

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, part-time**  
 Kind of subject: **obligatory**  
 Subject code: **ELR051363**  
 Group of courses: **NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	10			20	
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 programming techniques of direct and iterative matrix operations	2
Lec 4	Adding finite and infinite series. Alternating trigonometric numerical series. Gill-Moler algorithm. Summation of averaged partial sums	2
Lec 5	Planning numerical experiment. Design principles of numerical algorithms for monitoring and control of technological processes	1
Lec 6	Time for self-studies and preparation for a computer-based test that will be performed in the laboratory.	1
Total hours:		<b>10</b>

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, lgorithmization and programming, launching and testing the end-user application, preparing documentation. Project problems are different every year and are not repeated	11
Proj 6	Assessment of the project	1
Total hours:		<b>20</b>

## 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 <i>F - forming (during semester) P - concluding (at semester end)</i>	Educational effect number	Way of evaluating educational effect achievement
F1(w)	PEU_W01 PEU_W02	Remote self-teaching - partial test. E-learning platform: <a href="http://eportal.eny.pwr.edu.pl">http://eportal.eny.pwr.edu.pl</a>
F2(w)	PEU_W01 PEU_W02	Final test (final) in the computer lab. E-learning platform: <a href="http://eportal.eny.pwr.edu.pl">http://eportal.eny.pwr.edu.pl</a>
P(w)	$P=0.15 \times F1 + 0.85 \times F2$	
F1(p)	PEU_U01 PEU_U02 PEU_K01	Drafting interim papers electronically. E-learning platform: <a href="http://eportal.eny.pwr.edu.pl">http://eportal.eny.pwr.edu.pl</a> $F1=(Proj1+Proj2+Proj3+Proj4)/4$ where $Proj1, Proj2, Proj3, Proj4 > 4$
F2(p)	PEU_U01 PEU_U02 PEU_K01	Develop documentation in electronic form design. E-learning platform: <a href="http://eportal.eny.pwr.edu.pl">http://eportal.eny.pwr.edu.pl</a> $F2=Pr5$
P(p)	$P=0.35 \times F1 + 0.65 \times F2$	

<b>PRIMARY AND SECONDARY LITERATURE</b>
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<b>PRIMARY LITERATURE:</b>
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| <ul style="list-style-type: none"><li>[1] Metody numeryczne, G.Dahlquist, A.Bjork, PWN (any edition)</li><li>[2] Przegląd metod i algorytmów numerycznych - cz.1 i 2, J.i M. Jankowscy, WNT (any edition)</li><li>[3] Wstęp do programowania systematycznego, N.Wirth, WNT (any edition)</li><li>[4] E-learning platform: <a href="http://eportal.eny.pwr.edu.pl">http://eportal.eny.pwr.edu.pl</a></li><li>[5] Net-literature</li></ul> |
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<b>SECONDARY LITERATURE:</b>
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| <ul style="list-style-type: none"><li>[1] Algorytmy + struktury danych..., N. Wirth, WNT (any edition)</li><li>[2] Macierze w automatyce i elektrotechnice, T.Kaczorek, WNT (any edition)</li><li>[3] Handbook of mathematical functions, M. Abramowitz, I.Stegun, Washington 1964</li></ul> |
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<b>SUBJECT SUPERVISOR</b>
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