COURSE DESCRIPTION CARD – SPECIMEN

Faculty of Electrical Engineering									
Field of study	**Automatic Control and Robotics**							**Degree level and programme type**	**Bachelor's degree**
Specialization/ diploma path	-							**Study profile**	-
Course name	**Modern Control of Mechatronics Systems**							**Course code**	**IS-FEE-10057W**
								Course type	elective
Forms and number of hours of tuition	**L**	**C**	**LC**	**P**	**SW**	**FW**	**S**	**Semester**	winter
	15			15				**No. of ECTS credits**	**5**
Entry requirements	-								
Course objectives	This course deals with the study of control theory including advanced robust optimal methods, such as H-infinity, mu-Synthesis, LMI, mixed-sensitivity, loop-shaping, uncertain systems, nonlinear observers, feedback linearization, control Lyapunov functions. Moreover, these designs with its applications to the mechatronics systems, including electro-drives, electrical circuits, electro-mechanical, electro-pneumatics, and hydraulics. Major course topics include knowledge of linear/nonlinear and applications engineering principles and methodologies used to solve advanced problems in control systems.								
Course content	Principle subject outcomes include sensitivity and complementary sensitivity functions, H-2 and H-inf spaces. Dynamic systems with linear-parameter-varying. Design of structured and unstructured uncertainty. Robustness, small-gain theorem. Linear fractional transformation. Optimal control with H-2 or H-infinity. Mu-synthesis control. System order minimization. Stability of the nonlinear control systems according to control Lyapunov functions.								
Teaching methods	power-point presentations, Matlab/Simulink software, Matlab/Simulink Toolboxes, project examples, MathWorks help, text books, other documents given by the teacher								
Assessment method	lecture – written exam, project – project completion, presentation and discussion, performance of the project								
Symbol of learning outcome	**Learning outcomes**								**Reference to the learning outcomes for the field of study**
LO1	Basic knowledge of robust control design and application including optimal control, LFT models, and LPV systems								
LO2	Basic knowledge of system order reduction and minimization methods, calculating of the system's norms								
LO3	Practical skills of stability calculating and control performance index for closed-loop dynamic systems								
LO4	practical skills needed to develop and calculate the modelling of the uncertain systems and robustness								
LO5	skills and knowledge acquired to numerical calculations and simulation of linear/nonlinear control system using								

	Matlab/Simulink	
LO6	demand for cooperation with other student within group, as well as an increased awareness of its vital importance for development	**SM_K01**

Symbol of learning outcome	Methods of assessing the learning outcomes	Type of tuition during which the outcome is assessed
LO1	written exam, project evaluation, activity on project classes	**L, P**
LO2	written exam, project evaluation, activity on project classes	**L, P**
LO3	written exam, project evaluation, activity on project classes	**L, P**
LO4	written exam, project evaluation, activity on project classes	**L, P**
LO5	written exam, project evaluation, activity on project classes	**L, P**
LO6	student activity on project classes	**P**

Student workload (in hours)		No. of hours
Calculation	lecture attendance	**15**
	participation in classes	**15**
	preparation for projects	**30**
	working on projects, reports, etc.	**40**
	participation in student-teacher sessions related to the project	**2**
	preparation to the exam	**23**
	TOTAL:	**125**

Quantitative indicators	HOURS	No. of ECTS credits
Student workload – activities that require direct teacher participation	**38**	**1.5**
Student workload – practical activities	**85**	**3**

Basic references	1. A.Isidori, Nonlinear control systems, Springer 1996 2. R.Marino, P.Tomei, Nonlinear control design, Prentice Hall, 1995 3. K. Zhou, J.C. Doyle, Essentials of robust control, Prentice Hall, 1998. 4. R.A. Freeman, P.V. Kokotović, Robust nonlinear control design, State-space and Lyapunov techniques, Birkhäuser, 2008. 5. Ogata K., Modern Control Engineering, 4th ed., Pearson Education International, 2002.
Supplementary references	1. Dorf R.C., Bishop R.H., Modern Control Systems, 10th Edition, Prentice Hall, 2005. 2. Tewari A., Modern Control Design: With Matlab and Simulink, Wiley-IEEE Press, 2001. 3. Bequette B.W., Process Control, Modeling, Design and Simulation, Prentice Hall, 2003. 4. Potvin A. F., Nonlinear Control Design Toolbox, The MathWorks, Inc., Natick, MA., 1994. 5. The MathWorks, Control System ToolboxTM User's Guide, 8th ed., 2009.

Organisational unit conducting the course	Department of Automatic Control and Electronics	Date of issuing the programme
Author of the programme	**Assoc. Prof. Arkadiusz Mystkowski, PhD, DSc, Eng**	**25.03.2020**

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

S – seminar