FACULTY MECHANICAL AND POWR ENGINEERING

SUBJECT CARD

Name of subject in Polish Metody numeryczne
Name of subject in English **Numerical methods**
Main field of study (if applicable): **Power Engineering**
Specialization (if applicable):
Profile: **academic**
Level and form of studies: **2nd level, full-time**
Kind of subject: **obligatory**
Subject code **ESN120036**
Group of courses **NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30		30		
Number of hours of total student workload (CNPS)	60		60		
Form of crediting	crediting with grade		crediting with grade		
For group of courses mark (X) final course					
Number of ECTS points	2		2		
including number of ECTS points for practical classes (P)			1,5		
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	1		1,5		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Knowledge and skills acquired at Mathematical Calculus, Algebra with Geometry and Physics

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SUBJECT OBJECTIVES

C1 Presentation of knowledge on the use of tools and techniques of numerical methods to analyse and solve engineering problems.
C2 Developing the ability to solve engineering problems with the use of specialized MATLAB software. Visualization and interpretation of the obtained numerical results.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEU_W01 Student knows the basic properties of interpolation methods, spline functions and mean square approximation
PEU_W02 Student knows the methods of numerical integration and finding zeros of functions

relating to skills:

PEU_U01 Student can use the basic properties of interpolation methods, spline functions and mean square approximation to solve simple engineering problems.
PEU_U02 Student is able to use numerical integration methods and numerical techniques of finding zeros of functions to solve simple engineering problems

PEU_U03 Student interprets the results obtained from numerical calculations		
PROGRAMME CONTENT		
Lecture		**Number of hours**
Lec 1	Introduction to floating point calculations. Basic elements of the syntax of a programming language in MATLAB.	2
Lec 2	Example of coding in MATLAB – algebra operations, matrices, conditional loops	2
Lec 3	Example of coding in MATLAB – structure of functions and scripts.	2
Lec 4	Example of coding in MATLAB – graphical procedures, input and output procedures.	2
Lec 5	Basic properties of interpolation methods. Graphical interpretation. Polynomial interpolation. Vandermonde method.	2
Lec 6	Lagrange interpolation method, Newton interpolation method	2
Lec 7	Interpolation error. Runge's oscillation phenomenon at the extremities of the interpolation interval.	2
Lec 8	Properties of spline functions. Third degree natural spline function. Graphical interpretation.	2
Lec 9	The mean square norm. Mean square approximation. Techniques of reducing selected functions to the forms used in the mean square approximation.	2
Lec 10	Solving nonlinear scalar algebraic equations. Methods: bisection, regula falsi. Graphical interpretation of the discussed methods.	2
Lec 11	Fixed point method. Graphical interpretation.	2
Lec 12	Newton method. Secant method. Graphical interpretation.	2
Lec 13	Numerical integration. The method of rectangles and trapezoids.	2
Lec 14	Simpson's method and more advanced integral methods. Order of these methods.	2
Lec 15	Written test.	2
	Total hours	30
Laboratory		**Number of hours**
Lab 1	Introduction to floating point calculations. Basic elements of the syntax of a programming language in MATLAB	2
Lab 2	Example of coding in MATLAB – algebra operations, matrices, conditional loops	2
Lab 3	Example of coding in MATLAB – structure of functions and scripts	2
Lab 4	Example of coding in MATLAB – graphical procedures, input and output procedures.	2
Lab 5	Written test from MTLAB programming language.	2
Lab 6	Basic properties of interpolation methods. Graphical interpretation. Polynomial interpolation. Vandermonde method.	2
Lab 7	Lagrange interpolation method, Newton interpolation method.	2
Lab 8	nterpolation error. Runge's oscillation phenomenon at the extremities of the interpolation interval.	2
Lab 9	Properties of spline functions. Third degree natural spline function. Graphical interpretation.	2
Lab 10	The mean square norm. Mean square approximation. Techniques of reducing selected functions to the forms used in the mean square approximation.	2

Lab 11	Solving nonlinear scalar algebraic equations. Methods: bisection, regula falsi. Graphical interpretation of the discussed methods.	2
Lab 12	Fixed point method. Graphical interpretation.	2
Lab 13	Newton method. Secant method. Graphical interpretation.	2
Lab 14	Numerical integration. The method of rectangles and trapezoids.	2
Lab 15	Simpson's method and more advanced integral methods. Order of these methods	2
	Total hours	30

TEACHING TOOLS USED

N1. Traditional lecture with a use of slides with presentation of MATLAB examples
N2. Laboratories – computational exercises
N3. Laboratories – individual problem solving using MATLAB / Octave
N4. Consultation
N5. Self-reliant work – individual studies and preparation of partial reports

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F – forming during semester), P – concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
C	PEK_W01 - PEK_W02	Written test
F1	PEK_U01	Report
F2	PEK_U02	Report
F3	PEK_U03	Report
P=(F1+F2+F3)/3		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] D. Kincaid, W. Cheney, Numerical Analysis. Mathematics of Scientific Computing", Wadsworth, 2002
[2] G. Dahlquist, A. Bjorck, Numerical Methods in Scientific Computing .vol. I, SIAM, 2008
[3] A. Quarteroni, F. Saleri, Sceintific Computin with Matlab and Octave, Springer , 2006
[4] D. J. Higham, N. J. Higham : Matlab Guide,SIAM, 2005

SECONDARY LITERATURE:

[1] J. Kiusalaas , *Numerical Methods in Engineering with Matlab*, Cambridge, 2005.
[2] .J. H. Mathews, K. D. Fink, *Numerical Methods Using Matlab*,Prentice Hall, 1999
[3] G.W. Recktenwald, *Numerical methods with MATLAB - implementations and applications*, Prentice Hall Inc. 2000, New Jerse

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)

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