

DESCRIPTION OF THE COURSE

Name of the course: Control Theory I	Code: BIE44	Semester: 5
Type of teaching: Lectures, tutorials and laboratory work	Lessons per week: L – 1.5 hours; T - 1 hour; LW – 1 hour	Number of credits: 5

COURSE STATUS IN THE CURRICULUM: Compulsory for the students speciality Industrial Engineering BEng programme of the English Language Faculty of Engineering.

AIMS AND OBJECTIVES OF THE COURSE: To give knowledge on the basic approaches and methods for analysis and design of control systems, based on the classical concepts of transfer function, time-domain and frequency domain characteristics. To introduce the state-space description of systems and their fundamental properties (stability, controllability, observability), as well as the pole-placement design and the linear-quadratic design of control systems. To introduce basic concepts of Non-Linear Control. To develop knowledge on MATLAB and SIMULINK and practical skills for simulation of continuous-time and discrete-time control systems.

DESCRIPTION OF THE COURSE: The main topics concern: Basic concepts and definitions - systems, control systems, classification, the control problem. Transfer function description and block-diagram representations. Time-domain characteristics - unit impulse and unit step responses. Frequency-domain characteristics - Nyquist and Bode diagrams. Stability analysis - Nyquist and Routh array criteria. Root locus method. Discrete-time systems and z-transform. P and PI controllers. State-space description. Solution of the state equation. Controllability and observability. Stability and the second method of Lyapunov. Pole placement design. Observers. Linear Quadratic Optimal Design. Introduction to Nonlinear Control. Phase plane methods. Describing function method. Software tools and languages- MATLAB, SIMULINK.

PREREQUISITES: Mathematics I, II, III, IV, Physics, Mechanics, Computing, Electrical Engineering.

TEACHING METHODS: Lectures, laboratory work from laboratory manual, work in teams, protocols and course work description preparation and defence.

METHOD OF ASSESSMENT: Three and a half hours written test at the end of 4th semester and three and a half hours written test at the end of 5th semester. Each of the procedures carries up to 50% of the final marks. Defense of protocols from laboratory works (up to 20%).

INSTRUCTIONAL LANGUAGE: English.

BIBLIOGRAPHY:

1. Schwarzenbach J., K. F. Gill - System Modelling and Control, 3rd edition, Edward Arnold, 1992;
2. Dorf R. C., Modern Control Systems. 6th edition Addison - Wesley, 1992;
3. Kuo B. C., Automatic Control Systems, 6th ed. Prentice-Hall, Englewood Cliffs, N.J, 1991;
4. Szidarovszky F., A. Terry Bahill, Linear System Theory, CRC Press, Boca Raton, 1992;
5. Gatev G., K. Perv. Control Theory. Laboratory Manual, Technical University - Sofia, 2004.