FACULTY OF ELECTRONICS AND TELECOMMUNICATIONS

Please note! This is a preliminary list of courses for the study year 2016/2017. Changes may occur!

Autumn 2016
BACHELOR COURSES

REA204 Electron Devices
3.00 CP (4.50 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.

RAE361 Digital Devices of Telecommunications Systems
3.00 CP (4.50 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.

REA302 Materials, Components, Microelectronics
3.00 CP (4.50 ECTS)
General characteristics of materials and components. Electro-conductive materials and components. Dielectric materials. Resistors. Capacitors. Magnetic materials, inductive components. Semiconductors materials. Fundamentals of microelectronics technology.

RAE359 Distributed Systems in Telecommunications
3.00 CP (4.50 ECTS)
The course deals with distributive systems in telecommunications. The goal of the course is to give an introduction to the distributive system problems, modelling of parallel processes and understanding of Open System Interconnection reference model (OSI - RM), functionality and architecture of telecommunications networks.

RDE301 Telecommunications Theory
5.00 CP (7.50 ECTS)
The aim of electro-communications theory is to provide students with the basic knowledge of principles, structure and operation of communication systems. The following questions 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.

RAE261 Digital Electronics and Computer Architecture
3.00 CP (4.50 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.

RAE306 Digital Switching Systems
4.00 CP (6.0 ECTS)
Introduction to telecommunication systems and services. Basics of digital circuit switching, time and space switches. Digital networks: component and multiplexing systems, main types of lines and trunks. Digital switching systems: comparison of EWSD and S12. Basics of packet switching and transmission. Difference between circuit and packet switching. Open system interface. ATM. Compromise between circuit and packet switching.

RTR223 Electrical Engineering Theory
6.00 CP (9.00 ECTS)
Circuits elements, parameters and fundamental laws: current, voltage, resistance, power, energy, ideally linear elements R, L, C, ideal and real current and voltage sources, Ohm`s and Kirchoff`s laws. Resistive circuits, their analysis methods: current and voltage division rule, Thevenin, Norton and superpozition theorems. Sinusoidal steady state theory and analysis in frequency domain: complex impedance and admittance, phasors and phasor diagrams. Magnetically coupled circuits. Resonances in RLC series and parallel circuits. Three-phase power systems analysis.

RAE305 Teletraffic Theory
3.00 CP (4.50 ECTS)
The course gives knowledge and skills of modelling, analysis and simulation of telecommunication networks as mass service systems. Dealing with M/M/1, M/M/k systems analytically. The use of Markov chains as mathematical models. Acquiring skills in simulation of systems with Petrie nets and other simple simulating tools (Java Simulation TOOLS).

RAE348 Telecommunications and Computer Networks
3.00 CP (4.50 ECTS)
The objective of the course is to make students understand the development of the Internet together with essential telecommunications network. It will begin with a historical perspective through analysis of the development on the Internet (TCP/IP), email (SMTP) and voice over IP. Difference between switching and routing processes on the telecommunications network and Internet. Open system interconnection reference model and TCP/IP. Types of network: WAN, MAN and LAN, and their characteristic technologies, and routing protocols. Structure of routing tables. Advantages of virtual private networks. MPLS protocol and QoS. Ethernet as carrier, tunnelling. Ethernet over dark fibre. Structure of next generation network. Session initiation protocol. Cluster interconnection on GRID and CLOUD networks. The influence of standards and regulations on development will be included.

REA103 Fundamentals of Materials Science
2.00 CP (3.00 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.

MASTER COURSES

RAE473 Computer Technologies in Telecommunications *(graduate)*
3.00 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.

RAE475 Telecomunications and Computer Networks *(graduate)*
5.00 CP (7.5 ECTS)
Telecommunications networks and systems as a telecommunication business infrastructure are studied. Skills of using the network control and management technologies and tools, network planning skills, network simulation skills and tools are objectives of this course.

RDE410 Design and Maintenance of Telecommunications Networks *(graduate)*
4.00 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.

RDE417 Physics of Optical Information Processing *(graduate)*
4.00 CP (6.00 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.

RDE419 Fibre Optic Transmission Systems *(graduate)*
5.00 CP (7.50 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.

RDE432 Transmission Systems (special course) *(graduate)*
4.00 CP (6.00 ECTS)
The course deals with transmission systems (TS) at an advanced level. It includes the theoretical analysis of TS, as well as their practical implementation. In the laboratory students are trained in the practical skills in the area of TS. The following topics are discussed: noise and its influence on transmission quality, regeneration of digital signals, baseband line codes, passband line codes, clock extraction and timing, xDSL technologies.

RAE555 Teletraffic Theory *(graduate)*
3.00 CP (4.50 ECTS)
The course covers the experimental systems in relation to telecommunications network systems. Within the framework of the course students will discuss the network management and control methods. Students will be enabled to promote their understanding of the performance of real systems. Important part of the course is evaluation methods as well as current trends and problems in the context of Internet, mobile and broadband communications.

RDE418 Telecommunications Theory (special course) *(graduate)*
4.00 CP (6.00 ECTS)
Electric communication theory (special course) for M.Sc.students of RTU is intended to deepen their knowledge of signal sampling and approximation, of linear system theory basing on entire analytic function theory, as well as of other communication technology theoretical problems. Theory of entire analytic functions is a valuable tool in communication theory and practice because entire analytic functions in the complex plane correspond to the functions with limited spectra on the real axis.The latter are just functions which describe signals transmitted over the bandlimited communication channels. In this way it turns out that the well known sampling (Kotelnikov) theorem is merely the special case of Lagrange's interpolation formula of entire analytic functions enabling also other sampling possibilities including nonuniform sampling. Similiarly, other new possibilities appear in signal approximation and in approximation error evaluation, as well as in signal restoration if only a partial information about the signal is known.Signal multiplexing in CDMA systems and the main branches of quantum information including quantum communications (mainly quantum cryptography) and quantum computers.The following main topics are covered in this special course. Entire analytic functions and their application insignal sampling, approximation and restoration. Properties of Fourier transform. Signal mutiplexing in multichannel systems, CDMA systems. The negentropy principle of information and its meaning for telecommunications. The influence of quantum effects on signal transmission. Quantum communications. Quantum cryptography. Quantum computers. Stochastic resonance.

RAE472 Digital Switching Systems *(graduate)*
3.00 CP (4.50 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.

RDE416 Microwave Telecommunications Systems *(graduate)*
4.00 CP (6.00 ECTS)
Topics 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.

RAE553 Signalling Systems and Protocols *(graduate)*
3.00 CP (4.50 ECTS)
The rapid development of telecommunications branches required specialists, who would be able to analyse current situation, forecast development directions, make long-term responsible solutions about favourable signalling/protocol system selection.
The course provides students with the necessary skills for working in the sphere of signalling and communications protocols. Aspects of compatibility, scalability and security are emphasized. Message formats, time and state diagrams of protocols are analysed. Work with protocol analysers in emulation environment provides students with necessary skills for solving problems and preparing for changes in configuration.
Within the framework of the course, students are acquainted with fundamental telecommunications signallings and protocols, analyse its historical development with some essential drawbacks, expand their personal vision for future task solutions in future.

RAE411Telecommunications Software *(graduate)*
4.00 CP (6.00 ECTS)
Since in the field of the telecommunications today more and more software is built on the Java platform-independent language base, the telecom professionals need to know the Java language basics - that is the nature of technology, its application areas, language syntax, the key programmatic solutions, and the main technical solutions to hardware. The course covers the diverse range of networking tasks, which include a server-client applications, and traffic reading/generation operations with Java technology, as well as J2ME technology solutions, which allow you to create interactive applications for mobile devices.
The given course provides students with the skills necessary to build Java SE applications and applets as well as Java ME MIDlets.

RDE425 Research Seminars Part 1
2.00 CP (3.00 ECTS)
Scientific workshops cover the following themes: presentation and discussion of the problems in the next generation telecommunications networks based on the analysis of the scientific literature, presentation and discussion of MSc analytical and experimental research results, the latest reviews on communications and measurement methodology, the latest telecommunications software for the analysis and their application reviews, taking part in scientific seminars, and work on the master thesis discussions.