RIGA TECHNICAL UNIVERSITY

FACULTY OF ELECTRONICS AND TELECOMMUNICATIONS

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

BACHALOR COURSES
for students in electronics and telecommunications study programmes

RDE708 Telecommunications Systems
6.0 (9.0 ECTS)
The course in the telecommunication systems give 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.

RTR107 Introduction to Computers and Algorithms 2.0 (3.0 ECTS)
Computer machinery and principle of operation. Computing systems. Data storage. The concept of algorithm. Types of algorithm record. Linear, branched and cyclic algorithms. Implementation of basic algorithms in programming languages. Word processors for text and program writing. Program debugging and execution. The concept of an operating system and its functions.

RDE710 Introduction to Electronics and Telecommunications Branch Part 1 and Part 2 4.0 (6.0 ECTS)
The course is intended for the first-year students studying at bachelor study programmes of the Faculty of Electronics and Telecommunications. It contains information on Riga Technical University (RTU) and the Faculty of Electronics and Telecommunications, study programmes and organization of studies, memory features and active learning, as well as topics from the history of telegraph, telephone and radio. Within the framework of the course the following topics will also be covered: the history of development of telecommunications and electronics, different signal modulations and code methods, methods used in analogue/digital television and radio broadcasting.

RTR207 Computerization of Mathematical Tasks in Electrical Engineering 3.0 (4.5 ECTS)
Symbolic and numerical technical computing in electronics and telecommunications context. Technical computing and programming in MATLAB (ML). Programming, matrix computing, numerical solving of linear, nonlinear and ordinary differential equations using ML. Approximation, interpolation, numerical integration, and numerical solving of simple differential equations using ML.

TRT215 Fundamentals of Circuit Theory
3.0 (4.5 ECTS)
Resonances in RLC series and parallel network. Time-domain response of first-order and second-order circuits. The Laplace transform and the convolution. State variable analysis. Two-port networks: equations, matrices, connections.

TRT203 Semiconductor Devices

3.0 (4.5 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.

RDE303 Transmission Systems

4.0 (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.

RTR223 Electrical Engineering Theory

6.0 (9.0 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.

RAE359 Distributed Systems in Telecommunications 3.0 (4.5 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.

RTR108 Computer Studies (special course)

2.0 (3.0 ECTS)

The course provides further insights into contemporary computers and computing algorithms to be applied in further studies and engineering work, the basics of which were acquired within the framework of the course Computer Studies (basic course) taught during the first semester at RTU FET bachelor programme. The course outlines general data acquisition, computing and representation methods, related to potential automatization of these processes, using Internet recourses (telecommunication channels and Internet sites). Students get acquainted with Python programming language, study HTML elements presenting the data, and XML elements structuring the data. Within the framework of the course the students create electronic documents with the help of document production system LaTex. C++ and Python programming language object oriented programming elements are studied. The working computer environment is Linux based operational system like SUSE and/or UBUNTU. .

Practical programming tasks are connected with the special requirements imposed by the study field of electronics and telecommunications.

RAE362 Digital Devices and Systems

3.0 (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.

REA304 Analogue Equipment

5.0 (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.

RTR306 Anologue Electronics

5.0 (7.5 ECTS)

First part (semester 4) deals with signal converting in circuits with lumped nonlinear elements. The main themes: Performance curves of elements. Approximation types of elements curves. Mutual dependence of signal spectrum and its time function. Some express methods of calculation of signal spectrum. The illustration of most popular conversions of signals: amplification (linear, resonant, broadband); signal frequency multiplications; transposition of spectrum of signals; modulation types of signals (amplitude, frequency, phase); demodulation of modulated signals; rectification and elimination of the amplitude of signals; design of different oscillators; frequency stability and synchronization; design of parametrical R and C elements; converting of signals by using parametrical elements; suggestions for low noise parametrical amplification. Second part (semester 5): Operational Amplifier fundamentals. Basic OpAmp Configurations, Instrumentation Amplifiers. Signal generators. Free running multivibrators. Triangular wave generators. Sawtooth wave generators. Function generators.

REA706 Basics of Transducers of Non-electrical Quantities

3.0 (4.5 ECTS)

Transducers of non-electrical quantities are very important in different areas of human activities. Transducers are used to convert non-electrical quantities to electrical quantities which are more convenient for further processing and storage. In this subject students can widen their knowledge of various physical effects (e.g. Hall effect, AMR effect, and so on) and electrical methods which are used for measurements of non-electrical quantities. Students can widen their knowledge of principle of operation of electronic instruments for measuring non-electrical quantities.

RTR215 Circuit Theory

5.0 (7.5 ECTS)

Transient analysis of electric circuits. First order circuits. Second order circuits. State variable analysis. Discrete-time convolution. Continuous-time convolution. Convolution algebra. Laplace transforms. Transfer function. Bode plots. Two-port networks. Two-port parameters. Two-port interconnections. Introduction into electric filter analysis.

RRI703 Fundamentals of Mobile Communication Systems

7.0 (10.5 ECTS)

Course is intended as an introduction to mobile communication sysyems and consists of 3 modules: Fundamentals of communication, Transmitters and Radio receivers..

Fundamentals of communication is the first module. It covers the basic structure and implementation of data communication systems, communication channel, as well as mobile wireless communication network structure and operation principles. Examples are presented from digital communication systems, their elements and mobile communication systems 2G, 3G, 4G. .

In this mudule there are presented digital signals, modulation and errors in channel, Shannon’s theorem, throughput of Gaussian channel, as well as signal coding with block codes and convolution codes. .

There are given the examples of processing and transmission of signals in wireless mobile cellular networks, available frequency bands and signals, interference and noise, modulation schemas (FDMA, TDMA, CDMA), their specifications, as well as.

antennas used in mobile communication systems and radio wave propagation models in mobile communication. .

The second module is Transmitters. There are covered Radio frequency (RF) oscillators, efficiency of transmitter, power combining. As an examples are presented transmitters used in the Base Stations and safety engineering in application of transmitters. .

The third module is about Radio Receivers. It covers topics about methods and circuits used in radio signal reception: input circuits, selective RF amplifiers, frequency converters, detectors and automatic controls used in radio receivers. There are also presented examples of receiver concepts used in mobile communication systems – direct conversion, software defined and cognitive radios.

RTR220 Basics of Signal Theory

4.0 (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

MASTER COURSES
for students in electronics and telecommunications study programmes

RAE555 Teletraffic Theory *(graduate)*

3.0 (4.5 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.

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

4.0 (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)*

4.0 (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

RAE553 Signalling Systems and Protocols *(graduate)*

3.0 (4.5 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.

RAE473 Computer Technologies in Telecommunications *(graduate)*

3.0 (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)*

5.0 (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.

RDE703 Microwave Telecommunications Systems *(graduate)*

5.00 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.

RTR512 Microwave Devices and Equipment *(graduate)*

3.0 (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.

RTR702 Integrated Circuit Design. Part 1 *(graduate)*

3.0 (4.5 ECTS)

The aim of this course is to introduce students to the basic phases of integrated circuit development: theoretically in lectures and practically in lab. During the theoretical part of the course, students learn about the structure of the basic parts of electronics and simple circuits, layer design approaches, parasitic effects. During practical exercises, using CADENCE tools, students build and test an integrated circuit prototype: from the transistors inside the chip up to the outputs outside the chip. CADENCE is a professional tool for integrated circuit (chip) design automation and testing at various levels.