FACULTY OF ELECTRICAL ENGINEERING

SUBJECT CARD

Name in Polish:	**Metody numeryczne w technice**
Name in English:	**Numerical methods in engineering**
Main field of study (if applicable):	**Electrical Engineering**
Specialization (if applicable):	**Renewable Energy Sources**
Level and form of studies:	**2nd level, full-time**
Kind of subject:	**obligatory**
Subject code:	**ELR041311**
Group of courses:	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	15			15	
Number of hours of total student workload (CNPS):	30			30	
Form of crediting:	crediting with grade			crediting with grade	
For group of courses mark (X) final course:					
Number of ECTS points:	1			1	
including number of ECTS points for practical (P) classes :				1	
including number of ECTS points for direct teacher-student contact (BK) classes:	0.70			0.70	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Has basic knowledge about mathematical analysis and linear algebra
2. Has basic knowledge about applied statistics
3. Has basic knowledge about computational methods and techniques
4. Has basic knowledge about procedural programming
5. Is able to select development tools adequate to solve a given problem

SUBJECT OBJECTIVES

C1. introduction to selected elements of advanced computational methods

C2. acquisition of skills to apply multivariate algorithms to solving complex mathematical problems encountered in engineering problems

C3. preparation for problem solving in a design team

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 has knowledge about numerical methods and techniques necessary to recognise data processing engineering problems

PEK_W02 is able to formulate a numerical algorithm adequate for solving an engineering task

relating to skills:

PEK_U01 is able to source information about selecting numerical methods and procedures necessary to solve elementary engineering problems, from literature, databases and other sources

PEK_U02 is able to draft documentation describing execution of an engineering task and prepare a text discussing its results

relating to social competences:

PEK_K01 is able to evaluate design team performance and perform a critical analysis

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours:**
Lec 1	Introduction. Advanced computational techniques. Programming examples of technical issues in basic programming languages (ANSI C / Pascal) and dedicated packages (Matlab / CAD)	2
Lec 2	Algorithms for solving nonlinear problems. The modified method of bisection and Newton. Examples of nonlinear systems modeling technique. Parametric process control.	2
Lec 3	Gradient methods seek extreme functions of one and several variables. Examples optimize the control systems in distributed renewable energy installations	2
Lec 4	Selected aspects of methods differences and finite elements in engineering projects.	2
Lec 5	Fourier transformation programming. Hardware implementations - system processor. Horner algorithm. FFT- example Cooley-Tukey algorithm.	2
Lec 6	Genetic algorithms. Example of using formic algorithm in the systems monitoring and diagnostics	2
Lec 7	Numerical integration using Monte Carlo method	2
Lec 8	Final test	1
	Total hours:	**15**

Form of classes - project		Number of hours:
Proj 1	Students individually or in groups of two solve a selected problem concerning issues mentioned during lectures. Each project consists of the following stages: theoretical breakdown, algorithmization and programming, launching and testing the end-user application, preparing documentation. Project problems are different every year and are not repeated.	14
Proj 2	Assessment of the project	1
	Total hours:	**15**

TEACHING TOOLS USED
N1. introductory lecture with slideshow and elements of e-learning
N2. students code case-based programmes both individually and in teams
N3. remote self-education - http://eportal.eny.pwr.edu.pl: - partial and final test
N4. consultation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT		
Evaluation *F – forming (during semester)* *P – concluding (at semester end)*	**Educational effect number**	**Way of evaluating educational effect achievement**
F1(W)	PEK_W01 PEK_W02	Remote self-teaching - partial test. E-learning platform: http://eportal.eny.pwr.edu.pl
F2(W)	PEK_W01 PEK_W02	Final test (final) in the computer lab. E-learning platform: http://eportal.eny.pwr.edu.pl
P(W)	P=0.15xF1 + 0.85xF2	
F1(P)	PEK_U01 PEK_U02 PEK_K01	Develop documentation in electronic form design. E-learning platform: http://eportal.eny.pwr.edu.pl
P(P)	P=F1	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Metody numeryczne, G.Dahlquist, A.Bjork, PWN (any edition)
[2] Przegląd metod i algorytmów numerycznych - cz.1 i 2, J.i M. Jankowscy, WNT (any edition)
[3] Wstęp do programowania systematycznego, N.Wirth, WNT (any edition)
[4] E-learning platform: http://eportal.eny.pwr.edu.pl
[5] Net-literature

SECONDARY LITERATURE:

[1] Algorytmy + struktury danych..., N. Wirth, WNT (any edition)
[2] Macierze w automatyce i elektrotechnice, T.Kaczorek, WNT (any edition)
[3] Handbook of mathematical functions, M. Abramowitz, I.Stegun, Washington 1964

SUBJECT SUPERVISOR

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
ELR041311 - Numerical methods in engineering
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Electrical Engineering**
AND SPECIALIZATION **Renewable Energy Sources**

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	K2ETK_W02	C.1 C.2	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7	N.1 N.3 N.4
PEK_W02	K2ETK_W02	C.1 C.2	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7	N.1 N.3 N.4
PEK_U01	K2ETK_U02	C.2 C.3	Proj1	N.2 N.4
PEK_U02	K2ETK_U02	C.2 C.3	Proj1	N.2 N.4
PEK_K01	K2ETK_K02	C.3	Lec8 Proj1 Proj2	N.2 N.4