Zał. nr 4 do ZW 64/2012

FACULTY OF PURE AND APPLIED MATHEMATICS

SUBJECT CARD

Name in Polish METODY NIELINIOWE
Name in English NONLINEAR METHODS
Main field of study (if applicable): APPLIED MATHEMATICS
Specialization (if applicable): MATHEMATICS FOR INDUSTRY AND COMMERCE
Level and form of studies: ~~1st~~/ 2nd* level, full-time / ~~part-time*~~
Kind of subject: ~~obligatory~~ / optional / ~~university-wide*~~
Subject code MAP1996
Group of courses YES / ~~NO*~~

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30		30		
Number of hours of total student workload (CNPS)	90		90		
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		3		
including number of ECTS points for practical (P) classes			3		
including number of ECTS points for direct teacher-student contact (BK) classes	1.5		1.5		

*delete as applicable

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Student has knowledge of concepts, theorems and methods of mathematical analysis

2. Student has knowledge of concepts and methods of differential equations

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SUBJECT OBJECTIVES

C1 Study basic concepts and nonlinear methods used in applications

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:
PEK_W01 has advanced knowledge concerning nonlinear methods
PEK_W02 knows numerical methods applied for approximate solving of mathematical problems in applied sciences
relating to skills:
PEK_U01 is able to construct mathematical models in advanced applications of mathematics
relating to social competences:

PEK_K01 can, without assistance, search for necessary information in the literature, also in foreign languages

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours**
Lec 1	Examples of nonlinear phenomena	2
Lec 2	Examples of nonlinear phenomena	2
Lec 3	Nonlinear oscillators	2
Lec 4	Bifurcation and stability	2
Lec 5	Van der Pol equation	2
Lec 6	Duffig equation	2
Lec 7	2-D systems of nonlinear equations – equilibrium points	2
Lec 8	Classification of the equilibrium points	2
Lec 9	Systems of nonlinear equations - attractors	2
Lec 10	Lorenc equation	2
Lec 11	Strange attractors	2
Lec 12	Belolusov-Zabotynski equation	2
Lec 13	Benard cells – equations of hydrodynamics	2
Lec 14	Examples of nonlinear optimisation	2
Lec 15	Some methods of nonlinear optimisation	2
	Total hours	**30**

Form of classes - laboratory		**Number of hours**
Lab 1	Solving of problems illustrating theory given in the lectures by analytic methods and with MATLAB	30
	Total hours	**30**

TEACHING TOOLS USED
N1. Lecture – traditional method N2. Laboratory- solving problems with computers N3. Consultations N4. Student's self work – preparation for the laboratory

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation (F – forming (during semester), P – concluding (at	Educational effect number	Way of evaluating educational effect achievement

semester end)		
F1	PEK_W01 PEK_W02	test
F2	PEK_U01 PEK_K01	oral answers, calculus trainings, presentations, short tests, tests
P==0.5*F1+0.5*F2		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] D.W. Jordan, P. Smith, Nonlinear Ordinary Differential Equations
[2] G. Nicolis, Introduction to Nonlinear Science.

SECONDARY LITERATURE:

[1] D. P. Bertsekas, Nonlinear Programming

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

Prof. dr hab. Wojciech Okrasiński (Wojciech.Okrasinski@pwr.wroc.pl)

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT

NONLINEAR METHODS MAP1996

AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY

APPLIED MATHEMATICS

AND SPECIALIZATION **MATHEMATICS FOR INDUSTRY AND COMMERCE**

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)	K2MIC_W04	C1	Lec1-Lec15	1,3
PEK_W02	K2MIC_W10	C1	Lec1-Lec15	1,3
PEK_U01 (skills)	K2MIC_U15	C1	Lab1	2,3,4
PEK_K01 (competences)	K2MIC_K06	C1	Lec1-Lec15 Lab1	1,2,3,4

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

*** - from table above