

FACULTY: Computer Science & Management..... / DEPARTMENT.....

SUBJECT CARD**Name in Polish ...Metody Numeryczne.....****Name in English ...Numerical Methods.....****Main field of study (if applicable): Computer Science.....****Specialization (if applicable):****Level and form of studies: 1st level, full-time****Kind of subject: optional****Subject code ...INZ0292Wc****Group of courses :YES**

	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	90			
Form of crediting	crediting with grade	crediting with grade			
For group of courses mark (X) final course	X				
Number of ECTS points	2	3			
including number of ECTS points for practical (P) classes		2			
including number of ECTS points for direct teacher-student contact (BK) classes	1,2	1,8			

*delete as applicable

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Mathematical Analysis
2. Linear Algebra

SUBJECT OBJECTIVES

- C1 Acquisition of knowledge about dealing with Approximations and evaluation of Error Bounds.
- C2 Acquisition of knowledge about Interpolation and Interpolating Polynomials.
- C3 Acquisition of knowledge about methods of Numerical Integration
- C4 Acquisition of knowledge about methods of Numerical Differentiation
- C5 Acquisition of knowledge about methods of solving Nonlinear Equations
- C6 Acquisition of knowledge about methods of solving Sets of Linear Equations
- C7 Acquisition of knowledge about numerical methods of Matrix Inversion and finding Determinants
- C8 Acquisition of knowledge about methods of solving Sets of Nonlinear Equations
- C9 Acquisition of knowledge about numerical calculation of Eigenvalues & Eigenvectors
- C10 Acquisition of knowledge about Least Square Approximation of Functions
- C11 Acquisition of knowledge about Fitting Data with a Cubic Spline
- C12 Acquisition of knowledge about Numerical Solution of Ordinary Differential Equations
- C13 Development of skill of handling Approximations and evaluation of Error Bounds.
- C14 Development of skill of finding Interpolating Polynomials
- C15 Development of skill of using methods of Numerical Integration
- C16 Development of skill of using methods of Numerical Differentiation
- C17 Development of skill of using methods of solving Nonlinear Equations
- C18 Development of skill of using methods of solving Sets of Linear Equations

C19 Development of skill of using numerical methods of Matrix Inversion and finding Determinants
 C20 Development of skill of using methods of solving Sets of Nonlinear Equations
 C21 Development of skill of using numerical calculation of Eigenvalues & Eigenvectors
 C22 Development of skill of using methods for Least Square Approximation of Functions
 C23 Development of skill of using methods of Fitting Data with a Cubic Spline
 C24 Development of skill of using methods of Numerical Solution of Ordinary Differential Equations

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 Knows basic definitions of Approximations and evaluation of Error Bounds
 PEK_W02 Knows basic definitions of Interpolation and Interpolating Polynomials
 PEK_W03 Knows basic methods of Numerical Integration
 PEK_W04 Knows basic methods of Numerical Differentiation
 PEK_W05 Knows basic methods of solving Nonlinear Equations
 PEK_W06 Knows methods of solving Sets of Linear Equations
 PEK_W07 Knows numerical methods of Matrix Inversion and finding Determinants
 PEK_W08 Knows basic methods of solving Sets of Nonlinear Equations
 PEK_W09 Knows methods of numerical calculation of Eigenvalues & Eigenvectors
 PEK_W10 Knows methods for Least Square Approximation of Functions
 PEK_W11 Knows methods of Fitting Data with a Cubic Spline
 PEK_W12 Knows basic methods of Numerical Solution of Ordinary Differential Equations

relating to skills:

PEK_U01 Can evaluate Errors and Error Bounds
 PEK_U02 Can find various Interpolating Polynomials
 PEK_U03 Can use basic methods of Numerical Integration
 PEK_U04 Can use basic methods of Numerical Differentiation
 PEK_U05 Can use basic methods of solving Nonlinear Equations
 PEK_U06 Can solve Sets of Linear Equations
 PEK_U07 Can use numerical methods of Matrix Inversion and finding Determinants
 PEK_U08 Can use basic methods of solving Sets of Nonlinear Equations
 PEK_U09 Can calculate numerically Eigenvalues & Eigenvectors of a matrix
 PEK_U10 Can find Least Square Approximations of Functions
 PEK_U11 Can use methods of Fitting Data with a Cubic Spline
 PEK_U12 Can use basic methods of Numerical Solution of Ordinary Differential Equations

relating to social competences:

PEK_K01 Understands the need to use numerical methods in science and engineering.

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Lec 1	Introduction. Errors. Error bounds. Accuracy	2

Lec 2	Interpolation Polynomials	2
Lec 3	Numerical Integration I (Newton-Cotes formulas)	2
Lec 4	Numerical Integration II (Gauss, Adam & Milne formulas)	2
Lec 5	Numerical Differentiation	2
Lec 6	Solution of Nonlinear Equations I	2
Lec 7	Solution of Nonlinear Equations II	2
Lec 8.	Solving Sets of Linear Equations	2
Lec 9	Determinant of a Matrix. Matrix Inversion	2
Lec 10	Sets of Nonlinear Equations	2
Lec 11	Numerical Calculation of Eigenvalues & Eigenvectors	2
Lec 12	Least Square Approximation of Functions	2
Lec 13	Fitting Data with a Cubic Spline	2
Lec 14	Numerical Solution of Ordinary Differential Equations I	2
Lec 15	Numerical Solution of Ordinary Differential Equations I	2
	Total hours	30
Form of classes - class		Number of hours
Cl 1	Calculation of Errors, Errors Bounds, Accuracy considerations	2
Cl 2	Forming Difference Tables and Interpolation Polynomials	2
Cl 3	Practical use of Simpson's and other Newton-Coates Formulas	2
Cl 4	Practical use of Gauss, Adam and Milne methods	2
Cl 5	Finding Function Derivatives from Difference Tables	2
Cl 6	Solving Nonlinear Equations by Halving & Other Methods	2
Cl 7	Solving Nonlinear Equations by Newton's & Iteration Methods	2
Cl 8	Practical Use of Gauss-Seidel & Iteration Methods	2
Cl 9	Practical Methods for Finding Determinants and Matrix Inversion	2
Cl 10	Iteration & Newton Methods for Nonlinear Equations	2
Cl 11	Practical Calculation of Eigenvalues & Eigenvectors	2
Cl 12	Approximation of Functions by Various Polynomials	2
Cl 13	Practical Use and Application of Cubic Splines	2
Cl 14	Practical Solving of Ordinary Differential Equations I	2
Cl 15	Practical Solving of Ordinary Differential Equations II	2
	Total Hours	30

TEACHING TOOLS USED

- N1. Traditional lecture using board/video projector
- N2. Tutorial classes
- N3. Consultations
- N4. Student's home work

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation (F – forming (during semester), P – concluding (at semester end))	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01... PEK_U12	Oral answers, problem solving on board
F2	PEK_W01... PEK_W12	Attendance & activity during classes
F3	PEK_U01... PEK_U12 PEK_W01... PEK_W12	Written test
$P = 0,3 * F1 + 0,2 * F2 + 0,5 * F3$		

PRIMARY AND SECONDARY LITERATURE**PRIMARY LITERATURE:**

- [1] Conte S.C., Carl de Boor, Elementary Numerical Analysis – an algorithmic approach, McGraw-Hill Book Company, New York, 1980
- [2] Hoffman Joe D., Numerical Methods for Engineers and Scientists, , McGraw-Hill Book Company, New York, 1992, (Marcel Dekker, Inc. 2001)

SECONDARY LITERATURE:

- [1] Won Young Yang, Wenwu Cao, Tae-Sang Chung, John Morris, Applied Numerical Methods using MATLAB, John Wiley & Sons

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

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR
SUBJECT
.....**Numerical Methods**.....
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
.....Computer Science.....

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 (knowledge)	K1 INF_W01	C1	Lec 1	N1, N3, N4
PEK_W02	K1 INF_W01	C2	Lec 2	N1, N3, N4
PEK_W03	K1 INF_W01	C3	Lec 3, Lec4	N1, N3, N4
PEK_W04	K1 INF_W01	C4	Lec 5	N1, N3, N4
PEK_W05	K1 INF_W01	C5	Lec 6, Lec 7	N1, N3, N4
PEK_W06	K1 INF_W01	C6	Lec 8	N1, N3, N4
PEK_W07	K1 INF_W01	C7	Lec 9	N1, N3, N4
PEK_W08	K1 INF_W01	C8	Lec 10	N1, N3, N4
PEK_W09	K1 INF_W01	C9	Lec 11	N1, N3, N4
PEK_W10	K1 INF_W01	C10	Lec 12	N1, N3, N4
PEK_W11	K1 INF_W01	C11	Lec 13	N1, N3, N4
PEK_W12	K1 INF_W01	C12	Lec 14, Lec15	N2, N3, N4
PEK_U01 (skills)	K1 INF_W06	C13	Cl 1	N2, N3, N4
PEK_U02	K1 INF_W06	C14	Cl 2	N2, N3, N4
PEK_U03	K1 INF_W06	C15	Cl 3, Cl 4	N2, N3, N4
PEK_U04	K1 INF_W06	C16	Cl 5	N2, N3, N4
PEK_U05	K1 INF_W06	C17	Cl 6, Cl 7	N2, N3, N4
PEK_U06	K1 INF_W06	C18	Cl 8	N2, N3, N4
PEK_U07	K1 INF_W06	C19	Cl 9	N2, N3, N4
PEK_U08	K1 INF_W06	C20	Cl 10	N2, N3, N4
PEK_U09	K1 INF_W06	C21	Cl 11	N2, N3, N4
PEK_U10	K1 INF_W06	C22	Cl 12	N2, N3, N4
PEK_U11	K1 INF_W06	C23	Cl 13	N2, N3, N4
PEK_U12	K1 INF_W06	C24	Cl 14, Cl 15	N2, N3, N4
PEK_K01 (competences)	K1 INF_W01, K1 INF_W06	C1...C24	Lec1..15,Cl1...15	N1,N2, N3, N4

** - enter symbols for main-field-of-study/specialization educational effects

*** - from table above