

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): **Electrical Power Engineering**  
 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:		<b>15</b>

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:		<b>15</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 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: <a href="http://eportal.eny.pwr.edu.pl">http://eportal.eny.pwr.edu.pl</a>
F2(w)	PEK_W01 PEK_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)	PEK_U01 PEK_U02 PEK_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>
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. Jankowsky, 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

Jarosław Szymańda, [jaroslaw.szymanda@pwr.edu.pl](mailto:jaroslaw.szymanda@pwr.edu.pl)

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 **Electrical Power 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	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