RIGA TECHNICAL UNIVERSITY

## FACULTY OF ELECTRONICS AND TELECOMMUNICATIONS

**Please note! This is a preliminary list of courses for the Autumn semester of study year 2018/2019. Changes may occur!**

## BACHELOR COURSES

**RTR220 Basics of Signal Theory**
4.00 CP (6.0 ECTS)
Classification of signals, their characteristics, examples of use in communication systems. Continuous-time periodic and non-periodic signals, Fourier transforms, their properties. Discrete-time signals, Discrete Fourier Transforms, digital filtering, FIR and IIR filters. Modulation, AM, FM, PM signals, digital modulation, transformation of modulated signals by narrowband linear systems. Random signals, their main parameters, principles of measurement, noise in electronic systems.

**RAE362 Digital Devices and Systems**
3.00 CP (4.50 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.

**RDE302 Transmission Media**
6.00 CP (9.0 ECTS)
Communication line design. Classification of cable, insulating materials, protective covers. Electromagnetic processes in symmetrical, coaxial cable, waveguides. Design optimization. Electromagnetic compatibility. Mutual influence, rationing, protection. Shielding theory. Corrosion. Line construction, design, operation. The course includes both theory and communication lines measurements in the laboratory study. The international standards relating to the use of communication lines have been dealt with. Students are prepared both for practical work with lines of communication, and further studies in Master Course.

**RDE303 Transmission Systems**
4.00 CP (6.0 ECTS)
This course deals with transmission systems (TS), their evolution and application in modern telecommunications networks. Topics include signal digitalisation and transmission, regeneration of a digital signal and its conversion back to the analogue form. Formation and multiplexing of digital streams, as well as network synchronisation are examined. The course covers the theory of TS, as well as practical measurements in the laboratory. International standards related to TS interfaces are considered. Students are prepared for professional career and further studies at the Master's level.

**RDE201 Telecommunications Systems**
4.00 CP (6.0 ECTS)
Telecommunications development history in the world and Latvia. Trends. Report and tone. Steering, transmission and switching systems. Open die and closed systems. Fiber optic systems. Digital and analog systems and networks. Data transmission networks. Communications equipment, classification, application. Individual communications equipment. Telephone, fax, modem connection, use.

**RDE304 Electrical Measurements in Telecommunications**
3.00 CP (4.50 ECTS)
The course provides knowledge about electrical signal measurement methods and principles in the field of electronic communication. The course covers the following measurements: measurement of signal voltage and signal levels; frequency and time interval measurement, measurement and analysis of signal frequency spectrum, attenuation measurement, as well as service quality measurement. Students will obtain knowledge of measuring tools and measuring systems, as well as they learn about measurement and valuation methods of the quality of electronic communication services.

**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.

**RAE202 Electrical Engineering Theory**
3.00 CP (4.50 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.

**RAE202 Electrical Engineering Theory**
3.00 CP (4.50 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.

**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.

**TRT203 Semiconductor Devices**
3.00 CP (4.50 ECTS)
Small-signal parameters. Basic operating principles of devices. Diodes: rectifier diode, P- i- N diode, high frequency diode, impulse diode, tunnel diode, backward diode, light emitting diode, laser diode, stabilitron, varicap. Bipolar transistors and field-effect transistors. Charge-coupled devices. Thyristors. Photo resistors, diodes, transistors, thyristors. Optrons. Photoelectric multiplicators. Cathode ray lamps, kinescopes. Displays. Noise.

# MASTER COURSES

**RAE472 Digital Switching Systems**
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.

**RAE473 Computer Technologies in Telecommunications**
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.

**RDE417 Physics of Optical Information Processing**
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.

**RAE553 Signalling Systems and Protocols**
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.

**RAE475 Telecomunications and Computer Networks**
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.

**RDE418 Telecommunications Theory (special course )**
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.

**RDE419 Fibre Optic Transmission Systems**
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)**
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.

**RDE701 Telecommunications Software**
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.

**RDE703 Microwave Telecommunications Systems**
5.00 CP (7.50 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.