Zał. nr 4 do ZW 64/2012

FACULTY W-8 / DEPARTMENT……

SUBJECT CARD

Name in Polish Metody systemowe i decyzyjne w informatyce
Name in English Systems analysis and decision support methods in Computer Science
Main field of study (if applicable): Computer Science
Specialization (if applicable): ……..
Level and form of studies: 1st/ ~~2nd~~* level, full-time / ~~part-time~~*
Kind of subject: obligatory / ~~optional~~ / ~~university-wide~~*
Subject code INZ0297W, INZ0297C, INZ0297L
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	30	30		
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					
Number of ECTS points	**3**	1	1		
including number of ECTS points for practical (P) classes	0	0	1		
including number of ECTS points for direct teacher-student contact (BK) classes	1,8	0,6	0,6		

*delete as applicable

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knows basics of mathematical analysis and linear algebra.
2. Basic programming skills (variables, functions, loops, conditional statements).

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SUBJECT OBJECTIVES

C1 Knowledge about methods of modelling static and dynamic systems.
C2 Acquisition of skills necessary to develop computer models of technical and non-technical processes.
C3 Learning how to formulate typical decision making problems and how to solve them.
C4 Learning how to use computer engineering software to develop decision making support systems and solve optimization tasks.

SUBJECT EDUCATIONAL EFFECTS

related to knowledge:

PEK_W01 Knows basic ideas, problems and methods of systems modelling and identification.

PEK_W02 Knows typical decision making tasks and knows methods of solving optimization problems.

related to skills:

PEK_U01 Knows how to formulate decision making problems.

PEK_U02 Knows how to use MATLAB and SIMULINK for engineering computations, in particular for systems modelling and identification.

PEK_U03 Knows how to use computer engineering software to solve optimization tasks and to develop decision making support systems.

related to social competences:

PEK_K01 Knows how to make documentation of their own work, that is readable for other people.

PROGRAMME CONTENT

Form of classes - lecture		**Number of hours**
Lec 1	Model in systems research. Introduction – basic concept.	1
Lec 2	Continuous signal, the Laplace transform.	1
Lec 3	Discrete signal, the Z transform.	1
Lec 4	Typical plant models – relations between descriptions.	1
Lec 5	Basic linear elements.	1
Lec 6	Model building task based on experiment – identification problem.	1
Lec 7	Identification of static plant. Deterministic problem – determination of the plant parameters.	1
Lec 8	Noised measurements of the physical variables.	1
Lec 9	Estimation of plant parameters with noisy measurements.	1
Lec 10	Choice of the best model – probabilistic case. Regression functions.	1
Lec 11	Determination of the regression functions based on the experimental data.	1
Lec 12	Model based decision making (acceptable, satisfactory and optimal decisions).	1
Lec 13	Analytical methods of unconstrained optimization for multivariable functions.	1
Lec 14	Analytical methods of constrained optimization for multivariable functions.	2
Lec 15	Discrete optimization – the branch and bound algorithm.	1
Lec 16	Linear programming.	1
Lec 17	Numerical optimization methods – basic concepts. Numerical optimization methods for one variable function.	1
Lec 18	Pattern search optimization.	2
Lec 19	Gradient based optimization methods.	1
Lec 20	Methods for probabilistic optimization problems: the Monte Carlo method,	2

	evolutionary and genetic algorithms, simulated annealing.	
Lec 21	Multi-criteria optimization.	1
Lec 22	Pattern recognition algorithms for decision making support.	2
Lec 23	Multi-stage decision making, dynamical programming.	1
Lec 24	Decision making in uncertain conditions.	1
Lec 25	Game theory in decision making.	2
	Total number of hours	**30**

Form of classes - class		**Number of hours**
Cl 1	Examples of dynamical processes and their models.	1
Cl 2	Differential equations, the Laplace's transform and transfer function.	1
Cl 3	Solving differential equations with use of the Laplace transform.	1
Cl 4	Discrete processes examples and their models. The Z Transform.	1
Cl 5	Solving ordinary difference equations.	1
Cl 6	Numerical methods of solving differential equations. The Euler's scheme.	1
Cl 7	Optimization problems formulations. Decision variables, performance index, constraints.	2
Cl 8	Foundations of optimization. Convex sets and functions, quadratic form, gradient, the Hessian matrix.	1
Cl 9	Analytical methods for unconstrained and constrained optimization. Equality constraints and the Lagrange function.	1
Cl 10	Analytical methods for unconstrained and constrained optimization. Inequality constraints and Kuhn-Tucker conditions.	1
Cl 11	Linear programming.	1
Cl 12	Integer programming.	1
Cl 13	Dynamical programming.	2
	Total number of hours.	**15**

Form of classes - laboratory		**Number of hours**
Lab 1	Instructions for OSH. Introduction for MATLAB. Basic commands, working with command window.	1
Lab 2	Advanced functions in MATLAB for data processing.	1
Lab 3	Dynamical processes modeling in Simulink. Difference equations and transfer function. Solving difference equations.	2
Lab 4	Fundamental classes of dynamical processes. Simulation studies.	1
Lab 5	Building model and simulation of selected dynamical process. Programming test.	1
Lab 6	Optimization method for one variable function. Implementation and graphical presentation of selected methods.	2
Lab 7	Optimization method for multi variable function. Implementation and graphical presentation of selected methods. Report.	3
Lab 8	Application of Matlab's toolbox for advanced problems of modeling and optimization.	2
Lab 9	Elaboration of student's own project in Matlab environment. Report.	2

	Total hours	**15**
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		
Sem 2		
…		
	Total number of hours	

TEACHING TOOLS USED
N1. Traditional lecture. Multimedia presentations. N2. Student's own works – solving calculation tasks. N3. Collective works – consultations with teacher. N4. Student's own works – literature studies. N5. Student's own works – computer programming. N5. Student's own works – simulation studies. N7. Student's own works – results presentation.

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_U02	Observation of student's activity. Conversation with student about current laboratory exercises. Programming test.
F2	PEKU03 PEK_K01	Observation of student's activity. Conversation with student about current laboratory exercises. Report evaluation.
F3	PEK_W01 PEK_W02 PEK_U01	Observation of student's activity. Solving exercises. Test.
P1 (Lec)	PEK_W01 PEK_W02	Examination.
P2 (Cl)	PEK_W01 PEK_W02 PEK_U01	On the basis of F1.

P3 (La)	PEK_U02 PEK_U03	On the basis of F1, F2.

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Bubnicki Z., *Identification of control plants*, PWN, Warszawa, 1980.
[2] Bubnicki Z. *Modern Control Theory*, Springer, Berlin-Heidelberg-New York, 2005
[3] Ikonen E., Najim K., *Advanced identification and control*, CRC Press LLC, 2002

SECONDARY LITERATURE:

[1] Bazaraa M. S., Sherali H.D., Shett C. M., *Nonlinear Programming Theory and Algorithms*, John Wiley and Sons, Inc., 2006
[2] Chong E.K.P., Żak S.H., *An Introduction to Optimization*, Wiley-Interscience, 2008.
[3] Ogata K., *Modern Control Engineering*, Prentice Hall, 2009.

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

……..

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)	K1INF_W02 K1INF_W15	C1	Lec1 – Lec 11 Cl1 – Cl 6	N1, N2, N4
PEK_W02	K1INF_W01 K1INF_W15	C3	Lec 12 – Lec 25 Cl 7 – Cl 13	N1, N2, N4
PEK_U01 (skills)	K1INF_U15	C3	Lec 12, Lec 21, Lec 23 – Lec 25, Cl 7, Lab9	N1, N2
PEK_U02	K1INF_U07	C2	Lab1 – Lab5	N3, N5 – N7
PEK_U03	K1INF_U07 K1INF_U11	C4	Lab6 – Lab9	N3, N5 – N7
PEK_K01 (competences)			Lab7, Lab9	N3, N7

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

*** - from table above