



RIGA TECHNICAL
UNIVERSITY

Faculty of Electrical and Environmental Engineering

Note! This is a preliminary list of courses. Changes may occur!

AUTUMN SEMESTER

BACHELOR COURSES

“Study programme Electrical engineering”

Code	Course name	CP	ECTS
EEP475	Electronic Equipment	4.0	6.0
<p>The study course gives an insight on typical electronic power supply unit topologies. Linear and switching mode voltage regulators are discussed analysing the principles of operation and common integrated circuits. Overcurrent protection circuits are discussed. Power amplifiers, their classification, as well as their main characteristics are analysed. The structure and basic properties of operational amplifiers are discussed. The typical operational amplifier circuits, signal generators and active filters are analysed. Basic logic functions, logic gates and their properties are discussed. Typical combinational logic devices – decoders, encoders, multiplexers, adders, programmable logic devices, as well as the typical sequential logic devices – triggers, binary counters, parallel and shift registers are covered. Semiconductor ROM and RAM memories, their structure and parameters are discussed. Integrated logic circuit families - DTL, TTL, CMOS, BiCMOS, ECL, GaAs devices, their structure and parameters are analyzed and the good practice while working with digital devices is discussed. Various devices linking the digital and analog circuitry are covered - ADCs and DACs, „voltage – frequency” and „frequency – voltage” converters as well as timer circuits and applications.</p>			
BÜK702	Adaptive Systems in Biology	3.0	4.5
<p>The aim of the study course is to provide knowledge about the adaptive mechanisms in biology, their types and importance in control of biological processes. Study course tasks: 1. To provide basic knowledge in the following fields of biology - biochemistry, molecular biology, cell biology, evolution, ecology, and microbiology. 2. To create theoretical and practical knowledge about the mechanisms of process control in biological systems. 3. To promote the integration of biological processes in other sectors. 4. Explain the importance of biological processes in human life and exploitation potential.</p>			
EEE223	Fundamentals of Electrical Engineering Theory	6.0	9.0
<p>The aim of the study course is to provide the necessary knowledge and develop an understanding of electromagnetic phenomena and processes found in linear electrical circuits in stationary modes, as well as to provide knowledge about qualitative and quantitative relationships. The tasks of the study course are: 1) to present current, voltage and power calculations in DC and AC circuits (single-phase and three-phase); 2) to provide knowledge on how to represent sinusoidal currents and voltages in a complex plane in the form of vector diagrams, to create a potential topographic diagram of AC circuit points; 3) to introduce resonance and mutual induction phenomena; 4) to present the undesirable effects of higher harmonics on the operating modes of AC circuits and the operation of resonant filters, with the help of which their influence can be reduced.</p>			
EEI717	Embedded Systems (course project)	2.0	3.0
<p>Utilization of embedded microprocessor systems often includes acquisition of various data from sensors and their networks, as well as process control. The proposed course develops practical hardware and software skills related to sensor's use and process control.</p>			
EEI345	Programming Technologies (study project)	3.0	4.5
<p>The goal of the study course is to train to develop individually selected embedded software system and to solve the assigned technical task related to the control of electrical objects. The tasks of the study course are: 1) to provide knowledge about the design of embedded software project technical documentation; 2) to develop skills to perform system analysis, requirements analysis, structural analysis and algorithm development; 3) to improve programming skills; 4) to evolve competence to create and test the program according to the developed project and defined requirements.</p>			
EEP273	Basics of Regulation Theory	2.0	3.0
<p>In the study course the methods of regulation theory are acquired and the skills of parameter calculations are acquired. The essence of the study course is related to the regulation of the parameters of the technical object, according to a certain level, moreover, the object must be able to adjust the value of the output parameter, according to the control signal. In most cases, these control signals are generated based on information about the current parameter values of the object. Control process design skills in basic automatic control processes are acquired. Students acquire the skills of solving analogy electrical engineering object regulation tasks. Feedback calculation, system decompositions - division into stages, as well as stage characteristics, creation of their models and transition to frequency characteristics. Students evaluate the system parameters - the system stability assessment. The design of control circuits for closed systems is considered. Thus, the transition processes of systems, their quality improvement, parameters of regulators, analogy and</p>			

numerical modeling are performed. Examples of the application of numerical control are considered.

EEM305	Electrical Machines	5.0	7.5
<p>The study course covers the principles and constructions of electrical machines and transformers, theoretical issues in stationary and transient processes are considered, as well as their operating modes and operating properties are analysed. Objective of the study course is to acquaint with the process of electromechanical energy transformation in various types of electrical machines and transformers. Tasks of the study course are to develop and improve knowledge and skills in the calculation and operation of electric machines.</p>			

EEI344	Digital Electronics (Study Project)	2.0	3.0
<p>In this study course such topics as number systems, logic functions, analysis and design of combinational logic circuits, analysis and design of counter circuits, programmable logic and digital logic description languages are discussed. The goal of the study course is to give students knowledge about control system design using digital electronic circuits. Study course objectives are: 1. To teach how to use typical discrete logic elements for combinational and sequential circuit synthesis. 2. To teach how to synthesize logic circuits using programmable logic. 3. To teach how to practically use typical logic elements and programmable.</p>			

EEP203	Digital Electronics (basic level)	4.0	6.0
<p>in the study course such topics as digital quantities, number systems, logic functions, Boolean algebra and laws, Karnaugh map, analysis and design of combinational logic circuits, fixed function logic circuits, programmable logic and its description methods are discussed.</p>			

EEI718	Industrial Sensors and Actuators	4.0	6.0
<p>The study course focuses on industrial sensors and actuators. The working principles, terminology and classification of common industrial sensors are analysed. The electrical and pneumatic actuators are mainly discussed but some information is given also about hydraulic actuators. The typical solutions for connecting the sensors and actuators to the control equipment are explained.</p>			

BACHELOR COURSES

“Study programme Environmental engineering”

Code	Course name	CP	ECTS
EVA703	Introduction to Study Field	2.0	3.0
<p>The main issues of the course: content of environmental science bachelor study program and its realization; organization of study process; definition, history and problems of environmental science; basic principles of sustainable development; career opportunities.</p>			

VAS027	Sustainable Development	2.0	3.0
<p>The study course is related to system thinking, innovative and balanced approach to the development of economic, environmental and social dimensions at the same time. The historical perspective of sustainable development, conceptual models of sustainable development and evaluation of sustainable development indicators are looked closely.</p>			

VAS006	Introduction to Biotechnology	6.0	9.0
<p>The study course introduces approaches, technologies and examples of the use of local bio-resources and the production of high value-added products. The biotechnology approach is topical in the context of sustainable development of the state, the region, the municipality and for every inhabitant. The study course analyses obtaining and processing technology solutions of the bio-resources. The study course includes an analysis of the climate, environmental, economic, socio-economic and legislative aspects of the introduction of biotechnology.</p>			

VAS030	Air Quality Engineering (part 1)	3.0	4.5
<p>The air quality specialization includes both outdoor and indoor air quality. Outdoor air quality ranges from local, such as dust levels on city streets, to global climate change and the ozone hole in the upper atmosphere. Air quality is a concern both for human health and for the wider planet. The European Union has set air quality standards to regulate air quality. Indoor air quality is also crucial, especially given that people spend most of their time indoors. Indoor air pollutants can include radon (which escapes from the surrounding soil into a building); bioaerosols (including airborne viruses, bacteria, mould spores, etc.); volatile organic compounds released from paint, carpet, computer plastics, etc. The study course will provide an insight into the concept of air quality engineering, improve skills in gas and liquid mechanics, provide an understanding of how physical processes are described, what simplifications should be used to make calculations and how to apply them to find solutions to air quality pollution problems at the local level. and globally. Students will be introduced to the types of pollution and their spread, and the requirements for air quality.</p>			

VAS028	Smart Energy Systems (part 1)	3.0	4.5
<p>The study course introduces students to the fundamentals engineering principles of all major sources of renewable energy, including a detailed understanding of its conversion into electricity and subsequent distribution. Students will gain an overview of the engineering challenges of renewable energy production and a wider understanding of renewable energy in a societal context. The existing and future requirements of the distribution and transmission networks in relation to increased renewable and distributed generation will be covered, including the development of the Smart</p>			

energy systems. The leading technologies in the field will be examined in detail, with a focus on electrical machine and power conversion requirements.

VAS004	Concepts and Technologies of Waste Management (1)	3.0	4.5
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The study course consists of two parts. The first part is based on the sustainable waste management concept and is focused on the minimisation of amounts of produced and disposed wastes for the elimination of environmental pollution and useless consumption of resources. Different methods of pre-treatment and treatment wastes are studied and optimisation of waste management for environmental pollution prevention/ elimination and economic profitability is modelled during the study course. The second part of the study course will introduce different geophysical methods which are applicable solely or in combination, to solve engineering and environmental problems. The mathematical fundamentals will be explained shortly for each method as it is necessary for an understanding of the results. The description of each method includes descriptions of the equipment, the mathematical basis for obtaining the results, measurement methods and algorithms, determination of accuracy, economic and social aspects, interpretation and analysis of the processed measurement results.

VAS001	Metrology	4.0	6.0
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The study course "Metrology" explains various measurement methods and measuring instruments that are used for monitoring energy and environmental protection sectors. The study course includes several laboratory works and the student has to perform processing, analysis and presentation of the measurement results of the work. Part of the course is devoted to the official metrology and standardization..

EAS705	Theoretical aspects of climate technologies	4.0	6.0
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The course „Theoretical aspects of climate change“ is based on estimation and evaluation of climate change and global warming and their impact on environment. Besides the course takes a look at questions related to pollution of the atmosphere, calculation of greenhouse gas emissions, legislation regarding reduction of climate change and adaptation issues. One of the most important topics is climate technologies and the importance in the context of climate change

Note! Full course description available by clicking on the course code!

MASTER COURSES
“Study programme Electrical Engineering”
(available only to graduate students)

Code	Course name	CP	ECTS
EEP504	Microprocessors - based Automation Systems	3.0	4.5

The course has been composed for any student who has elementary knowledge in the field of electrical engineering and programming and wish to gain basic practical skills of utilization of microcontrollers MSP430. The course briefly discusses basic design features of microcontrollers MSP430 in the context of various architectures of microprocessors, microcontrollers and peripheral devices. The most significant part of the course is devoted to the programming of MSP430 – including the programming of digital I/O, watchdog and arithmetical operations. The course is based on practical studies and assumes active individual training of the students in the laboratory or at home.

EEP585	Simulation of Electrical Processes	5.0	7.5
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The subject is devoted to simulation of electrical circuits. Principles of composing of differential equation systems for electrical equipment, of their numerical calculation, and its features in MATLAB are given in the first significant part of the course. The second part is devoted to PSPICE circuit description language and to the features of its practical utilization. The theoretical part of the course deals with solutions of ordinary differential equation systems and basics principles of PSPICE. The practical (most important) part of the course includes various examples of simulation of electrical equipment.

EEP433	Automated Electrical Drive	3.0	4.5
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Electrical drives and automation by usage of the DC, AC induction and synchronous type motors. Tracking drives, programmable, adaptive and self-organizing systems. Electric magnets, electric-magnetic clutches. Choice of the motors and its protection. Reliability of the systems.

EEP584	Theory of Electronic Converters of Electrical Energy	4.0	6.0
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General theory of energy conversion. Rectifiers and line-frequency controlled inverters. Autonomous inverters. Current-source, voltage-source and resonance mode inverters. Modulation methods. BUCK and BOOST converters. Frequency converters with high-frequency links. Matrix type converters. Cycloconverters.

EEI701	Effective Lighting	2.0	3.0
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The course is focused on lighting issues. The course summarizes the current lighting and electrical systems, as well as explains their operating principle as well as the basic methods of the modern systems of the lighting control and

regulation. One of the most important questions connected with the energy saving from the modern lighting systems.

<u>EEA432</u>	Electrical Installation of Buildings	2.0	3.0
Structure of buildings and their construction. Schemes of electric installation and systems of conventional signs. Electrical equipment in household and its control. Selection of electrical devices and mounting technology. Tools and devices for mounting. How to draw up a plan of installation.			

<u>EEP524</u>	Design of Power Electronics Systems	3.0	4.5
The subject is proposed for full and part-time RTU academic master study program „Computerized Control of Electrical Technologies” students. The power electronics system main converter design and calculation are considered. It is described the design and calculation of controllable rectifier, net inverter, DC pulse converter and autonomous inverter power and control schemes.			

<u>EEP570</u>	Elements of Automatics	9.0	13.5
Within the study course, the main stages of the automation process are considered, the design of an individual prototype is performed, the corresponding calculation and selection of elements is performed. Sensors of electrical and non-electrical quantities, signal measurement circuits are studied. During the study course, the synthesis of the logical part is performed. Schemes and application of functional converters, characteristics of their technical parameters as well as the analysis of the reliability indicators of the schemes are studied is performed.			

<u>EEP572</u>	The Control Systems of Power Electronics Equipment	5.0	7.5
Electronic elements of control systems. Saw-teeth mode voltage, forming of firing pulses. Achieving of the time delay in control systems, phase shifting control, synchronization with network, generators for clock pulses, diversification devices, Pulse Width Modulators, microprocessor based control systems for frequency converters.			

MASTER COURSES
“Study programme Environmental Engineering”
(available only to graduate students)

Code	Course name	CP	ECTS
<u>EAS722</u>	Environmental policy and economics	5.0	7.5
The environmental policy and economics course is an analysis of how environmental awareness has evolved historically based on the ethical principles and moral values present in society, as well as on the development of science, structure of society, environmental psychology, the structure of economic and political systems and their impact on the development of environmental policy. The course has a comparative analysis of the development of environmental legislation in Latvia, the EU and elsewhere and looks at methods for evaluating and calculating losses to the environment by using direct and indirect valuation methods. The course is conducted through lectures, seminars and role plays.			

<u>EVA705</u>	Environmental Technologies (part 1)	4.0	6.0
The Environmental technologies course is related with various innovative solutions and approaches to reduce effect on environment from the manufacturing processes and maximize resource efficiency, including improving and developing management systems and optimizing manufacturing processes. Issues end-of-pipe technologies, cleaner production strategies and climate technologies are looked closely.			

<u>VAS012</u>	Intersectoral and Interdisciplinary Research Methods	4.0	6.0
The study course provides the knowledge necessary for the student to perform scientific research. During the lessons, planning of scientific research, planning and conducting experiments, analysis of measurement uncertainties, visualization of experimental data, analysis and processing methods, numerical and optimization calculation methods, reports of scientific research results, writing of scientific publications are considered.			

<u>EAS723</u>	Renewable energy sources	4.0	6.0
Renewable energy flow; solar, wind, hydro, ocean waves, tide, geothermal and bio-fuel energy systems. Energy storage and distribution. Integration of renewable energy sources into the energy systems. Planning of energy supply scenarios with increased share of renewables.			

<u>EVA709</u>	Biotechnologies	4.0	6.0
The course "Biotechnologies" provides the knowledge on design and operation of bio-based technologies in environmentally friendly and costs effective manner. It provides the knowledge on use of cells and cells elements (i.e. enzymes) in industrial production processes and provides it's comparison with traditional chemical production processes.			

VAS016	Adapting to Climate Change (part 1)	2.0	3.0
<p>The study course provides knowledge of climate change, mitigation and adaptation strategies. The aim of the course is to develop the basics, criteria, processes and values that will help to cope with disaster risk management and improve resilience. The study course focuses on the resilience of infrastructures. The study course provides basic knowledge in disaster risk reduction and mitigation, promoting adaptation to climate change and improving the resilience of society and critical infrastructures. The first part of the study course is designed to teach understanding of the basic terms: risk, disaster, vulnerability, and disaster, including natural disasters and man-made disasters. This part explains the term disaster along with vulnerability, creating a link between cause of the disaster and consequences for society and critical infrastructures.</p>			
VAS020	Development and Analysis of Biotechonomy (part 1)	2.0	3.0
<p>The study course provides information about the concept of biotechonomy, its influencing factors (environmental, climate, economic, socioeconomic, technological) and tools (political, economic, etc.). Methods of biotechonomy analysis and evaluation of possibilities of using different alternative bio-resources are acquired, comparison and determination of the optimal solution. Theoretical knowledge is transferred to practical examples by analyzing biotechonomy at various levels - international, national, regional, industry and local, and developing recommendations for improvement.</p>			
VAS016	Adapting to Climate Change (part 1)	2.0	3.0
<p>The study course provides knowledge of climate change, mitigation and adaptation strategies. The aim of the course is to develop the basics, criteria, processes and values that will help to cope with disaster risk management and improve resilience. The study course focuses on the resilience of infrastructures. The study course provides basic knowledge in disaster risk reduction and mitigation, promoting adaptation to climate change and improving the resilience of society and critical infrastructures. The first part of the study course is designed to teach understanding of the basic terms: risk, disaster, vulnerability, and disaster, including natural disasters and man-made disasters. This part explains the term disaster along with vulnerability, creating a link between cause of the disaster and consequences for society and critical infrastructures.</p>			
EAS704	Socio-economic aspects of energy supply	4.0	6.0
<p>Concept of socio-economic aspects of energy supply systems. Techno-economic, socio-economic and environmental aspects of energy supply; the current situation, trends and projections at the global, EU and Latvian context. Investment project cycles. Public regulation of energy supply. Basic aspects of pre-investment study. Market institutions and technological change, its impact on the technical and economic studies; the entrance and exit barriers. Content of the technical-economic study. The basic principles of calculation of capital investments, financial analysis of energy project and investment analysis. Calculation of long-term marginal cost of electricity production. Activities of the energy supply companies in a competitive environment. The external costs in economic calculation. Socio-economic figures for energy projects.</p>			

Note! Full course description available by clicking on the course code!