FACULTY OF ELECTRICAL ENGINEERING

SUBJECT CARD

Name in Polish:	**Metody numeryczne**
Name in English:	**Numerical methods**
Main field of study (if applicable):	**Electrical Engineering**
Specialization (if applicable):	
Level and form of studies:	**1st level, full-time**
Kind of subject:	**obligatory**
Subject code:	**ELR051305**
Group of courses:	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	15			30	
Number of hours of total student workload (CNPS):	30			60	
Form of crediting:	crediting with grade			crediting with grade	
For group of courses mark (X) final course:					
Number of ECTS points:	1			2	
including number of ECTS points for practical (P) classes :				2	
including number of ECTS points for direct teacher-student contact (BK) classes:	0.70			1.40	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Has basic knowledge about mathematical analysis and linear algebra
2. Has basic knowledge about electrical engineering
3. Has basic knowledge about developing algorithms and computer programming
4. Is able to write computer programmes based on given algorithm

SUBJECT OBJECTIVES

C1. introduction to selected theoretical basis of numerical computations
C2. introduction to selected numerical computational techniques for engineering purposes
C3. algorithmization introduction to methods of calculation procedures in engineering activities
C4. preparation for problem solving in a design team

SUBJECT LEARNING OUTCOMES

relating to knowledge:

PEU_W01 has knowledge about numerical methods and techniques necessary to recognise data processing engineering problems

PEU_W02 is able to formulate a numerical algorithm adequate for solving an engineering task

relating to skills:

PEU_U01 is able to source information about selecting numerical methods and procedures necessary to solve elementary engineering problems, from literature, databases and other sources

PEU_U02 is able to draft documentation describing execution of an engineering task and prepare a text discussing its results

relating to social competences:

PEU_K01 is able to think and action in a creative and enterprising manner

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours:**
Lec 1	Introduction. Elements of the theory of errors - propagation of errors. Analysis of apparent disturbances. Fixed-point and floating-point arithmetic of numbers with finite binary representation Floating Point/Fixed-Point Numbers. Standardisation of floating-point numbers	2
Lec 2	Indicators conditioning algorithms. Examples of algorithms poorly conditioned, correct and stable numerically. Machine epsilon	2
Lec 3	Basic methods of computational linear algebra. Effective direct programming techniques matrix operations	2
Lec 4	Iterative methods for solving algebraic systems of equations. Special matrices in technical science. Overdetermined systems	2
Lec 5	Adding finite and infinite series. Alternating trigonometric numerical series. Gill-Moler algorithm. Summation of averaged partial sums	2
Lec 6	Practical examples of design software interfaces for functions and procedures contained in the number of binary libraries. Simple computing applications (ANSI C, Pascal, Matlab, VBA Excel)	2
Lec 7	Planning numerical experiment. Design principles of numerical algorithms for monitoring and control of technological processes	2
Lec 8	Time for self-studies and preparation for a computer-based test that will be performed in the laboratory.	1
	Total hours:	**15**

Form of classes - project		**Number of hours:**
Proj 1	Conversion and standardisation of floating-point numbers	2
Proj 2	Determining machine epsilon and accuracy of real number representation in numerical computations (significant figures)	2
Proj 3	Summation of infinite alternating trigonometric numerical series using the method of partial sum averaging as modified by Gill-Moler (G-M)	2
Proj 4	Solving the Dirichlet electrostatic problem for two-dimensional geometrical areas (examples: Laplace's and Poisson's equation)	2
Proj 5	Students in groups of two select a single project problem concerning application of computational techniques in engineering problems. 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	21
Proj 6	Assessment of the project	1
	Total hours:	**30**

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 LEARNING OUTCOMES ACHIEVEMENT		
Evaluation *F – forming (during semester)* *P – concluding (at semester end)*	**Educational effect number**	**Way of evaluating educational effect achievement**
F1(W)	PEU_W01 PEU_W02	Remote self-teaching - partial test. E-learning platform: http://eportal.eny.pwr.edu.pl
F2(W)	PEU_W01 PEU_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)	PEU_U01 PEU_U02 PEU_K01	Drafting interim papers electronically. E-learning platform: http://eportal.eny.pwr.edu.pl F1=(Proj1+Proj2+Proj3+Proj4)/4 where Proj1,Proj2,Proj3,Proj4 > 4
F2(P)	PEU_U01 PEU_U02 PEU_K01	Develop documentation in electronic form design. E-learning platform: http://eportal.eny.pwr.edu.pl F2=Pr5
P(P)	P=0.35xF1 + 0.65xF2	

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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