

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Procesne naprave
Course title:	Process equipment

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Tehnologije in sistemi – prva stopnja	Tehnologije in sistemi	tretji	peti
Technologies and systems – 1st cycle	Technologies and systems	third	fifth

Vrsta predmeta / Course type modularni/modular

Univerzitetna koda predmeta / University course code: TS M1 UN2

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Laboratorijske vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
45		15	15		100	6

Nosilec predmeta / Lecturer: izr. prof. dr. Viktor Grilc

Jeziki / Languages:	Predavanja / Lectures:	slovenski/slovenian
		angleški/english
	Vaje / Tutorial:	slovenski/slovenian
		angleški/english

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

- vpis v tretji letnik študija,
- znanje vsaj enega tujega jezika (angleščina),
- študent(ka) naj pripravi vsaj eno seminarsko nalogo, ki jo predstavi pred občinstvom (študenti, profesorji).

Prerequisites:

- enrollment in the third year of study,
- knowledge of at least one foreign language (English),
- the student should prepare at least one seminar assignment to present in front of the audience (students, professors).

Vsebina:

Content (Syllabus outline):

- *Mehanske procesne naprave:* filtracija, aglomeracija, drobljenje, mešanje: posode z mešalom, tipi mešal, vnos energije, čas pomešanja, naprave in procesi.
- *Naprave v kemijskem inženirstvu:* reaktorji in reakcijski sistemi, kataliza, naprave in procesi.
- *Naprave v bioprocenem inženirstvu:* mikrobiološki in biokemijski procesi, bioreaktorji, kinetika bioprocsov.
- *Membranska tehnologija:* mikrofiltracija, ultrafiltracija, reverzna osmoza, elektrodializa, separacija plinov, pervaporacija, naprave in procesi.
- *Okoljsko procesno inženirstvo:* medsebojni vplivi C, S, P, N in O tokokrogov v naravi in njihov vpliv na bio celico, mehansko, termično in biološko čiščenje trdnih, kapljevityh in plinastih emisij.
- *Čistilne naprave za vodo:* voda in antropogeni vplivi, KPK, BPK, biološke čistilne naprave, čiščenje industrijskih odpadkov.
- *Ravnanje z odpadki:* ločeno zbiranje in reciklaža, odlaganje in odlagališča, sežiganje in sežigalnice.
- *Vodenje in nadzor procesov, saržni in kontinuirani procesi, procesni modeli in modeliranje, strategije vodenja procesov.*
- *Procesni inženiring.*
- *Načrtovanje procesov.*
- *Predstavitev projektnege dela.* Procesne naprave.
- *Sonaravni razvoj in procesna tehnika:* ekonomski, okoljski in socialni vidik, inženirski kodeks, standardi in priporočila, integralno okoljsko poročilo.

- *Mechanical processing devices:* filtration, agglomeration, crushing, mixing: mixing vessels, types of mixers, energy input, mixing time, devices and processes.
- *Devices in chemical engineering:* reactors and reaction systems, catalysis, devices and processes.
- *Devices in bioprocess engineering:* microbiological and biochemical processes, bioreactors, kinetics of bioprocesses.
- *Membrane technology:* microfiltration, ultrafiltration, reverse osmosis, electrodialysis, gas separation, pervaporation, devices and processes.
- *Environmental process engineering:* mutual influences of C, S, P, N and O circuits in nature and their influence on the bio cell, mechanical, thermal and biological purification of solid, droplet and gaseous emissions.
- *Water treatment plants:* water and anthropogenic influences, COD, BOD, biological treatment plants, cleaning of industrial waste.
- *Waste management:* separate collection and recycling, disposal and landfills, incineration and incinerators.
- *Process management and control, batch and continuous processes, process models and modeling, process management strategies.*
- *Process engineering.*
- *Process planning.*
- *Presentation of project work.* Process devices.
- *Sustainable development and process technology:* economic, environmental and social aspects, engineering code, standards and recommendations, integrated environmental report.

Temeljni literatura in viri / Readings:

Temeljna literatura/Basic literature

Hriberšek, Matjaž. Procesna tehnika. Del 1, Osnove, mešanje, sušenje. Maribor: Fakulteta za strojništvo, 2005. ISBN - 86-435-0674-5.

Tuma, Matija in Mihael Sekavčnik, Energetski stroji in naprave: osnove in uporaba. Ljubljana: Fakulteta za strojništvo, 2005. ISBN - 961-6536-01-X.

Priporočljiva literatura/Recommended literature

Ullmann's Encyclopedia of Industrial Chemistry, 6th Edn. (2003) Weinheim: Wiley-VCH, 40 volumes
Vogel, G. H. (2005) *Process development*. Weinheim: Wiley-VCH Verlag.

Schwister, K. (2000) *Taschenbuch der Verfahrenstechnik. Fachbuchverlag*. Leipzig: Leipzig, Carl Hanser Verlag.

Perry, H. R., Green, D. W. (2007) *Perry's chemical engineer's handbook. Eighth edition*. New York: McGraw-Hill.

Seader, J. D., Henley, E. J. (1998) *Separation process principles*. New York: John Wiley and Sons.

Grossmann, P., Widmer, F., Sinn, H. (1997) *Einführung in die thermische Verfahrenstechnik, 3. Auflage* Berlin: De Gruyter.

Levenspiel, O. (2003) *Chemical Reaction Engineering, 3rd edn*. New York: John Wiley and Sons.

Katoh, S., Yoshida, F. (2009) *Biochemical Engineering*. Weinheim: Wiley-VCH.

Fränzle, S., Markert, B., Wüschmann, S. (2012) *Introduction to Environmental Engineering*. Weinheim: Wiley-VCH.

Cilji in kompetence:

Učna enota prispeva predvsem k razvoju naslednjih splošnih in specifičnih kompetenc:

- sposobnost obvladovanja standardnih razvojnih metod, postopkov in procesov,
- sposobnost uporabe pridobljenega teoretičnega znanja v praksi,
- sposobnost obvladovanja razvoja in napredka,
- kooperativnost, usposobljenost za timsko delo,
- sposobnost razumevanja in uporabe sodobnih teorij s področja tehniških, tehnoloških in naravoslovnih ved,
- sposobnost interdisciplinarnega povezovanja znanja,
- sposobnost reševanja konkretnih delovnih problemov na področju tehnologij in sistemov z uporabo standardnih strokovnih metod in postopkov,
- poznavanje, uporabljanje in spremljanje metode celovite kakovosti (ISO 14000, EMAS).

Objectives and competences:

The learning unit mainly contributes to the development of the following general and specific competences:

- the ability to master standard development methods, procedures and processes,
- the ability to use acquired theoretical knowledge in practice,
- the ability to manage development and progress,
- willingness to cooperate and work in a team,
- the ability to understand and apply modern theories in the fields of technical, technological and natural sciences,
- the ability to integrate knowledge in an interdisciplinary manner,
- the ability to solve specific work problems in the field of technologies and systems using standard professional methods and procedures,
- knowledge, use and monitoring of the comprehensive quality method (ISO 14000, EMAS).

Predvideni študijski rezultati:

Znanje in razumevanje:

Študent/študentka:

- spozna in doume pomen procesnih naprav in predvsem pomen kompleksnega dogajanja v njih,
- pridobi znanje o osnovnih procesnih tehnologijah,
- spozna in doumeva odnose med osnovnimi in aplikativnimi raziskavami, njihovo medsebojno prepletenost in povezanost znanosti s sodobno tehniko in visokimi tehnologijami.

Intended learning outcomes:

Knowledge and understanding:

Student:

- learns and understands the importance of process devices and especially the importance of complex processes within them,
- acquires knowledge of basic process technologies,
- learns about and understands the relationships between basic and applied research, their interconnectedness and how science is linked to modern engineering and high technologies.

Metode poučevanja in učenja:

- *predavanja z aktivno udeležbo študentov* (razlaga, diskusija, problematika, razvijanje ustvarjalnosti),
- *seminarske naloge in vaje*, vezane na problematiko okoljskih tehnologij,
- uvajanje samostojnosti razmišljanja in osebnega ukrepanja pri širokem izboru ustvarjalnega in inovativnega dela,
- *priprava študij možnostni* (Feasibility Studies) za posamezne tehnološke rešitve,
- *razumevanje izbranih tehnologij in tehnoloških shem* (Flow-Sheet),
- *seznanjenje z nekatero tehnološko opremo, stroji, aparati, merilnimi instrumenti*,
- *uporaba spletnih virov* in seznanjanje s široko strokovno in družbeno literaturo in praktično uporabo dosegljive dokumentacije (knjig, revij, arhivov itd.),
- *strokovne ekskurzije* in ogledi izbranih in pomembnih tehnoloških naprav in procesov.

Learning and teaching methods:

- *lectures with active participation of students* (explanation, discussion, problems, development of creativity),
- *seminar assignments and tutorials* related to the issue of environmental technologies,
- introduction of independent thinking and personal action in a wide selection of creative and innovative work,
- *preparation of feasibility studies* for individual technological solutions,
- *understanding of selected technologies and technological schemes* (Flow-Sheet),
- *familiarity with some technological equipment, machines, devices, measuring instruments*,
- *use of online resources* and familiarization with wide professional and social literature and practical use of available documentation (books, magazines, archives, etc.),
- *professional excursions* and tours of selected and important technological devices and processes.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Način (pisni izpit, ustno izpraševanje, naloge, projekt): <ul style="list-style-type: none"> • pisni izpit • ustni izpit • projektno in seminarsko delo Ocenjevalna lestvica: ECTS.	50% ocene 30% ocene 20% ocene	Type (examination, oral, coursework, project): <ul style="list-style-type: none"> • written exam • verbal exam • project and seminar work Grading scale: ECTS.