RTU Course "Fundamentals of Industrial Electronics"

33000 Faculty of Computer Science, Information Technology and Energy

General data

Code	EEI504
Course title	Fundamentals of Industrial Electronics
Course status in the programme	Compulsory/Courses of Limited Choice
Responsible instructor	Oskars Krievs
Academic staff	Ivars Raņķis
Volume of the course: parts and credits points	1 part, 4.5 credits
Language of instruction	LV, EN
Annotation	Automation of manufacturing technologic processes and electronic junctions of automation systems. Discrete control of manufacturing processes and its electronic elements. Analogue electronic automation systems and its elements. Digital and analogue sensors in manufacturing processes, its operation principles and typical realization. Junctions of analogue signal processing on base of operational amplifiers. Junctions of digital processing systems. Systems of programmable logical controllers, its structure and realization. Industrial communication networks and their construction and classification. Systems safety elements, estimation of possible risks and safety systems architecture.
Goals and objectives of the course in terms of competences and skills	Provide knowledge in fundamentals of industrial electronics. Develop the ability to recognize and design basic electronic equipment applicable in industrial environment.
Structure and tasks of independent studies	Students have to carry out 4 practical laboratory exercises as well as independently design and describe a simple process control system.
Recommended literature	J.Greivulis, I.Raņķis. Iekārtu vadības elektroniskie elementi un mezgli. Rīga: Avots, 1997, 288 lpp; I. Raņķis, A. Žiravecka, Industriālās elektronikas pamati. Rīga: Avots, 2007, 212 lpp; A.R. James, G.J. Sartori, Industrial Electronics. Pearson Education Inc., Prentice Hall, 2006. 862.p; Прянишников В.А. Электроника. Полный курс лекций. Корона-Принт, 2004. – 416с. Волович Г. И. Схемотехника аналоговых и аналого-цифровых электронных устройств / Г.И. Волович. - Москва : Додэка-XXI, 2005. - 528с.
Course prerequisites	Basic knowledge of fundamentals of electrical engineering theory and in solid-state devices.

Course contents

Content	Full- and part-time intramural studies		Part time extramural studies	
	Contact Hours	Indep. work	Contact Hours	Indep. work
Introduction to the topics to be covered, literature and requirements.	1	0	0	0
Classification of manufacturing systems, technology pyramid and tree.	1	0	0	0
Solid-state devices – transistor and thyristor switches, solid state relays AC and DC voltage regulators.	2	0	0	0
Discrete sensors – inductive, capacitive, photoelectric sensors, operational principles and typical implementation.	2	0	0	0
Analogue industrial sensors and transducers, their operational principles and typical implementation.	4	0	0	0
The structure and basic properties of operational amplifiers.	2	0	0	0
Analogue signal conditioning with operational amplifiers. Instrumental amplifier.	4	0	0	0
Industrial power supply topologies, integrated voltage regulators. Switching mode power supplies.	2	0	0	0
Logic gates, synthesis and minimization of logic functions.	2	0	0	0
Integrated logic circuit families - DTL, TTL, CMOS, BiCMOS, ECL, GaAs devices, their structure and parameters.	6	0	0	0
Introduction to programmable logic controller (PLC) systems. The structure and modules of PLCs. „Ladder" diagrams.	2	0	0	0
Classification and structure of industrial communication networks. Common communication protocols.	2	0	0	0
Elements of safety systems, risk assessment and prevention, selection of safety system architecture.	2	0	0	0
Laboratory work No.1. Investigation of discrete control input and output devices.	4	0	0	0
Laboratory work No.2. Investigation of discrete and analogue sensors.	4	0	0	0
Laboratory work No.3. Investigation of typical operational amplifier circuits.	4	0	0	0
Laboratory work No.4. Investigation of logic circuit families.	4	0	0	0
Total:	48	0	0	0

Learning outcomes and assessment

Learning outcomes	Assessment methods
Ability to recognize and apply typical discrete control input and output devices.	Accomplished and defended lab. work No.1. Passed an exam.
Ability to recognize and apply typical discrete and analogue sensors.	Accomplished and defended lab. work No.2. Passed an exam.
Ability to recognize and apply typical analogue signal conditioning modes with operational amplifiers.	Accomplished and defended lab. work No.3. Passed an exam.
Knowledge about parameters of different logic families and ability to implement them in practice.	Accomplished and defended lab. work No.4. Passed an exam.
Ability to design simple process control systems.	Accomplished and defended home task. Passed an exam.

Study subject structure

Part	CP	Hours			Tests		
		Lectures	Practical	Lab.	Test	Exam	Work
1.	4.5	2.0	1.0	0.0		*	