

## Specification for the book of courses

<b>Study program</b>		Control Systems		
<b>Module</b>		Automatic Control		
<b>Type and level of studies</b>		Master studies		
<b>The name of the course</b>		Modern Control of Industrial Processes		
<b>Lecturer (for lectures)</b>		Milojković T. Marko		
<b>Lecturer/associate (for exercises)</b>		Milovanović B. Miroslav		
<b>Lecturer/associate (for OFE)</b>		Milovanović B. Miroslav		
<b>Number of ECTS</b>		5	<b>Course status (obligatory/elective)</b>	Elective
<b>Prerequisites</b>				
Introduction to the concepts of the Industry 4.0. Mastering advanced modeling and simulation techniques in production. Introduction to the ideas of Industrial Internet of Things (IIoT), Big Data and Cloud computing. Mastering the methodologies for the digital transformation of industrial applications. The application of the virtual reality in production. Introduction to the process of additive production and 3D printing. Application of the blockchain technologies in production processes.				
<b>Course objectives</b>				
Theoretical and practical knowledge on the elements of Industry 4.0, areas of IIoT, design of automatic control system with the possibility of internet and distributed computer systems control, as well as the digitization of conventional control logic. Mastering the techniques of additive manufacturing and the application of virtual reality in manufacturing. Practical implementation of blockchain applications in improving production cycles.				
<b>Course outcomes</b>				
Theoretical and practical knowledge on the elements of Industry 4.0, areas of IIoT, design of automatic control system with the possibility of internet and distributed computer systems control, as well as the digitization of conventional control logic. Mastering the techniques of additive manufacturing and the application of virtual reality in manufacturing. Practical implementation of blockchain applications in improving production cycles.				
<b>Course outline</b>				
Industry 4.0. Cyber-physical environment for smart production. Virtual reality in the industry. Examples of applications of expanded reality in production. Additive production. 3D printing - preparation and realization of 3D models. Industrial Internet of Things (IIoT). Examples of IIoT applications. Network protocols and standards for the implementation of the IIoT system. Architecture of the IIoT system. Blockchain technology. Using blockchain technologies in the industry. Development of blockchain applications.				
<b>Theoretical teaching</b>				
Laboratory work with equipment for virtual reality. 3D modeling, preparation for printing and printing on a 3D printer. Practical development of the IIoT system using the development boards Arduino and Raspberry Pi. Development of blockchain applications in the Python programming language.				
<b>Practical teaching (exercises, OFE, study and research)</b>				
<b>Textbooks/references</b>				
1	S. Raschka, "Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, and Tensor Flow, 2nd Edition", Packt Publishing, 2017.			
2	C. Dow, "Internet of Things Programming Projects : Build modern IoT solutions with the Raspberry Pi 3 and Python", Packt Publishing, 2018.			
3	P. Desai, "Python Programming for Arduino", Packt Publishing, 2015			
4	S. Monk, "Programming The Raspberry Pi", McGraw-Hill Education TAB, 2015.			
5	A. Géron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow", O'Reilly Media, 2017			
<b>Number of classes of active education per week during semester/trimester/year</b>				
<b>Lectures</b>	<b>Exercises</b>	<b>OFE</b>	<b>Study and research work</b>	<b>Other classes</b>
2	1	1		
<b>Teaching methods</b>				
Lectures, Practical classes, Laboratory classes, Consultations				
<b>Grade (maximum number of points 100)</b>				
<b>Pre-exam duties</b>		<b>Points</b>	<b>Final exam</b>	<b>Points</b>
<b>Activity during lectures</b>			<b>Written exam</b>	30
<b>Exercises</b>		20	<b>Oral exam</b>	30
<b>Colloquia</b>				
<b>Projects</b>		20		