UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Osnove industrijske avtomatizacije
Course title:	Fundamentals of industrial automation

Študijski program in stopnja **Study programme and level**	**Študijska smer** **Study field**	**Letnik** **Academic year**	**Semester** **Semester**
Informatika v sodobni družbi, visokošolski strokovni študijski program prve stopnje	-	Drugi ali tretji	Četrti ali šesti
Informatics in Contemporary Society, first cycle Professional Study Programme	-	Second or third	Fourth or sixth

Vrsta predmeta / Course type	Izbirni / Elective
Univerzitetna koda predmeta / University course code:	1-ISD-VS-IP-APIR-2021-11-29

Predavanja **Lectures**	**Seminar** **Seminar**	**Vaje** **Tutorial**	**Klinične vaje** **work**	**Druge oblike študija**	**Samost. delo** **Individ. work**	**ECTS**
24	/	48	/	/	108	6

Nosilec predmeta / Lecturer:	Prof. dr. Slavko Kocijančič

Jeziki / Languages:	**Predavanja / Lectures:**	Slovenski / Angleški
	Vaje / Tutorial:	Slovenski / Angleški

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

Za vključitev v delo mora študent osvojiti vsebine predmetov Uvod v programiranje in Informacijski sistemi. Pogoj za pristop k izpitu je oddaja ustrezno pripravljene raziskovalne seminarske naloge.	Course requires knowledge obtained within the courses Introduction to Programming and Information Systems. The condition for taking the exam is the submission of a properly prepared research seminar paper.

Vsebina:	**Content (Syllabus outline):**
• Osnove programabilnih logičnih krmilnikov (PLK-jev) • Spoznavanje različnih načinov programiranja PLK-jev • Osnove industrijske komunikacije • Izdelava enostavnih SCADA (angl. Supervisory Control And Data Acquisition; sistemi za nadzorovanje in krmiljenje tehnoloških procesov z računalnikom) rešitev • Zajem podatkov v proizvodnji • Uporab MES (angl. Manufacturing Execution System; informacijski sistem, ki omogoča dodeljevanje vseh potrebnih proizvodnih virov in spremljanje proizvodnega procesa) sistema v proizvodnji • Osnove industrijske robotike • Izdelava enostavnega robotskega programa • Integracija programskih in tehničnih rešitev v avtomatizirano linijo	• Basics of programmable logic controllers (PLCs) • Getting to know different ways of programming PLC • Basics of industrial communication • Development of simple SCADA (Supervisory Control and Data Acquisition; systems for monitoring and controlling technological processes with a computer) solutions • Capturing data production • Use of MES (Manufacturing Execution System; information system that enables allocation of all necessary production resources and monitoring of the production process) of the system in production • Fundamentals of industrial robotics • Creating a simple robotic program • Integration of software and technical solutions into an automated line

Temeljni literatura in viri / Readings:

- Lerher, T. (2021). Avtomatsko vodeni in avtonomni vozički ter mobilni roboti v intralogistiki. Univerza v Mariboru, Fakulteta za strojništvo.
- Lerher, T. (2021). Skladiščno-komisionirni sistemi. Univerza v Mariboru, Fakulteta za strojništvo.
- Kay B. M. (2016). Lecture Notes for Production system design, North Carolina State University, USA.
- LOVREC, Darko, TIČ, Vito. (2018). Hidravlika za mehatronike. 1. izd. Maribor: Univerzitetna založba Univerze: Fakulteta za strojništvo, 2018. X, 458 str., ilustr. ISBN 978-961-286-217-6.
- International Federation of Robotics: History of Industrial Robots. (2012) From the first installation until today (International Federation of Robotics, Frankfurt: IFR.
- Hägele M., Nilsson K., Pires J.N., Bischoff R. (2016) Industrial Robotics. In: Siciliano B., Khatib O. (eds) Springer Handbook of Robotics. Springer Handbooks. Springer, Cham.
- J. Bartenschlager et al. (2009): Mehatronika. Založba Pasadena.

- K. Debeljak: Prosojnice pri predmetu Avtomatizacija, podatkovni inženiring in robotika, Moodle FIŠ.

Cilji in kompetence:

Splošne kompetence:

- Poznavanje in razumevanje širokega nabora aplikacij informacijsko komunikacijske tehnologije v sodobni družbi
- Sposobnost fleksibilne in aplikativne uporabe teoretičnega znanja
- Razvoj (samo)kritične presoje

Predmetno-specifične kompetence:

- Poznavanje osnov ter programiranje industrijskih programabilnih logičnih krmilnikov (PLK-jev).
- Razumevanje proizvodnih sistemov na globalni ravni, v podjetju in laboratoriju.
- Ugotavljanje pomanjkljivosti obstoječih proizvodnih sistemov in možnosti izboljšav glede na zunanje in notranje omejitve.
- Osnovna znanja industrijske robotike, sistematično razumevanje in kritično zavedanje ključnih vidikov industrijske robotike in njihove integracije v avtomatizirane sisteme.
- Razumevanje ter uporaba različnih robotskih rešitev (klasični roboti, kolaborativni roboti, mobilni roboti).

Objectives and competences:

General competences:

- Knowledge and understanding of a wide range of applications of information communication technology in the modern society
- Ability to flexibly apply knowledge in practice
- Development of (self)critical judgement;

Subject-specific competences:

• Knowledge of basics and programming of industrial programmable logic controllers (PLCs).
• Understanding of production systems globally, in the company and in the laboratory.
• Identifying the shortcomings of existing production systems and the possibility of improvements in relation to external and internal constraints.
• Basic knowledge of industrial robotics, systematic understanding and critical awareness of key aspects of industrial robotics and their integration into automated systems.
• Understanding and use of various robotic solutions (classic robots, collaborative robots, mobile robots).

Predvideni študijski rezultati:

Znanje in razumevanje:

- sposobnost izdelati enostavnejši program za krmiljenje PLK-jev, vključno z vzpostavitvijo industrijske komunikacije,
- poznavanje in razumevanje različnih ravni proizvodnega sistema od

Intended learning outcomes:

Knowledge and understanding:

• the ability to develop a simple program for the control of PLCs, including the establishment of industrial communication,
• knowledge and understanding of different levels of the production system from the global company to the individual machine;

globalnega podjetja do posameznega stroja; sposobnost izraziti, kako te ravni medsebojno delujejo. • poznavanje in razumevanje pomena krmilnih, podatkovnih in računalniških sistemov pri nadzoru kompleksnih proizvodnih sistemov ter sposobnost ugotoviti, kaj v teh sistemih lahko vodi do okvare. • sposobnost načrtovanja in integracije različnih robotskih rešitev, razpravljanja o kompleksnosti zasnove in tehničnih rešitvah.	the ability to express how these levels interact. • knowledge and understanding of the importance of control, data and computer systems in the control of complex production systems, and the ability to identify what in these systems can lead to failure. • ability to design and integrate various robotic solutions, discuss design complexity and technical solutions.

Metode poučevanja in učenja:	**Learning and teaching methods:**
• Predavanja z aktivno udeležbo študentov (razlaga, diskusija, primeri, reševanje problemov); • Vaje na seminarski način (refleksija prebranih besedil in lastnih izkušenj, timsko delo, metode kritičnega mišljenja, diskusija, sporočanje) • Praktične vaje na industrijski opremi (programiranje različnih tipov PLK), izdelava SCADA, izdelava enostavnejših robotskih programov, integracija mobilnih robotov; • Individualne in/ali skupinske konzultacije (diskusija, dodatna razlaga, obravnava specifičnih vprašanj); • Mentoriranje in samostojen študij (motiviranje, usmerjanje, samoopazovanje, samouravnavanje, refleksija).	• Lectures with active participation of students (explanation, discussion, examples, problem solving); • Exercises in a seminar way (reflection of read texts and own experiences, team work, methods of critical thinking, discussion, communication) • Practical exercises on industrial equipment (programming of different types of PLC), production of SCADA, production of simpler robotic programs, integration of mobile robots; • Individual and / or group consultations (discussion, additional explanation, discussion of specific issues); • Mentoring and independent study (motivation, guidance, self-observation, self-regulation, reflection).

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Način (pisni izpit, seminarska naloga):		Type (examination, oral, coursework, project):
Pisni izpit	100 %	Written exam

Reference nosilca / Lecturer's references:

- AVSEC, Stanislav, KOCIJANČIČ, Slavko. A path model of effective technology-intensive inquiry-based learning. Educational technology & society. 2016, vol. 19, issue 1, str. 308-320, ilustr., tabele. ISSN 1436-4522.
- RIHTARŠIČ, David, AVSEC, Stanislav, KOCIJANČIČ, Slavko. Experiential learning of electronics subject matter in middle school robotics courses. International journal of technology and design education. 2016, vol. 26, no. 2, str. 205-224, ilustr., tabele, graf. prikazi. ISSN 1573-1804.
- AVSEC, Stanislav, RIHTARŠIČ, David, KOCIJANČIČ, Slavko. A predictive study of learner attitudes toward open learning in a robotics class. Journal of science education and technology. 2014, vol. 23, issue 5, str. 692-704, tabele, graf. prikazi. ISSN 1573-1839.
- ŠORGO, Andrej, KOCIJANČIČ, Slavko. False reality or hidden messages: reading graphs obtained in computerized biological experiments. Eurasia journal of mathematics, science and technology education. 2012, vol. 8, no. 2, str. 129-137. ISSN 1305-8223.
- AVSEC, Stanislav, RIHTARŠIČ, David, KOCIJANČIČ, Slavko. The impact of robotics-enhanced approach on students' satisfaction in open learning environment.
- DEBELJAK, Krištof, KOCIJANČIČ, Slavko, ABERŠEK, Boris. Comparison of the efficiency of textual and iconic programming environments for teaching programmable logic controllers.
- AVSEC, Stanislav, KOCIJANČIČ, Slavko. Effectiveness of inquiry-based learning : how do middle school students learn to maximise the efficacy of a water turbine?. http://www.ijee.ie/latestissues/Vol30-6A/10_ijee2982ns.pdf, http://pefprints.pef.uni-lj.si/id/eprint/2623.
- AVSEC, Stanislav, RIHTARŠIČ, David, KOCIJANČIČ, Slavko. Students' satisfaction with an INFIRO robotic direct manipulation learning environment. http://www.wiete.com.au/journals/WTE&TE/Pages/Vol.12,%20No.1%20(2014)/01-Avsec-S.pdf, http://pefprints.pef.uni-lj.si/id/eprint/2115.
- AVSEC, Stanislav, KOCIJANČIČ, Slavko. The effect of the use of an inquiry-based approach in an open learning middle school hydraulic turbine optimisation course. http://www.wiete.com.au/journals/WTE&TE/Pages/Vol.12,%20No.3%20(2014)/01-Avsec-S.pdf, http://pefprints.pef.uni-lj.si/id/eprint/2637.
- RIHTARŠIČ, David, KOCIJANČIČ, Slavko. The role of equipment and accessories in the early teaching of robotics. http://www.wiete.com.au/journals/WTE&TE/Pages/Vol.10,%20No.1%20%282012%29/04-09-Rihtarsic-D.pdf.
- ŠANTEJ, Gorazd, KOCIJANČIČ, Slavko. Electronics course for in-service teachers of engineering and technology. http://www.wiete.com.au/journals/WTE&TE/Pages/Vol.10,%20No.1%20%282012%29/10-10-Santej-G.pdf.

- RIHTARŠIČ, David, KOCIJANČIČ, Slavko. Introducing engineering to middle school students through technology day of robotics. http://jtie.upol.cz/jtie_o_casopisu.htm.
- ŠANTEJ, Gorazd, RIHTARŠIČ, David, KOCIJANČIČ, Slavko. School activity days : electronics workshop. http://jtie.upol.cz/jtie_o_casopisu.htm.