

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: **ELR041305**
 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 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 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	Final test	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 EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation <i>F - forming (during semester) P - concluding (at semester end)</i>	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)	$P=0.15 \times F1 + 0.85 \times F2$	
F1(P)	PEK_U01 PEK_U02 PEK_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)	PEK_U01 PEK_U02 PEK_K01	Develop documentation in electronic form design. E-learning platform: http://eportal.eny.pwr.edu.pl $F2=Pr5$
P(P)	$P=0.35 \times F1 + 0.65 \times F2$	

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 ELR041305 - Numerical methods AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Electrical Engineering**

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	K1ETK_W07 K1ETK_W15	C.1 C.2 C.3	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7	N.1 N.3 N.4
PEK_W02	K1ETK_W07 K1ETK_W15	C.1 C.2 C.3	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7	N.1 N.3 N.4
PEK_U01	K1ETK_U05 K1ETK_U12	C.2 C.3 C.4	Proj1 Proj2 Proj3 Proj4 Proj5	N.2 N.4
PEK_U02	K1ETK_U05 K1ETK_U12	C.2 C.3 C.4	Proj1 Proj2 Proj3 Proj4 Proj5	N.2 N.4
PEK_K01	K1ETK_K05 K1ETK_K06	C.4	Lec8 Proj5 Proj6	N.2 N.4