

	UČNI NAČRT PREDMETA/COURSE SYLLABUS
Predmet	Tehniška kibernetika
Course title	Technical Cybernetics

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Tehnologije in sistemi v strojništvu/ 2. stopnja	Ni smeri študija	2. letnik	3.
Technologies and systems in mechanical engineering/ 2 nd Cycle	No study field	2 nd year	3 rd

Vrsta predmeta/Course type

obvezni/core

Univerzitetna koda predmeta/University course code

TSS 2 UN 1

Predavanja Lectures	Seminar Seminar	Sem. vaje Tutorial	Lab. vaje Laboratory work	Teren. vaje Field work	Samost. delo Individ. work	ECTS
30		15	15		120	6

Nosilec predmeta/Lecturer:

doc. dr. Elvis Hozdić

Jeziki/ Predavanja/Lectures:
Languages: Vaje/Tutorial:

slovenski/Slovenian
slovenski/Slovenian

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

<ul style="list-style-type: none"> Vpis v prvi letnik študijskega programa. Študent mora pred izpitom pripraviti in predstaviti ter zagovarjati projektno seminarsko nalogo. 	<ul style="list-style-type: none"> A prerequisite for inclusion is enrolment in the first year of study. Student has to prepare, present and defend a project seminar before the exam.
--	--

Vsebina:

Content (Syllabus outline):

<ul style="list-style-type: none"> <i>Uvod.</i> Osnovni pojmi in definicije, sistemi in kibernetika, tehniška kibernetika, proizvodna kibernetika, zgodovinski razvoj tehnične kibernetike in vodenja sistemov, sistemi, procesi, signali in sistemska teorija, sistemsko inženirstvo, tehniški procesi in sistemi. <i>Modeliranje in analiza sistemov.</i> Modeliranje z diferencialnimi enačbami. numerično reševanje diferencialnih enačb, prenosna karakteristika, blokovna algebra, Laplaceova transformacija, Fourierova transformacija, stabilnost sistemov, z-transformacija. <i>Sinteza sistemov.</i> Sinteza v frekvenčni domeni, PID krmilniki, diskretni PID krmilniki, izvedba prenosnih karakteristik, 	<ul style="list-style-type: none"> <i>Introduction.</i> Basic concepts and definitions, systems and cybernetics, technical cybernetics, production cybernetics, historical development of technical cybernetics and systems control, systems, processes, signals and systems theory, systems engineering, technical processes and systems. <i>Systems modeling and analysis.</i> Modeling with differential equations. numerical solution of differential equations, transfer characteristic, block algebra, Laplace transformation, Fourier transform, system stability, z-transformation. <i>Synthesis of systems.</i> Frequency domain synthesis, PID controllers, discrete PID
---	---

<p>digitalni krmilni sistemi, zaprtozančni sistemi.</p> <ul style="list-style-type: none"> • <i>Napredna analiza in sinteza.</i> Modeliranje in simulacija linearnih dinamičnih sistemov, lastnosti simulacijskih sistemov, sistem za modeliranje in simulacijo MATLAB-Simulink, napredna uporaba simulacijskega programa Simulink za modeliranje in simulacijo procesov in sistemov vodenja. • <i>Vodenje energetskih procesov in sistemov.</i> Dinamika značilnih energetskih procesov in sistemov, elementi in gradniki sistema vodenja energetskih naprav in sistemov, načrtovanje vodenja energetskih procesov in sistemov. • <i>Vodenje proizvodnih procesov in sistemov.</i> Dinamika značilnih proizvodnih procesov in sistemov, elementi in gradniki vodenja proizvodnih naprav in sistemov, načrtovanje vodenja proizvodnih procesov in sistemov. 	<p>controllers, implementation of transmission characteristics, digital control systems, closed loop systems.</p> <ul style="list-style-type: none"> • <i>Advanced analysis and synthesis.</i> Modeling and simulation of linear dynamical systems, properties of simulation systems, modeling and simulation system MATLAB-Simulink, advanced use of simulation program Simulink for modeling and simulation of processes and control systems. • <i>Control of energetics processes and systems.</i> Dynamics of typical energetics processes and systems, elements and components of systems and systems control in energetics, planning and control of processes and systems in energetics. • <i>Control of production processes and systems.</i> Dynamics of typical production processes and systems, elements and components for control of production processes and systems, planning and control of production processes and systems.
--	--

Temeljna literatura in viri/Readings:

Temeljna literatura/Basic literature

- PODRŽAJ Primož. *Linearna teorija krmiljenja sistemov.* Ljubljana: Fakulteta za strojništvo, 2014. ISBN - 978-961-6536-49-3
- PODRŽAJ, Primož *Zbirka rešenih nalog s področja linearne teorije krmiljenja sistemov.* Ljubljana: Fakulteta za strojništvo, 2016. ISBN - 978-961-6536-74-5
- STRMČNIK, Stanko in drugi. *Celostni pristop k računalniškemu vodenju procesov.* Ljubljana: Fakulteta za elektrotehniko, 1998 SBN - 961-6210-51-3

Priporočljiva literatura/Recommended literature

- OGATA, Katsuhiko. *Modern control engineering.* Boston [etc.]: Prentice Hall, 2010. ISBN - 978-0-13-615673-4
- DORF, Richard C. in Robert H. BISHOP. *Modern control systems,* Harlow [etc.]: Pearson, 2017. ISBN - 978-1-292-15
- KLJAJIČ, Miroljub, *Teorija sistemov,* Kranj: Moderna organizacija, 1994. ISBN - 86-81049-82-8

Cilji in kompetence:

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

- sposobnost samostojnega in ustvarjalnega raziskovalno-razvojnega dela na področju strojništva,
- sposobnost samostojnega spremljanja in kritične presoje najnovejših dosežkov s področja strojništva in širše,
- sposobnost aktivnega pisnega in ustnega sporazumevanja na visoki strokovni kot tudi

Objectives and competences:

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

- ability of independent and creative research and development work in the field of mechanical engineering,
- ability to independently perceive and critically assess the latest achievements in the field of mechanical engineering and beyond,
- ability to actively communicate in writing and orally at a high professional as well as at a

<p>na poljudni ravni, odvisno od ciljnega občinstva,</p> <ul style="list-style-type: none"> • sposobnost timskega dela s strokovnjaki z različnih področij, • sposobnost učinkovite uporabe informacijsko-komunikacijske tehnologije, • sposobnost prevzeti odgovornost za lasten poklicni in osebnostni razvoj, • sposobnost delovanja v sozvočju s poklicno, okoljsko, socialno in etično odgovornostjo. • poznavanje in razumevanje področja tehniške kibernetike in vodenja sistemov, • obvladovanje izbranih metod in orodij za modeliranje, analizo in sintezo sistemov za vodenje, • sposobnost reševanja konkretnih problemov s področja tehniškega vodenja proizvodnih in energetskih naprav in sistemov. 	<p>popular level, depending on the target audience,</p> <ul style="list-style-type: none"> • ability to work in teams with experts from different fields, • ability to effectively use information and communication technology, • ability to take responsibility for one's own professional and personal development, • ability to work according to professional, environmental, social and ethical responsibility. • knowledge and understanding of technical cybernetics and system control, • mastery of selected methods and tools for for modelling, analysis and synthesis of control systems, • ability to solve practical problems of system control for production and energetic devices and systems.
---	---

Predvideni študijski rezultati:

<p>Študent/študentka:</p> <ul style="list-style-type: none"> • pozna področje tehniške kibernetike in sistemov vodenja, • pozna metode, postopke in orodja za modeliranje, analizo in sintezo sistemov vodenja, • razume namen, vlogo in uporabo tehniške kibernetike za vodenje proizvodnih in energetskih naprav in sistemov, • razvije znanja in sposobnosti za razvoj in vrednotenje sistemov vodenja v proizvodnih in energetskih sistemov in naprav, • se usposobi za uporabo digitalnih inženirskih orodij za načrtovanje in vrednotenje sistemov vodenja, • zna kritično presojati in analizirati ter predvidevati uporabo novih dognanj in rešitev na področju sistemov vodenja.
--

Intended learning outcomes:

<p>Students:</p> <ul style="list-style-type: none"> • know the field of technical cybernetics and system control, • know the methods, procedures and tools for modelling, analysis and synthesis of control systems, • understand the purpose, role and use of technical cybernetics for control of production and energetics devices and systems, • develop knowledge and skills for the development and evaluation of control systems for production and energetic devices and systems, • develop skills in the use of advanced engineering tools for the design and evaluation of system control, • are able to critically assess and analyse, and anticipate the use of new findings and solutions in the field of system control.

Metode poučevanja in učenja:

<ul style="list-style-type: none"> • <i>predavanja</i> z aktivno udeležbo študentov (razlaga, diskusija, vprašanja, primeri, reševanje problemov), • <i>avditorne vaje</i>: reševanje problemov, študije primerov, kritično presojanje, diskusija, refleksija izkušenj, vrednotenje, projektno delo, timsko delo,

Learning and teaching methods:

<ul style="list-style-type: none"> • <i>lectures</i> with active student participation (explanation, discussion, questions, examples, problem solving), • <i>tutorial</i>: problem solving, case studies, methods of critical thinking, discussion, reflection of experience, evaluation, project work, team work,
--

<ul style="list-style-type: none"> • <i>laboratorijske vaje</i>: praktično reševanje več tipičnih problemov v laboratoriju (na računalniku), • <i>seminar</i>: priprava, predstavitev in uspešen zagovor projektne/raziskovalne naloge, (reševanje problemov, študije primera, kritično presojanje, diskusija, refleksija izkušenj, vrednotenje, projektno delo, timsko delo). 	<ul style="list-style-type: none"> • <i>laboratory work</i>: practical solving of several typical problems in laboratory (on a computer), • <i>seminar tutorial</i>: presentation and defence of project/research work (problem solving, studies, critical thinking, discussion, reflection of experience, evaluation, project work, team work).
--	--

Načini ocenjevanja:	Delež (v %) Weight (in %)	Assessment:
Načini: <ul style="list-style-type: none"> • pisni izpit • ustni izpit • projektno seminarsko delo Ocenjevalna lestvica: ECTS.	40 % 40 % 20 %	Types: <ul style="list-style-type: none"> • written exam • oral examination • project seminar Grading scheme: ECTS.