RTU Course "Industrial Electronic Equipment"

11103 Industriālās elektronikas un elektrotehnol.katedra

General data

Code	EEP453
Course title	Industrial Electronic Equipment
Course status in the programme	Compulsory/Courses of Limited Choice; Courses of Free Choice
Course level	Undergraduate Studies
Course type	Professional
Field of study	Power and Electrical Engineering
Responsible instructor	Ivars Raņķis
Academic staff	Oskars Krievs Genadijs Zaļeskis
Volume of the course: parts and credits points	1 part, 4.0 Credit Points, 6.0 ECTS credits
Language of instruction	LV, EN
Possibility of distance learning	Not planned
Abstract	Classification of manufacturing systems, technology pyramid and tree. Discrete control input and output devices – control switches, relays, actuators and indicators. Solid-state devices in industrial applications – transistor and thyristor switches, solid state relays, AC and DC voltage regulators. Industrial power supply topologies. Discrete industrial sensors – inductive and capacitive proximity sensors, photoelectric sensors, their operational principles and typical implementation. Output interfaces of discrete sensors. Analogue industrial sensors and transducers – temperature, pressure, flow, level, position and speed sensors, their operational principles and typical implementation. Analogue signal conditioning with operational amplifiers. Basics of Boolean algebra. Logic gates, synthesis and minimization of logic functions and their implementation in integrated circuits. Programmable logic controller systems, their structure and typical components. Ladder diagrams. Classification and structure of industrial communication networks. Elements of safety systems, risk assessment and prevention, selection of safety system 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 outline

Theme	Hours
Introduction to topics to be covered, literature and requirements.	1
Classification of manufacturing systems, technology pyramid and tree.	1
Mechanically activated control switches, relays, actuators.	2
Solid-state devices – transistor and thyristor switches, solid state relays AC and DC voltage regulators.	4
Discrete sensors – inductive, capacitive, photoelectric sensors, operational principles and typical implementation.	4
Analogue industrial sensors and transducers, their operational principles and typical implementation.	4
The structure and basic properties of operational amplifiers.	2
Analogue signal conditioning with operational amplifiers. Instrumental amplifier.	8
Industrial power supply topologies, integrated voltage regulators.	6
Logic gates, synthesis and minimization of logic functions.	2
Integrated logic circuit families - DTL, TTL, CMOS, BiCMOS, ECL, GaAs devices, their structure and parameters.	8
Introduction to programmable logic controller (PLC) systems. The structure and modules of PLCs. „Ladder" diagrams.	2
Classification and structure of industrial communication networks. Common communication protocols.	2
Elements of safety systems, risk assessment and prevention, selection of safety system architecture.	2
Laboratory work No.1. Investigation of discrete control input and output devices.	4
Laboratory work No.2. Investigation of discrete and analogue sensors.	4
Laboratory work No.3. Investigation of typical operational amplifier circuits.	4
Laboratory work No.4. Investigation of logic circuit families.	4

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.
Ability to recognize and apply typical discrete and analogue sensors.	Accomplished and defended lab. work No.2.
Ability to recognize and apply typical analogue signal conditioning modes with operational amplifiers.	Accomplished and defended lab. work No.3.
Knowledge about parameters of different logic families and ability to implement them in practice.	Accomplished and defended lab. work No.4.
Ability to design simple process control systems.	Accomplished and defended home task.

Study subject structure

Part	CP	ECTS	Hours per Week			Tests			Tests (free choice)		
			Lectures	Practical	Lab.	Test	Exam	Work	Test	Exam	Work
1.	4.0	6.0	3.0	0.0	1.0		*		*		