FACULTY W-8 / DEPARTMENT………………

SUBJECT CARD

Name in Polish Modelowanie i analiza systemów
Name in English System Modeling and Analysis
Main field of study (if applicable): Computer Science
Specialization (if applicable): Computer Engineering
Level and form of studies: 1st/ 2nd* level, full-time / part-time*
Kind of subject: obligatory / optional / university-wide*
Subject code INZ0108Wcs
Group of courses YES / NO*

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30	15			15
Number of hours of total student workload (CNPS)	90	45			45
Form of crediting	Examination / crediting with grade*	Examination / crediting with grade*	Examination / crediting with grade*	Examination / crediting with grade*	Examination / crediting with grade*
For group of courses mark (X) final course	X				
Number of ECTS points	3	2			1
including number of ECTS points for practical (P) classes		2			
including number of ECTS points for direct teacher-student contact (BK) classes	1,8	1,2			0,6

*delete as applicable

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES
1. Knowledge about mathematical analysis and linear algebra.
2. Knows basics of probability theory and statistics.

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SUBJECT OBJECTIVES
C1 Acquisition of knowledge about dynamical systems modelling.
C2 Ability to analyse properties of dynamic processes.

SUBJECT EDUCATIONAL EFFECTS
related to knowledge:
PEK_W01 Knowledge of the basic concepts related to modeling of dynamic systems.
PEK_W02 Knowledge of basic ideas, problems and methods of system identification.

related to skills:
PEK_U01 Knows how to analyze dynamic systems.
PEK_U02 Knows how to estimate parameters of dynamic systems.

related to social competences:
PEK_K01 Knows how to readily communicate knowledge to other people.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours**
Lec 1	Model in systems research. Introduction – basic concepts.	2
Lec 2	Physical signal characteristics.	2
Lec 3	Continuous signal, the Laplace transform.	2
Lec 4	Discrete signal, the Z transform.	2
Lec 5	Typical plant models – relations between descriptions.	1
Lec 6	Model building task based on experiment – identification problem.	2
Lec 7	Identification of static plant. Deterministic problem – determination of the plant parameters.	1
Lec 8	Identification of static plant. Deterministic problem – choice of the best model.	2
Lec 9	Noised measurements of the physical values.	1
Lec 10	Estimation of plant parameters with noisy measurements.	2
Lec 11	Choice of the best model – probabilistic case. Regression functions.	2
Lec 12	Determination of the regression functions based on the experimental data.	1
Lec 13	Identification of dynamic systems.	2
Lec 14	Recursive identification algorithms.	2
Lec 15	Selected problems of complex systems modeling.	2
Lec 16	Modeling of complexes of operation systems.	2
Lec 17	Model based decision making (optimal decision, satisfactory decision, acceptable decision).	2
	Total number of hours	30
Form of classes - class		**Number of hours**
Cl 1	Examples of continuous dynamic processes and ordinary differential equations (ODEs) as their models.	1
Cl 2	The Laplace transform and analytical solutions of linear ODEs.	2
Cl 3	ODEs, state vector description and the transfer function. Relations between descriptions of dynamic processes.	2
Cl 4	Numerical methods of solving ODEs; the Euler scheme. Relations between continuous and discrete models.	2
Cl 5	Least square approximation – choice of the best model.	2
Cl 6	The maximum likelihood method - estimation of plant parameters with noisy measurements.	2
Cl 7	Test I	2
Cl 8	Test II	2
	Total number of hours	15

Form of classes - laboratory		Number of hours
Lab 1		
Lab 2		
Lab 3		
Lab 4		
Lab 5		
…		
	Total hours	

Form of classes - project		Number of hours
Proj 1		
Proj 2		
Proj 3		
Proj 4		
…		
	Total hours	

Form of classes - seminar		Number of hours
Sem 1	Introduction. How to design proper scientific presentation.	2
Sem 2	Students' presentations.	13
	Total number of hours	15

TEACHING TOOLS USED
N1. Traditional lecture. Multimedia presentations. N2. Student's own works – solving exercises. N3. Student's own works – literature studies. N4. Student's own works – oral presentations.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	The way of evaluating educational effect achievements
F1	PEK_W01 PEK_W02 PEK_U01 PEK_U02	Observation of student's activity. Solving exercises.
F2	PEK_W01 PEK_K01	Multimedia presentation.
P1 (Lec)	PEK_W01 PEK_W02 PEK_U01 PEK_U02	Examination
P2 (Cl)	PEK_W01 PEK_W02 PEK_U01	On the basis of F1.

	PEK_U02	
P3 (Sem)	PEK_W01 PEK_K01	On the basis of F2.

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Brzostowski K., Drapała J. – *Systems modelling and identification*, skrypt PWr.

[2] Bubnicki Z., *Identification of control plants*, PWN, Warszawa, 1980.

[3] Ikonen E., Najim K*., Advanced identification and control*, CRC Press LLC, 2002

[4] Ljung L., Glad T., *Modelling of dynamic systems*, 1994.

[5] Larkowski T., Burnham K. – *System identification, parameter estimation and filtering*, skrypt PWr.

SECONDARY LITERATURE:

[1] Ogata K., *Modern Control Engineering*, Prentice Hall, 2009.

[2] Logan J.D., *A First Course in Differential Equations*, Springer, 2006.

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT

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AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY

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AND SPECIALIZATION …………………………..

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)**	Subject objectives***	Programme content***	Teaching tool number***
PEK_W01 (knowledge)	K2_INF_W01	C1	Lec1 – Lec6	N1, N3
PEK_W02	K2_INF_W05	C2	Lec7 – Lec17	N1, N3
PEK_U01 (skills)	K2_INF_U05	C1	Cl1 – Cl4, Cl7 – Cl8	N2, N3
PEK_U02	K2_INF_U05	C2	Cl5 – Cl8	N2, N3
PEK_K01 (competences)	K2_INF_U05	C1, C2	Sem1 – Sem2	N3, N4

** - enter symbols for main-field-of-study/specialization educational effects

*** - from table above