠP Tehniška varnost, 1. stopnja	/	2.	3.
USP Technical Safety, 1 st Cycle	/	2 nd	3 rd

Vrsta predmeta / Course Type

obvezni / Mandatory

Univerzitetna koda predmeta / University Course Code:

TV111

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:

prof. dr. Igor Plazl / Dr. Igor Plazl, Full 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:

Kemijski procesi: od surovih materialov do kemijskega produkta. Načrtovanje kemijskih procesov in integracija. Kontinuirni in šaržni procesi. Osnovne operacije (mletje; mešanje filtracija; absorpcija, destilacija, sušenje). Nadzor procesov. Procesna varnost in modeliranje.
Termodinamske lastnosti in fazno ravnotežje. Termodinamski sistemi. Enačbe stanja. Zakoni termodinamike (prvi zakon o ohranitvi energije, drugi ali entropijski zakon). Specifična toplota, notranja energija, delo, entalpija, prosta energija in prosta entalpija. Fazni prehodi.
Uvod v kemijsko reakcijsko inženirstvo. Osnove reakcijske kinetike. Hitrost kemijske reakcije. Idealni reaktorji. Šaržni in polšaržni reaktorji.

Content (Syllabus Outline):

Chemical process: from raw materials to chemical product. Design and integration of chemical processes. Continuous and batch processes. Unit operations (milling, mixing, absorption, filtration, distillation, drying). Process control. Process safety and modeling.
Thermodynamic Properties and Phase Equilibrium. Thermodynamic systems. Equations of State. Thermodynamics laws (the first law of conservation of energy, entropy or the second law). Specific heat, internal energy, work, enthalpy, free energy and free enthalpy. Phase transitions.
Fundamentals of Chemical Reaction Engineering. Basics of Reaction Kinetics. Rate of reaction. Ideal reactors. Batch and semi batch reactors. Stirred reactors. Ideal tubular

Mešalni reaktor. Idealni pretočni reaktor. Uvod v katalitske reakcije.

Osnove transportnih pojavov. Prenos gibalne količine in tok tekočin. Uvod v mehaniko fluidov. Prenos toplote. Mehanizmi prenosa toplote: prevajanje, konvekcija, sevanje. Prenos snovi. Mehanizmi prenosa snovi: difuzija, konvekcija. Stacionarnost in nestacionarnost. Rešitev enodimenzijskih primerov.

Uvod v modeliranje procesov. Opredelitev problema: procesna shema, opredelitev odvisnih in neodvisnih spremenljivk, procesni parametri. Opredelitev mehanizmov procesa. Ohranitvene enačbe in razvoj modelnih enačb za preproste sisteme. Rešitev preprostih sistemov.

reactors. Basis of catalysis.

Introduction to transport phenomena. Momentum and fluid flow. Fundamentals of fluid mechanics. Heat transport. Mechanisms of heat transport: conduction, convection, radiation. Mass transport. Mechanisms of mass transport: diffusion, convection. Stationary and nonstationary systems. Solving of one dimension problems.

Introduction to process modeling. Problem definition: scheme of the process, process dependent and independent variables, process parameters. Definition of process mechanisms. Elementary balances and development of model equations. Solving of simple systems.

Temeljna literatura in viri / Readings:

- Z. Rant, Termodinamika: knjiga za uk in prakso, Ljubljana, Fakulteta za strojništvo, 2001, 607 str., (30%)

- T. Koloini, Prenos toplote in snovi, FKKT, Ljubljana, 1999, 273 str., (30%)

Dopolnilna literatura:

- Y. A. Cengel and M. A. Boles, Thermodynamics: An Engineering Approach, McGraw-Hill, Inc, USA 2005, 988 str.,

- R. Modic, Termične in difuzijske operacije, DDU Univerzum, Ljubljana, 1978, 148 str.,

- C.J. Geankoplis, Transport Processes and Unit Operations, Prentice Hall PTR, 1993, 921 str.,

- W. L. McCabe, J. Smith, P. Harriott, Unit Operations of Chemical Engineering, McGraw-Hill Professional, New York, 2004, 1152 str.,

- O. Levenspiel, Osnovi teorije i projektovanja hemijskih reaktorov, ICS i TMF, Beograd, 1979, 571 str.,

- O. Levenspiel, Chemical Reaction Engineering, 3-rd Edition, John Wiley and Sons, USA, 1998, 688 str.,

- Perry's Chemical Engineers' Handbook, 8-th Ed., Mc Graw-Hill Book Company, New York, 2007, 2400 str.,

- R. King, Safety in the Process Industries, New Ed., Butterworth-Heinemann Ltd. London, 1994, 762 str.

Cilji in kompetence:

Cilj predmeta je omogočiti globlje spoznavanje in razumevanje baznih znanj termodinamike, transportnih pojavov in kemijske tehnike, skupaj s poznavanjem osnovnih inženirskih konceptov.

Objectives and Competences:

Objective of the course is deeper knowledge and understanding fundamentals of thermodynamics, transport phenomena and chemical technology, on basis of chemical engineering concepts.

Predvideni študijski rezultati:

Intended Learning Outcomes:

<p><u>Znanje in razumevanje</u> Varnostni inženir je pri svojem delu soočen s potrebo po osnovnem razumevanju tehnoloških postopkov in raznovrstnih specifičnih procesov, ki ga usposablajo za kvalitetno in inovativno delo na svojem področju.</p>	<p><u>Knowledge and Comprehensions:</u> Safety Engineer is faced at his/her work with the need to understand the basic techniques and understanding of specific processes, which qualify him/her for excellence and innovative work in his/her field</p>
<p><u>Uporaba</u> Tako izobražen profil je sposoben ustrezne strokovne komunikacije z ostalimi tehnično podkovanimi kadri, kar privede do uspešnih in rešitev konkretnih problemov. Pomemben vidik predmeta je študenta naučiti kritičnega pogleda na problem in na osnovi sintetiziranih znanj podati hitre in učinkovite rešitve v praksi.</p>	<p><u>Application</u> Such educated profile student is skilled for professional communication with other technically knowledgeable staffs which leads to successful solutions to concrete problems. Student learns to have critical view on the problem and on the basis of synthesized knowledge to provide quick and effective solutions in practice.</p>
<p><u>Refleksija</u> Kritična primerjava teoretskega znanja s praktično uporabo na področju pojava in širjenja požarov.</p>	<p><u>Analysis</u> Critical comparison of theoretical knowledge with practical application in candidate's working field.</p>
<p><u>Prenosljive spretnosti</u> Pri predmetu se študent nauči sintetizirati vsebine znanj, pridobljene z različnih področij tehničnih in naravoslovnih segmentov, ter tako pridobi vzorec za inovativno delo na drugih področjih.</p>	<p><u>Skill-transference Ability</u> By matter of this course student learns to connect knowledge of different technical and natural science segments and acquires mode for innovative work on different fields.</p>

Metode poučevanja in učenja:

Predavanja, seminarji (individualno delo predavatelj – študent)

Learning and Teaching Methods:

Lectures, seminars.

Načini ocenjevanja:

Izpit pisni in ustni.
Ocene: 6-10 pozitivno

Delež (v %) /

Weight (in %) **Assessment:**

Written and oral exam.

Reference nosilca / Lecturer's References:

- JOVANOVIĆ, Goran N., ATWATER, James E., ŽNIDARŠIČ PLAZL, Polona, **PLAZL, Igor**. Dechlorination of polychlorinated phenols on bimetallic Pd/Fe catalyst in a magnetically stabilized fluidized bed. The chemical engineering journal, ISSN 1385-8947. [Print ed.], 2015, vol. 274, str. 50-60
- LUBEJ, Martin, KALČÍKOVÁ, Gabriela, **PLAZL, Igor**, ŽGAJNAR GOTVAJN, Andreja. Feasibility of carbon nanofiber catalyst support for the heterogeneous Fenton process. Journal of environmental engineering, ISSN 0733-9372, str. 1-6
- MILOŽIČ, Nataša, LUBEJ, Martin, NOVAK, Uroš, ŽNIDARŠIČ PLAZL, Polona, **PLAZL, Igor**. Evaluation of diffusion coefficient determination using a microfluidic device. Chemical and biochemical engineering quarterly, ISSN 0352-9568, 2014, vol. 28, no. 2, str. 215-22.