RTU Course "Electrical Engineering Theory"

13223 Elektronikas pamatu katedra

General data

Code	RTR223
Course title	Electrical Engineering Theory
Course status in the programme	Compulsory/Courses of Limited Choice
Course level	Undergraduate Studies
Course type	Academic
Field of study	Electronics and Telecommunications
Responsible instructor	Andrejs Strauts
Academic staff	Jānis Semeņako Kārlis Brīvkalns Juris Grēve Tatjana Solovjova Vladimirs Ņikišins Vairis Janovskis
Volume of the course: parts and credits points	1 part, 6.0 Credit Points, 9.0 ECTS credits
Language of instruction	LV, RU
Possibility of distance learning	Not planned
Maximum auditorium capacity	200
Maximum number of students per semester	200
Abstract	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.
Goals and objectives of the course in terms of competences and skills	To acquaint students with the basic concepts of analysis DC and AS electric circuits. To teach students how to analyze DC and AS circuits with independent and controlled current and voltage sources. To develop competence to analyze series and parallel resonant RLC circuit parameters. To acquaint students with analysis methods of three-phase power systems. To teach students how to use MATLAB and PSpice computer programs for electric circuit analysis.
Structure and tasks of independent studies	1. Preparation for the laboratory works, home calculations, submitting lab reports and defending of lab reports; defending of lab reports are provided at a set time. Objective: to develop experimental and simulation skills and promote the understanding of theoretical material. 2. Development of term paper. Objective: to develop theoretical calculation and simulation skills. 3. Implementation of home assignments. Objective: to prepare for the examination.
Recommended literature	1. Strauts, A. Elektrotehnikas teorētiskie pamati: lekciju konspekts. Rīga: RTU, 2007. 196 lpp. 2. Strauts, A. Elektrotehnikas teorētiskie pamati: metodiskie norādījumi semināru uzdevumu risināšanas gaitā, vingrinājumu un mājas darbu uzdevumi. Rīga: RTU, 2009. 154 lpp. 3. Strauts, A. Elektrotehnikas teorētiskie pamati: metodiskie norādījumi studiju darba izpildei. Rīga: RTU, 2006. 42 lpp. 4. Brīvkalns, K, Strauts, A. Elektrotehnikas teorētiskie pamati, laboratorijas darbi, MatLab programmas un PSpice pielietojumi. Rīga: RTU, 2008. 57 lpp. 5. Elektrotehnikas teorētiskie pamati: stacionārie procesi lineārās ķēdēs. J.Briedis, I.Dūmiņš, U.Lasis u.c.; red. I.Dūmiņš.. Rīga: Zvaigzne ABC, 1999. 301 lpp. 6. Лосев, А.,К. Теория линейных электрических цепей . М: ВШ, 1987. 511 с. 7. Boctor, S.A. Circuit Analysis. New Jersey: Prentice Hall, 1987. 847 p. 8. Claiton, R.Paul. Analysis of linear Circuits. New York a.o.: McGraw-Hill, 1989. 792 p. 9. Kraus, Allan D. Circuit Analysis. St.Paul etc.: West Publishing Company, 1991. 859 p. 10. Thomas, Roland E., Rosa, Albert J. The Analysis and Design of Linear Circuits. Wiley, 2004. 788 p.
Course prerequisites	General Physics and Calculus. Analysis of Functions. Complex Numbers.

Course outline

Theme	Hours
Introduction. Course Overview. Network Elements. Connection of Elements. Circuit elements R,L,C	9
Signals and Singularity Functions. Ideal and nonideal Current and Voltage Sources. Controlled Sources.	6
Single Resistive Networks. Ohm`s and Kirchoff`s laws. Current and Voltage Division Rule.	9
Mesh Current and Node Voltage Methods for Resistive Circuits.	12
Network transformation. Thevenin, Norton, Superpozition and Maximum Power Transfer Theorems.	15
Average and Effective (RMS) Values of Periodic Functions. Sinusoidal Steady-state theory and AC Circuits Analysis	6
AC Analysis in the Frequency Domain (Mesh and Node Analysis) Phasor Diagram.	12

Mutual Inductance. Linear Transformer. Ideal transformer.	9
Series and Parallel Resonant RLC Circuits	12
Three-Phase Power Systems Analysis.	6

Learning outcomes and assessment

Learning outcomes	Assessment methods
Ability to analyze resistive circuits using Ohm`s and Kirchoff`s laws and current and voltage division rule	Home assignments, Defending of lab works, Examination
Ability to develop equations and solve them with MATLAB, using Mesh current and Node voltage methods for resistive circuits	Home assignments, Defending of lab works, Term work and Examination
Ability to use Thevenin`s and Norton`s theorems	Home assignments, Defending of lab works, Term work and Examination
Ability to analyse powers in resistive networks	Defending of lab works, Term work and Examination
Ability develop equations and solve them (MATLAB) for AS networks with independent and controlled sources.	Home assignments, Defending of lab works, Term work and Examination
Ability to use computer simulation tools for analyzing circuits	Defending of lab works, Term work and Examination
Ability to analyze magnetically coupled circuits	Home assignments, Defending of lab works, Examination
Ability to provide analytical determination of series and parallel resonant circuit parameters	Examination
Ability to analyze three-phase power systems	Examination

Study subject structure

Part	CP	ECTS	Hours per Week			Tests		
			Lectures	Practical	Lab.	Test	Exam	Work
1.	6.0	9.0	3.0	2.0	1.0		*	