RTU Course "Basics of Regulation Theory"

11103 Industriālās elektronikas un elektrotehnol.katedra

General data

Code	EEP273
Course title	Basics of Regulation Theory
Course status in the programme	Compulsory/Courses of Limited Choice
Course level	Undergraduate Studies
Course type	Academic
Field of study	Power and Electrical Engineering
Responsible instructor	Ivars Raņķis
Academic staff	Viesturs Bražis Nadežda Kuņicina Vladimirs Ņikišins Genadijs Zaļeskis
Volume of the course: parts and credits points	1 part, 2.0 Credit Points, 3.0 ECTS credits
Language of instruction	LV, EN, RU
Possibility of distance learning	Not planned
Abstract	The regulation tasks in analog electrical engineering systems. Feed-back loops, typical junctions, its characteristics, modeling, transient to the frequency characteristics. Estimation of stability. Closed- loop systems. Transient processes. Improving of quality indicators. Regulators. Analogue and numerical simulation. Numerical control.
Goals and objectives of the course in terms of competences and skills	To teach students in comprehension of regulation system construction, its calculation, application of substitution schemes, static deviations and make evaluation of stability and transient processes.
Structure and tasks of independent studies	Students must calculate 11 tasks independently providing its design and defending at test also must be done 2 laboratory investigation works.
Recommended literature	I.Raņķis, V.Bražis Regulēšanas teorijas pamati. Rīga:RTU, 2001, 100 lpp I. Raņķis, V.Bražis Regulēšanas teorijas pamati, Lekciju konspekts, Atkārtots izdevums, Rīgas Tehniskā universitāte Rīga, 2007 I. Raņķis, V.Bražis Uzdevumi regulēšanas teorijas pamatos, Rīga, 1999. J.Osis Automātiskā vadība un regulēšana. - Rīga: Zvaigzne, 1969.- 268 lpp.
Course prerequisites	Mathematics, Theory of electrical engineering, electrical machinery basics.

Course outline

Theme	Hours
Introduction in fundamentals of regulation theory.	2
Designation of elements and control modes.	2
Examples of regulation systems.	2
Drawing up of typical block - schemes.	2
Concept about transfer function.	2
Substituting with typical elements of regulation system.	2
Kombinated regulators with P, I, D links and its description.	4
Concept about apperiodical link.	2
Investigation of regulation system – evaluation of stability.	2
Investigation of regulation system using algorithm of Rauth, Mihailov method and Naiqvist criteria, examples.	2
Practical realisation of optimization.	2
Analyses of system qualitative parameters.	2
Functional schemes.	2
Analyses of quality of transient process.	4

Learning outcomes and assessment

Learning outcomes	Assessment methods
Ability to describe elements of regulation system, its features and working principles.	Must be calculated 5 home tasks on links of regulation system.
To be able interpretate regulation system based on its characteristics.	Must be calculated 1 task on characteristics of regulation systems.
To be able calculate the algebric and complex transfer functions for serial connection of links.	Must explane calculation of serial connection of links.
To be able evaluate stability of proportional regulation system and apply its characteristics.	Must be calculated 1 task for proportional regulation system.
To be able evaluate stationary deviation and stability of proportional regulation system using Rauth criterion.	Must be calculated 2 tasks for proportional regulation system using Rauth criterion.

To be able evaluate stability of regulation system using Nyquist and Mihailov criterion.	Must be calculated 1 task for proportional regulation system using Nyquist criterion.
To be able calculate parameters of regulation system for DC electrical motor, evaluate its stability and transient processes.	Protection of calculation task on investigation of regulation system for DC electrical motor.

Study subject structure

Part	CP	ECTS	Hours per Week			Tests		
			Lectures	Practical	Lab.	Test	Exam	Work
1.	2.0	3.0	1.5	0.0	0.5		*	