(*faculty stamp*)

COURSE DESCRIPTION

1. Course title: SYSTEM IDENTIFICATION	**2. Course code**
3. Validity of course description: 2012/2013	
4. Level of studies: 2nd cycle of higher education	
5. Mode of studies: intramural studies	
6. Field of study: MACROCOURSE	(FACULTY SYMBOL) RAU
7. Profile of studies: All-academic	
8. Programme: AUTOMATIC CONTROL	
9. Semester: 1	
10. Faculty teaching the course: Institute of Automatic Control, RAu1	
11. Course instructor: Jerzy Kasprzyk, Dsc. Eng.	
12. Course classification: common	
13. Course status: compulsory	
14. Language of instruction: English	
15. Pre-requisite qualifications: Fundamentals of system dynamics, matrix operation, probability and statistics, numerical methods. It is assumed that student starting this course has ability to use computers and Matlab.	
16. Course objectives: The aim of the course is to present the main problems of theory and practice of system identification. The course concerns identification of parametric and non-parametric dynamic models..	

17. Description of learning outcomes:

Nr	Learning outcomes description	Method of assessment	Teaching methods	Learning outcomes reference code
1.	Knowledge and comprehension of identification experiment, data processing, model structure and model validation	EP	WM	K_W10
2.	Knowledge and comprehension of parameter estimation of static and dynamic models and, their properties and limitations	EP	WM	K_W11
3.	Skills in static and dynamic system identification	CL, PS	L	K_U15
4.	Skills in model validation	CL, PS	L	K_U15
8.	Ability to cooperate and work in a team taking on different roles.	PS, OS	L	K_K03

18. Teaching modes and hours

Lecture / BA /MA Seminar / Class / Project / Laboratory: 45 / 0 / 0 / 0 / 30

19. Syllabus description:

Semester : 1

Lecture:

Introduction: Ways of modelling; Identification Problem; Common terms used in system identification; Static and dynamic models: signals and systems; How to interpret the noise source; Variants of model description, Terms to characterize the dynamic model properties: Impulse response, Step response, Frequency response, Zeros and poles; Basic steps in system identification.
Least Squares: Linear regression, LS estimates; Statistical properties - bias, variance, covariance, Noise-variance estimation.
Linear Time Invariant discrete-time systems: Models of LTI systems and signals; One step ahead prediction; Methods of Parameter Estimation: LS, Maximum Likelihood, Instrumental Variable Method, Choice of Instruments.
Nonparametric Identification: Problem formulation; Time-domain methods: Correlation analysis, Spectral analysis, Frequency-Response Analysis; Empirical Transfer Function Estimate (ETFE).
Identification Experiment: Input Design; Spectral properties, Persistent Excitation, Selection of the sampling interval.
Model structure determination: Order selection, Model validation, Examples.
MISO and MIMO Systems.

Recursive estimation; Recursive LS; Time-varying systems; LMS algorithm.
Identification of nonlinear systems: Neural Networks; General aspects of Black-box models; Grey-box models; Special issues for non-linear models.
Examples of system identification.

Laboratory:

1. Least squares method
2. Nonparametric models
3. Step response and FIR
4. ARX models
5. Real-world process identification
6. Time - varying models

20. Examination: yes

21. Primary sources:

1. Lennart Ljung. *System Identification: Theory for the user*. Prentice Hall
2. T.Soderstom, P.Stoica. *System Identification*. Prentice Hall

22. Secondary sources:

1. Kasprzyk J. (red).: *Identyfikacja Procesów*. Wydawnictwo Politechniki Śląskiej, Gliwice, 2002
2. Janiszowski K.: *Identyfikacja modeli parametrycznych w przykładach*. Akademicka Oficyna Wydawnicza EXIT, Warszawa, 2002.

23. Total workload required to achieve learning outcomes

Lp.	Teaching mode :	Contact hours / Student workload hours
1	Lecture	45 / 20
2	Classes	0 / 0
3	Laboratory	30 / 40
4	Project	0 / 0
5	BA/ MA Seminar	0 / 0
6	Other	15 /30
	Total number of hours	90 / 90

24. Total hours:180

25. Number of ECTS credits: 6

26. Number of ECTS credits allocated for contact hours: 3

27. Number of ECTS credits allocated for in-practice hours (laboratory classes, projects): 3

26. Comments:

Approved:

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(date, Instructor's signature) (*date , the Director of the Faculty Unit signature)*