Bialystok University of Technology									
Field of study	**Computer Science**							**Degree level and programme type**	**Engineer's degree full-time programme**
Specialization/ diploma path	**---**							**Study profile**	academic
Course name	**Linear Control Theory**							**Course code**	**FCS-00069**
								Course type	obligatory
Forms and number of hours of tuition	L	C	LC	P	SW	FW	S	**Semester**	3
	30	30						**No. of ECTS credits**	**6**
Entry requirements	Linear Algebra (FCS-00030), Linear Algebra and Analytic Geometry 2 (FCS-00060), Differential and Difference Equations (FCS-00064),								
Course objectives	Providing the knowledge of mathematical foundations of linear control theory. Gaining ability of analysis and synthesis of linear control systems. Gaining ability of using mathematical tools in problems of linear control theory.								
Course content	Lecture: Stability and asymptotic stability of linear continuous-time and discrete-time systems. Different representations of control systems. Controllability. Criteria of controllability. Observability. Ctriteria of observability. Realization problem for continuous-time and discrete-time systems. Different variants of realization problem. Realization of input-output map. Realization of transfer matrix and equation of higher order. Minimal realizations. Uniqueness. Isomorphic realizations. Feedback. Stabilization and stabilizability of continuous-time and discrete-time systems. Relations between controllability and stabilizability. Detectability and observers. Canonical forms and transformations of control systems. Systems on time scales. Positive systems. Classes: Linear homogeneous systems of differential and difference equations of first order. Stability and asymptotic stability of linear continuous-time and discrete-time systems. Different representations of control systems. Controllability. Criteria of controllability. Observability. Ctriteria of observability. Realization problem for continuous-time and discrete-time systems. Different variants of realization problem. Realization of input-output map. Realization of transfer matrix and equation of higher order. Minimal realizations. Uniqueness. Isomorphic realizations. Feedback. Stabilization and stabilizability of continuous-time and discrete-time systems. Relations between controllability and stabilizability. Detectability and observers. Canonical forms and transformations of control systems. Systems on time scales.								
Teaching methods	informative lecture, lecture problem, discussion related to the lecture, subject exercises,								
Assessment method	Lectures: oral test; Classes: 6-8 tests.								

Symbol of learning outcome	**Learning outcomes**	**Reference to the learning outcomes for the field of study**
LO1	knows basic theorems from known areas of linear control theory	K_W01
LO2	knows elements of linear algebra and nows how to use them in linear control theory	K_W01
LO3	is able to apply theorems and methods of differential calculus of one variable in control theory	K_U01
LO4	is able to analyze and design linear control systems	K_U01

Symbol of learning outcome	**Methods of assessing the learning outcomes**	**Type of tuition during which the outcome is assessed**
LO1	oral test	L
LO2	oral test	L
LO3	test	C
LO4	test	C

Student workload (in hours)	**No. of hours**
1 - Attendance at lectures -	30
2 - Attendance at classes -	30
3 - Doing homework -	33
4 - Attendance at consultations -	15
5 - Preparation to tests -	20
6 - Preparation to exam -	20
7 - Attendance at exam -	2
TOTAL:	**150**

Quantitative indicators	**HOURS**	**No. of ECTS credits**
Student workload – activities that require direct teacher participation	77 (2)+(1)+(7)+(4)	3.1
Student workload – practical activities	83 (2)+(3)+(5)	3.3

Basic references	1. Sh. Bhattacharyya, Linear control theory : structure, robustness, and optimization, Boca Raton : CRC/Taylor & Francis, 2009. 2. E.D. Sontag, Mathematical Control Theory, Springer-Verlag, 1998. 3. A.N. Gundes, C.A. Desoer, Algebraic theory of linear feedback systems with full and decentralized compensators, Berlin : Springer-Verlag, 1990.
Supplementary references	1. S. Rolewicz, Functional analysis and control theory : linear systems, Warszawa : PWN-Polish Scientific Publishers, 1987
Organisational unit conducting the course	Department of Mathematics — **Date of issuing the programme**
Author of the programme	prof. dr hab. inż. Zbigniew Bartosiewicz — Feb. 17, 2022

L – lecture, C – classes, LC – laboratory classes, P – project, SW – specialization workshop, FW – field work,S – seminar