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 MAT001574
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)	150				
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	5				
including number of ECTS points for practical (P) classes	2		2		
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 –	Educational effect number	Way of evaluating educational effect achievement

concluding (at 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.edu.pl)

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT

NONLINEAR METHODS MAT001574

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)	K2MST_W04 K2MST_mic_W01	C1	Lec1-Lec15	1,3
PEK_W02	K2MST_W10 K2MST_mic_W02 K2MST_mic_W03	C1	Lec1-Lec15	1,3
PEK_U01 (skills)	K2MST_U15 K2MST_U24 K2MST_U25 K2MST_mic_U01 K2MST_mic_U02 K2MST_mic_U03	C1	Lab1	2,3,4
PEK_K01 (competences)	K2MST_K06 K2MST_mic_K01 K2MST_mic_K02	C1	Lec1-Lec15 Lab1	1,2,3,4

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

*** - from table above