RIGA TECHNICAL UNIVERSITY

Faculty of Electronics and Telecommunications

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

AUTUMN SEMESTER

BACHELOR COURSES

Code	Course name	CP	ECTS
RAE261	**Digital Electronics and Computer Architecture**	**3.0 CP**	**4.5 ECTS**

Types of electrical signals. Arithmetic and algebra of binary counting system. Logic algebra and its functions. Minimization of logical functions. Combinational logic circuit analysis and synthesis. Sequential logic basic elements. Basic structure of computers, general concepts: algorithm, command, program, operand, address, operational system, computer memory, central processor, arithmetic-logic-unit.

RAE362	**Digital Devices and Systems**	**3.0 CP**	**4.5 ECTS**

Pulse signals and their impact on linear electrical circuits. Pulse signals transformer. Digital switches. Logic families, their parameters and electrical structures. Limiters. Pulse generators. Analogue and digital comparators. Digital to Analogue and Analogue to Digital Converters. Timers. Computer memories. Computer internal and external interfaces.

RDE708	**Telecommunications Systems**	**6.0 CP**	**9.0 ECTS**

The course gives an idea and a basic understanding of the various types of wired, wireless and fiber optic transmission systems and their main switching elements. The course examines the history of the development of telecommunications systems in the world, in Latvia and future trends. Laboratory and practical work with engineering prototypes of the telecommunications system is also planned.

RAE202	**Computer Technologies in Telecommunications**	**3.0 CP**	**4.5 ECTS**

Global information transmission networks. Open systems. Concept of interworking. Control systems. Distributive and centralized control. Real-time execution. Processing and distribution of information. Network management. Maintenance. Designing. SDL. Databases. Datamodels, Data structures. Specifications. Relation DB. Statistical modelling.

RDE707	**Telecommunications Theory**	**6.0 CP**	**9.0 ECTS**

The aim of the course is to provide students with the basic knowledge of principles, structure and operation of communication systems. The following topics are covered: the history of telecommunication systems, their development, classification; signal and noise as random processes; geometrical interpretation of signals; sampling theorem, discretization of continuous signals; modulation and detection; the models of communication channels, information theory; codes, their classification and application; Shannon's theorems, theory of optimal reception of digital and continuous signals; signal filtering. Laboratory work and practical work are also envisaged.

RAE701	**Digital Devices of Telecommunications Systems**	**4.0 CP**	**6.0 ECTS**

Addressing modes in processor systems. Systems of commands of one-byte microprocessors and programming basics. Floating comma number formatting and the subprocessor. External memory and its addressing and protection. Pipeline processing commands and the data. Alarm processors, their use.

REA204	**Electron Devices**	**3.0 CP**	**4.5 ECTS**

Electron devices as two and four terminal devices, their current-voltage characteristics. Small signal parameters of two and four terminal devices and corresponding equivalent circuits. Electron energy spectrum of solids, their division in metals, dielectrics and semiconductors. Intrinsic semiconductors and semiconductors with impurities. Electron statistics in semiconductors. P-n junction, its equilibrium and non-equilibrium properties. Heterojunction and contact metal-semiconductor. Rectifier, p-i-n, high frequency, pulse, tunnel, reverse, Zener, variable capacitance and Schottky diodes. Bipolar junction transistors, thyristors, field effect transistors and charge coupled devices. Structure, operation principles, current-voltage characteristics, parameters, mathematical models, advantages and drawbacks of devices considered. Influence of temperature on operation of electron devices.

RTR701	**Laboratory Exercises in Electronics**	**3.0 CP**	**4.5 ECTS**

Resistance for circuits containing resistors connected in parallel, series and mixture connection; time delay by RC circuit; bipolar transistor as a switch; bipolar transistor as an amplifier; biasing of bipolar transistors; amplifier circuits; MSP 430 microcontroller, microcontroller pin programming as input, output, masks, programming several MSP430 integrated peripherals. The volume of subject areas may be varied according to the background and interest of specific groups.

REA103	Fundamentals of Materials Science	2.0 CP	3.0 ECTS
The role of materials in provision of existence of the human being. Simple materials and composite materials. Structural levels of materials. Interconnection between structure and properties of materials. Practically usable forms of materials. Methods of obtaining of these forms. Technological characteristics of materials. Life cycle of materials. Principles of material selection and new material design strategy.			

REA304	Analogue Equipment	5.0 CP	7.5 ECTS
General parameters. Resistance amplification stages. Feedback theory and characteristics of amplifiers with feedback. Frequency independent inverse feedback. Resistance to self-oscillations, correction of AFR, slew rate. DC operation mode stabilization of transistors, DC amplifiers. Op amps. Analogue signal converters with op amps. Power and selective amplifiers. Amplifiers with frequency dependent feedback. Generators.			

RTR307	Electrodynamics and Vector Analysis	4.0 CP	6.0 ECTS
Charges and currents. Electromagnetic field vectors. The application of vector analysis in field theory. The fundamental laws of electromagnetic field theory. Maxwell's equations in differential and integral form and their physical interpretation. Static and stationary fields. .The propagation of electromagnetic waves in homogeneous medium. Boundary conditions and boundary problems. The radiation and excitation of electromagnetic waves. Electromagnetic waves in the simplest transmission lines. Waveguides and optical fibers. Propagation of radio waves in the real area. Ground waves. Waves in atmosphere (troposphere, ionosphere) and aerospace.			

REA701	Embedded Systems Architecture	3.0 CP	4.5 ECTS
Students learn about the design, architecture and operation of microprocessors and microcontrollers, from transistor level up to code execution and application level. During the course, students will have an opportunity to design their own simple microcontrollers from logic gates. They will also get to know the most popular and widespread microcontrollers used in the industrial design, and build their own embedded systems with a microcontroller.			

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

MASTER COURSES

Code	Course name	CP	ECTS
RDE419	Fibre Optic Transmission Systems	5.0 CP	7.5 ECTS
Topics covered include FOTS element classification, optical fibre, cables, manufacturing, parameter system, loss mechanism, optical connections, optical waveguide electrodynamics, irradiating and receiving modules, multiplexers, demultiplexers, parameter measurements, optical sensors. International standards related to optical communication systems are discussed. Students are prepared both for practical work with optical elements and further studies at doctoral study programmes.			

RAE411	Telecommunications Software	4.0 CP	6.0 ECTS
The goal of the course is to ensure that the learning outcomes are achieved. The objectives: 1. to acquire the knowledge of the basic concepts of Java technology - OOP, independency of platform, automatic memory release, JVM; 2. to acquire skills to create, compile and run a simple Java console and GUI applications, applets and J2ME MIDlets; 3. to acquire skills to create, compile and run simple and complex Java networking applications; 4. to acquire skills to use the Java API, as well as external class libraries independently; 5. to acquire skills to build server-client application, to work with socket operations, to read packets from network interfaces.			

RDE410	Design and Maintenance of Telecommunications Networks	4.0 CP	6.0 ECTS
The course deals with projecting of transmission systems. Students identify and define tasks, structure, and content of a project. Topics include principles of electricity supply and powering, maintenance tasks and management, parameters and methods, condition, control means and parameters of communication systems, remote control systems.			

RAE473	Computer Technologies in Telecommunications	3.0 CP	4.5 ECTS
The objective of the course is to enable students to construct software by means of systematic object-oriented analysis and design. The course covers the methods for object-oriented analysis and modelling of application domains and software systems. The analysis includes description of objects and their structuring and functional specifications. The design will include the system modelling with layering and partitioning.			

RDE417	Physics of Optical Information Processing	4.0 CP	6.0 ECTS
The course is designed to introduce students to the fundamentals of optoelectronic and optical communications. Topics cover waveguide optics, nanophotonics, metamaterials, holography, optical information processing, laser technology and nonlinear optics, atmospheric laser communications, FOTS information multiplexing and computer simulation.			

RDE703	Microwave Telecommunications Systems	5.0 CP	7.5 ECTS

Topics covered by the course include microwave propagation, radio communication, attenuation factor, radio link components: antennae, feeder, receiver and transmitter; analogue and digital radio systems, noise immunity, communication stability and grade of service, satellite and mobile systems, short range radio systems for telephone communication.

RAE472	Digital Switching Systems	3.0 CP	4.5 ECTS

This course is partly based on CCNP SWITCH 642-813 Official Certification Guide. .Introduction to OSI system Layer 2 and multilayer switch operation. Basic VLAN concepts. End-to-end VLAN. VLAN channel. Ethernet application in campus network. Inter VLAN communication through Layer 3 routing. Switch port aggregation with EtherChannel. Spanning tree protocol. Multilayer switching with CEF. Voice VLAN. Catalyst and ASR switches. Enterprise network, Ethernet carrier environment. Switching in optical networks.

RAE541	Encoding and Encryption	4.0 CP	6.0 ECTS

Characteristics of codes. Simple codes for error detection and error correction. Prefix and suffix codes. Cyclic codes, swapped codes. Applications. Filtering of digital signals. Synchronizaton in TV and message transmission. Methods of encryption.

RTR803	Signal Processing Systems	3.0 CP	4.5 ECTS

Within the framework of the study course students are provided information on such topics as classification of signals and systems; models of signals, signal spaces; representation of signals by sets of orthogonal functions: complex exponentials, Walsh, Haar, Laguerre functions, wavelets; short-time Fourier, Hilbert transforms; transformations of narrowband signals by bandpass systems; optimum filtering, matched filters, Viener, Kalman filtering; spread spectrum signals, multicarrier signals; nonlinear dynamical systems, chaos.

RTR804	Signal Processing Systems (Study work)	2.0 CP	3.0 ECTS

Topics covered by the course include: classification of signals and systems; models of signals, signal spaces; representation of signals by sets of orthogonal functions: complex exponentials, Walsh, Haar, Laguerre functions, wavelets; short-time Fourier, Hilbert transforms; transformations of narrowband signals by bandpass systems; optimum filtering, matched filters; nonlinear dynamical systems.

RTR512	Microwave Devices and Equipment	3.0 CP	4.5 ECTS

The features of microwave range. Energy interchange. S-matrices. Electron devices: klystrons, magnetrons, O and M travelling wave tubes and design. Microwave semiconductors: diodes, transistors, chips. Design of generators. Quantum devices and constructions. From paramagnetic amplifier till semiconductor laser.

REA703	Data Transmission in Wireless Sensor Networks	3.0 CP	4.5 ECTS

In this course, students will learn about the modern wireless sensor network standards. They will study about digital modulation, contents of over-the-air packets, standard network protocols, and standard security protocols. Students will have an opportunity to do a hands-on work with RF transceivers, creating their own wireless networks using the available development boards. Means of power efficiency and techniques of power reduction will be thoroughly analyzed and tested.

REA707	Digital Electronic Systems Design	3.0 CP	4.5 ECTS

Study course allows obtaining of analytical and practical skills in the process of analysis and design of digital electronic systems. The material is based on sequential explanation of design process, finally focusing on the Register Transfer Level design procedure, creating the basis for FPGA programming courses. Theoretical knowledge obtained during lectures is applied to solution of practical exercises- design of digital electronic systems. The following approach will give students the possibility to solve digital electronics testing and design problems and will serve as the foundation for further studies.

RTR710	Signal Processing in Heterogeneous Systems Containing FPGA	3.0 CP	4.5 ECTS

Heterogeneous systems (HS) utilize multiple data processing units of different types, for example – hard-processor (HPS) and reprogrammable gate array (FPGA). In contrast to homogeneous systems, which gain in performance by increasing count of identical type of resources (e.g. processor cores), HS achieve similar effect by utilizing diversity of its components, and solving each part of the task by most suitable available resource. Modern technologies allow integration of HS components on a single crystal, making a System on a Chip (SoC). In SoCs different data processing units are connected to a single bus, allowing for fast exchange of huge data streams.. Work with HS demands competence in broad range of disciplines – electronics, computer architecture, programming and signal processing. This course offers 2 signal processing models and all concepts, necessary for these model practical realization in HS: HS architecture, usage of Hardware Description Language (HDL) for signal processing in HS's FPGA part, methods of data exchange between HPS and FPGA, and briefly about Operating System tools to support this data exchange. Coursework with students working in groups is included in this course.

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