

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Digitalna transformacija industrijskih in poslovnih procesov
Course title:	Digital Transformation of Industrial and Business Processes

Študijski program in stopnja Study programme and level	Modul Module	Letnik Academic year	Semester Semester
Informacijske in komunikacijske tehnologije, 2. stopnje	Digitalna transformacija	1	1
Information and Communication Technologies, 2 nd cycle	Digital Transformation	1	1

Vrsta predmeta / Course type

Izbirni / Elective

Univerzitetna koda predmeta / University course code:

IKT2-872

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
60	30	30		30	450	20

**Navedena porazdelitev ur velja, če je vpisanih vsaj 15 študentov. Drugače se obseg izvedbe kontaktnih ur sorazmerno zmanjša in prenese v samostojno delo. / This distribution of hours is valid if at least 15 students are enrolled. Otherwise the contact hours are linearly reduced and transferred to individual work.*

Nosilec predmeta / Lecturer:

Prof. dr. Đani Juričić
Doc. dr. Pavle Boškosi
Doc. dr. Biljana Mileva Boshkoska

Jeziki /

Predavanja / Lectures: Slovenski, angleški / Slovene, English

Languages:

Vaje / Tutorial: Slovenski, angleški / Slovene, English

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

Zaključen študijski program prve stopnje s področja naravoslovja, tehnike ali računalništva.

Prerequisites:

Student must complete first-cycle study programmes in natural sciences, technical disciplines or computer science.

Vsebina:

- Digitalna tehnologija kot gonilna sila inovacij:
 - Digitalni poslovni modeli
 - Digitalno vodenje
 - Digitalno sodelovanje z uporabniki
 - Digitalne metrike uspeha
- Uvod v E-Vzdrževanje
 - Modeli vzdrževanja
 - Pogoji za implementacijo vzdrževanja po stanju
 - Veljavni standardi, ki definirajo procese vzdrževanja v digitalni dobi
 - Upravljanje z osnovnimi sredstvi
- Osnove strojne komunikacije – industrijski internet stvari

Content (Syllabus outline):

- Digital technology as an enabler of fundamental innovation and disruption
 - Digital business models
 - Digital operational models
 - Digital customer experience
 - Digital talent and skills
 - Digital performance metrics
- Introduction to E-maintenance
 - Maintenance models
 - Requirements for implementing predictive maintenance
 - Active standards defining digital maintenance processes
 - Asset cycle management

- Uvod v analizo podatkovnih tokov
 - Baze podatkov za časovne vrste
 - Baze podatkov s shranjevanjem po stolpcih
 - Statistično zaznavanje nenadnih sprememb
 - Nestacionarni podatkovni tokovi
- Transformacija energije in mobilnosti
 - Pametna distribucijska omrežja
 - Obnovljivi viri energije
 - Digitalna proizvodnja, prodaja, servis in vzdrževanje

- Basics of machine-to-machine communication – IIoT (industrial internet of things)
- Introduction of data streams processing
 - Time-series database (TSDB)
 - In-memory column-wise storage
 - Statistical detection of abrupt changes
 - Non-stationary data streams
- Transformation of energy and mobility
 - Smart grids
 - Renewable energy sources
 - Supply chains
 - Digital manufacturing, retail, service and maintenance

Temeljni literatura in viri / Readings:

- Diego Galar. E-maintenance. **Essential Electronic Tools for Efficiency**. 2017 Elsevier Inc. **ISBN: 978-0-12-811153-6**
- Ted Dunning, Ellen Friedman. Time Series Databases: New Ways to Store and Access Data. 2014 **O'Reilly Media**. **ISBN-13: 978-1491914724**
- Michelle Basseville, Igor V. Nikiforov. **Detection of Abrupt Changes: Theory and Application**. 1996 **Prentice-Hall Inc**. **ISBN-13: 978-0131267800**

Cilji in kompetence:

Industrijska digitalna transformacija je multidisciplinarna problematika. Glavni cilj tega predmeta je zagotoviti osnovna znanja, ki so potrebna za pravilno razumevanje industrijske digitalne transformacije. Poleg tega predmet zagotavlja poglobljeno predstavitev dodatnih segmentov industrijske digitalne transformacije, in sicer:

- poglobljeno poznavanje principov e-vzdrževanja
- pametna distribucijska omrežja in obnovljivi viri energije
- digitalna proizvodnja

Splošne kompetence:

- poglobljeno poznavanje sprememb, ki jih prinaša digitalna transformacija industrije
- poznavanje orodij in mehanizmov za obdelavo velikih količin podatkov v kontekstu industrijske proizvodnje
- poznavanje spremenjenih načel proizvodnje in vzdrževanja, ki jih prinaša Industrija 4.0
- poznavanje najnovejših trendov pri proizvodnji energije in njene distribucije

Objectives and competences:

The subject covered by digital transformation is broad one. The objective of this course is to provide an introduction to various areas required for proper understanding of digital transformation of industries. Additionally, this course provides in-depth presentation of segments of digital transformation that include:

- in-depth presentation of e-maintenance strategies
- smart grids and renewable energy production and storage
- digital manufacturing

General competences:

- understanding of the changes brought by the digital transformation of industries
- knowledge of data processing tools and mechanisms for handling of vast amount of industrial data streams
- knowledge of the disruptive production and maintenance practices required in the age of Industry 4.0
- knowledge of latest trends in smart energy production distribution and consumption enabled by the digital transformation process

Predvideni študijski rezultati:

Študent:
 Pridobi napredna znanja ter razvite sposobnosti za implementacijo konceptov industrijske digitalne transformacije in je pripravljen prispevati praktične/relevantne ideje in perspektive o dodani vrednosti, ki jih te spremembe prinašajo v novih okoljih.
 Svoje znanje o postopkih implementacije vsakega stebra industrijske digitalne transformacije je sposoben prenašati na druge.
 Zna uporabljati moderna orodja in postopke za implementacijo posameznih konceptov digitalne transformacije ter ima izkušnje z njihovimi praktičnimi izvedbami v različnih industrijskih okoljih.

Intended learning outcomes:

The student:
 Has advanced knowledge and developed skills for implementation of the concepts of digital transformation of industry and is confident in providing practical/relevant ideas and perspectives on the added values such a change offers in new environments.
 Is capable of coaching others in the application of each pillar of the digital transformation process. Proficiency in usage of the modern tools and processes required for implementing particular concepts of digital transformation as well as experience of their practical implementations in different industrial settings.

Metode poučevanja in učenja:

- Predavanja z aktivno udeležbo študentov (razlaga, diskusija, vprašanja, primeri, reševanje problemov, predstavitev);
- Vaje;
- Individualne in skupinske konzultacije (diskusija, dodatna razlaga, obravnava specifičnih vprašanj).

Learning and teaching methods:

- Lectures (explanation with discussions, questions, case-studies, presentations);
- Tutorials;
- Individual and group consultations (debate, additional explanations, considering specific issues).

Delež (v %) /

Weight (in %)

Načini ocenjevanja:

- Pisni ali ustni izpit
- Seminarska naloga
- Predstavitev naloge

50 %

25 %

25 %

Assessment:

- Written or oral exam
- Seminar work
- Presentation of the seminar work

Reference nosilca / Lecturer's references:

- DOLENC, Boštjan, BOŠKOSKI, Pavle, STEPANČIČ, Martin, POHJORANTA, Antti, JURIČIČ, Đani. State of health estimation and remaining useful life prediction of solid oxide fuel cell stack. *Energy conversion and management*, ISSN 0196-8904. 2017, vol. 148, str. 993-1002
- DOLENC, Boštjan, BOŠKOSKI, Pavle, JURIČIČ, Đani. Distributed bearing fault diagnosis based on vibration analysis. *Mechanical systems and signal processing : MSSP*, ISSN 0888-3270. [Tiskana izd.], 2016, vol. 66/67, str. 521-532
- BOŠKOSKI, Pavle, JURIČIČ, Đani. Inverse Gaussian mixtures models of bearing vibrations under local faults. *Mechanical systems and signal processing : MSSP*, ISSN 0888-3270. 2016, vol. 66/67, str. 546-556
- MILEVA BOSHKOSKA, Biljana, BOHANEK, Marko, BOŠKOSKI, Pavle, JURIČIČ, Đani. Copula-based decision support system for quality ranking in the manufacturing of electronically commutated motors. *Journal of intelligent manufacturing*, ISSN 0956-5515, 2015, vol. 26, no. 2, str. 281-293.
- MILEVA BOSHKOSKA, Biljana, BOŠKOSKI, Pavle, DEBENJAK, Andrej, JURIČIČ, Đani. Dependence among complex random variables as a fuel cell condition indicator. *Journal of power sources*, ISSN 0378-7753, jun. 2015, vol. 284, str. 566-573.