

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Orodja avtomatizacije
Course title:	Basic Tools of Automation

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Tehnologije in sistemi – prva stopnja	/	tretji	peti
Technologies and Systems – 1st cycle	/	Third	Fifth

Vrsta predmeta / Course type izbirni/elective

Univerzitetna koda predmeta / University course code: TS IP UN 8

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: doc. dr. Tomaž Perme

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

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

- vpis v tretji letnik študija.

Prerequisites:

- enrollment in the third year of study.

Vsebina:

- *Uvod.* Zgodovinski mejniki razvoja in pregled programskih orodij za podporo načrtovanju, izvedbi, obratovanju in nadzoru avtomatiziranih sistemov v kosovni proizvodnji in procesni industriji.
- *Zajem in obdelava signalov.* Veriga od zaznaval, obdelave signalov do analize in prikaza rezultatov. Vrste signalov (analogni, digitalni), strojna oprema za zajem signalov (zajem, vzorčenje, AD in DA pretvorba), programska oprema za obdelavo, analizo in prikaz rezultatov. Praktični primeri uporabe

Content (Syllabus outline):

- *Introduction.* Historical milestones in the development and review of software tools to support the design, implementation, operation and control of automated systems in batch production and process industries.
- *Capture and processing of signals.* The chain from detector to signal processing to analysis and display of results. Types of signals (analog, digital), signal acquisition hardware (acquisition, sampling, AD and DA conversion), software for processing, analysis and display of results. Practical

v industriji ter osnovna uporaba programskega okolja LabVIEW.

- *Modeliranje in simulacija sistemov vodenja.* Pregled teoretičnih osnov systemske analize in načrtovanja sistemov vodenja. Simulacijska shema in prenosna funkcija ter osnovne lastnosti simulacijskih sistemov. Simulacijsko okolje MATLAB-Simulink, osnovna uporaba in analiza modelov s simulacijskim programom Simulink na primerih iz prakse.
- *Programska orodja za načrtovanje strege in montaže.* Osnove načrtovanja montažnih in strežnih sistemov ter preverjanja rešitev v digitalnem okolju. Osnove modeliranja izdelka, procesov in sredstev ter izdelava povezanega simulacijskega modela. Primeri iz prakse ter osnovna uporaba programskih orodij *Tecnomatix Process Planner* in *Process Simulate*.
- *Programska orodja za programiranje in simulacijo robotskih rešitev.* Osnove o robotih in robotskih rešitvah za strego in montažo ter o vodenju in programiranju robotov in robotskih sistemov. Izdelava modela delovnega okolja, izbira ustreznega robota, modeliranje prijemal in orodij, načrtovanje poti in gibov robota, izdelava, urejanje in preverjanje robotskega programa v programskem okolju *RobotStudio* na primeru iz prakse.
- *Modeliranje in simulacija toka materiala.* Osnove diskretne dogodkovne simulacije, modeliranje diskretnih sistemov ter pregled programskih orodij in rešitev za modeliranje in simulacijo toka materiala v kosovni proizvodnji. Praktični primeri ter osnove uporabe programske rešitve *Tecnomatix Plant Simulation*.
- *Sistemi za zajem, obdelavo in analizo slik.* Zgradba, sestavine in delovanje računalniškega oziroma strojnega vida. Uporaba strojnega vida v proizvodnji za merjenje, nadzor, urejanje ter kontrolo kakovosti. Načrtovanje, priprava, procesiranje in analiza sive ali barvne slike ter opredelitev in iskanje vzorcev na

examples of industrial use and basic application of the LabVIEW programming environment.

- *Modeling and simulation of control systems.* An overview of the theoretical foundations of system analysis and management system design. Simulation scheme and transfer function and basic properties of simulation systems. MATLAB-Simulink simulation environment, basic application and analysis of models using Simulink simulation programme with real-world examples.
- *Software tools for storage and assembly planning.* Basics of planning assembly and server systems and review of solutions in a digital environment. Fundamentals of product, process and system modelling and related simulation modelling. Real-world examples and basic application of Tecnomatix Process Planner and Process Simulate software tools.
- *Software tools for programming and simulation of robotic solutions.* The basics of robots and robotic solutions for service and assembly, as well as the management and programming of robots and robotic systems. Creation of a model of the work environment, selection of a suitable robot, modeling of grippers and tools, planning of paths and movements of the robot, creation, editing and verification of the robot program in the RobotStudio software environment using a practical example.
- *Material flow modelling and simulation.* Basics of discrete event simulation, modeling of discrete systems and overview of software tools and solutions for modeling and simulation of material flow in batch production. Practical examples and basics of using the Tecnomatix Plant Simulation software solution.
- *Systems for capturing, processing and analysing images.* Structure, components and functionality of computer or machine vision. Use of machine vision in production for measuring, controlling, editing and quality control. Planning, preparation,

praktičnih primerih. Osnovna uporaba in programiranje s programskimi orodji za delo v industriji (*NI Vision, VisionPro*).

processing and analysis of gray or color images, as well as defining and finding patterns using practical examples. Basic application and programming with industrial software tools (*NI Vision, VisionPro*).

Temeljni literatura in viri / Readings:

Temeljna literatura/Basic literature

- Bajd, T., Mihelj, M., Lenarčič, J., Stanovnik, A., Munih, M. (2010) *Robotika*. Ljubljana:Fakulteta za elektrotehniko.
- Corke, P. (2011) *Robotics, Vision and Control - Fundamental Algorithms in MATLAB*. Springer.
- Kandray, D. E. (2009) *Programmable Automation: An Introduction to CNC, Robotics and PLCs*.

Priporočljiva literatura/Recommended literature

- Balič, J. (2001) Računalniška integracija proizvodnje. Maribor: Fakulteta za strojništvo.
- Zupančič, B. (2011). Avtomatsko vodenje sistemov, Učno gradivo, Ljubljana: Založba FE in FRI.
- Strmčnik, S. in drugi (1998). *Celostni pristop k računalniškemu vodenju procesov*. Ljubljana: Založba FE in FRI
- Eley, M. (2008). *Simulation in der Logistik : eine Einführung in die Erstellung ereignisdiskreter Modelle unter Verwendung des Werkzeuges "Plant Simulation"*, Heidelberg : Springer.
- Gorup, Ž. (2006). *Uvod v Labview*. Ljubljana : Fakulteta za elektrotehniko.
- King, R.H. (2012) *Introduction to Data Acquisition with LabView*. McGraw-Hill.
- Bajd, T., Mihelj, M., Lenarčič, J., Stanovnik, A., Munih, M. (2010) *Robotika*. Ljubljana:Fakulteta za elektrotehniko.
- Azad, P., Gockel, T., Dillmann, R. (2008). *Computer vision : principles and practice*. Dorchester: Elektor Electronics Publishing

Cilji in kompetence:

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

- sposobnost evidentiranja problema in njegove analize ter predvidevanja operativnih rešitev v tehnološkem smislu ali v procesu organizacije in vodenja,
- 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,

Objectives and competences:

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

- the ability to identify a problem and analyze it, as well as foresee operational solutions in a technological sense or in the process of organization and management,
- 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;

- 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, načrtovanje, vpeljevanje in upravljanje avtomatizacije in robotizacije,
- razvoj strokovnih veščin in spretnosti na področju tehnologij in sistemov
- sposobnost stalne uporabe informacijske in komunikacijske tehnologije na svojem strokovnem področju.

- 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, planning, implementation and management of automation and robotics,
- development of professional skills and abilities in the field of technologies and systems
- the ability to continuously use information and communication technology in one's professional field.

Predvideni študijski rezultati:

Znanje in razumevanje:

Študent/študentka:

- razume pomen in vlogo avtomatizacije ter pozna osnovna programska orodja za njihovo načrtovanje in uporabo,
- zna uporabiti pridobljeno teoretično in osnovno praktično znanje za izbiro pravega pristopa in orodja za načrtovanje avtomatiziranih sistemov v kosovni proizvodnji in procesni industriji,
- zna poiskati in uporabiti ustrezno strokovno literaturo ter oceniti primernost razpoložljivih programskih rešitev in orodij glede na potrebe in zahteve avtomatizacije.

Intended learning outcomes:

Knowledge and understanding:

Student:

- understands the importance and role of automation and knows the basic software tools for its planning and use,
- is able to use the basic theoretical and practical knowledge acquired to select the right approach and tool for designing automated systems in the piece production and process industries,
- is able to find and use relevant professional literature and assess the suitability of available software solutions and tools in relation to automation needs and requirements.

Metode poučevanja in učenja:

- *predavanja* z aktivno udeležbo študentov (razlaga, diskusija o problemih, razvijanje ustvarjalnosti),
- tečaj iz grafičnega programiranja,
- vodeni individualni študij – aplikacije z grafičnim programiranjem,
- skupinski projekt,

Learning and teaching methods:

- *lectures* with active participation of students (explanation, discussion of problems, development of creativity),
- graphic programming course,
- guided individual study - applications with graphic programming,
- group project,

- uporaba spletnih virov in seznanjanje s široko strokovno literaturo in praktično uporabo dosegljive dokumentacije (knjig, revij, arhivov itd.).

- use of online resources and familiarization with a wide range of professional literature and practical use of available documentation (books, magazines, archives, etc.).

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Način (pisni izpit, ustno izpraševanje, naloge, projekt): <ul style="list-style-type: none"> • seminarska (projektna) naloga • pisni(ustni) izpit Ocenjevalna lestvica: ECTS.	40 % ocene 60 % ocene	Type (examination, oral, coursework, project): <ul style="list-style-type: none"> • seminar (project) assignment • written (oral) exam Grading scale: ECTS.