

STUDY UNIT DESCRIPTION

Faculty of Electrical Engineering

CODE _____

TITLE Theory of automatic control

LEVEL 02 - Years 2, 3 in Modular Undergraduate Course

ECTS CREDITS 7

DEPARTMENT Electric Drives

DESCRIPTION Fundamentals of systems' dynamics: differential equations, Laplace transform, transfer functions. Typical dynamic elements, their mathematical description, transient functions, application for electromechanics.

Analysis of systems in the frequency domain: amplitude-to-frequency and phase-to-frequency characteristics, logarithmic characteristics. Analysis of systems' stability. Correlation between frequency characteristics and transients.

Closed-loop systems. Multi-loop cascade control principle. Feedbacks and regulators. Synthesis of regulators according to the given optimization criteria.

Discrete systems. Analysis of dynamic systems in the z-domain. Stability of discrete systems, synthesis of discrete regulators.

Study-unit Aims:

The unit gives mathematical base for the analysis and synthesis of control systems for electric drives. The unit outlines approaches for improvement of dynamical performances of electromechanical systems.

Learning Outcomes:

1. Knowledge & Understanding:

By the end of the study-unit the student will be able to:

- make transfer function of any dynamic element/process basing on its differential equations;
- arrange feedbacks and regulators in the control system;
- estimate system's stability;
- build regulators and calculate their parameters to meet certain target criteria.

2. Skills:

By the end of the study-unit the student will be able to:

- compose the structure of the closed-loop control system for typical electric drives;
- perform calculations concerning analysis of system's performances and improve system's dynamics.

Main Text/s and any supplementary readings:

- Automation control System. Farid Golnaragh (Simon Fraser University), Benjamin C. Kuo (University of Illinois at Urbana-Champaign)
- Constantine H. Houpis-Quantitative Feedback Theory_ Fundamentals and Applications (Automation and Control Engineering)-CRC Press (1999)
- Automation and Control Engineering Shankar P. Bhattacharyya, Aniruddha Datta, Lee H. Keel-Linear Control Theory_ Structure, Robustness, and Optimization (Automation and Control Engineering).

ADDITIONAL

NOTES Pre-requisite Study-units: Theoretical fundamentals of electrical engineering, Electrical machines.

**STUDY-UNIT
TYPE**

Lecture and Tutorial, laboratory works

**METHOD OF
ASSESSMENT**

Assessment Component/s	Resit Availability	Weighting
Practical	No	10%