Course code B.3. **Course item** ……

1. INFORMATION ABOUT THE COURSE

A. Basic information

Course title	Numerical Methods in Engineering
Field of study	Computer Aided Engineering
Cycle	*Second*
Study profile	*Academic*
Study mode	*Full-time*
Specialisation	*Not relevant*
Unit responsible for the field of study	*Faculty of Mechanical Engineering*
Lecturer	*Dr hab. inż. Dariusz Skibicki, Prof. nadzw. UTP*
Introductory courses	*Not relevant*
Prerequisites	*Basic knowledge of information technology*

B. Semester/ weekly timetable

Semester	Lectures	Classes	Laboratories	Project classes	Seminars	Field experience	ECTS credits
I	15	-	30	-	-	-	4

LEARNING OUTCOMES (acc. to National Qualifications Framework)

No.	Description of learning outcomes	Reference to learning outcomes for the field of study	Reference to learning outcomes for the area of study
KNOWLEDGE			
K1	student knows and understands digital arithmetic	CAE_W01, CAE_W02	T2A_W02, T2A_W03, T2A_W07
K2	student knows methods of linear equation system solving	CAE_W01, CAE_W02	T2A_W02, T2A_W03, T2A_W07
K3	student knows methods of curve-fitting and interpolation	CAE_W01, CAE_W02	T2A_W02, T2A_W03, T2A_W07
K4	student knows methods numerical integration	CAE_W01, CAE_W02	T2A_W02, T2A_W03, T2A_W07
K5	student knows methods of linear algebraic equations solving	CAE_W01, CAE_W02	T2A_W02, T2A_W03,

			T2A_W07
K6	student knows methods of ordinary differential equations solving	CAE_W01, CAE_W02	T2A_W02, T2A_W03, T2A_W07
K7	student understands the idea of finite elements method	CAE_W01, CAE_W02	T2A_W02, T2A_W03, T2A_W07
K8	student understands the idea of optimization of technical systems	CAE_W01, CAE_W02	T2A_W02, T2A_W03, T2A_W07
SKILLS			
S1	student is familiar with the calculation software packages	CAE_U01, CAE_U02	T2A_U09, T2A_U16, T2A_U17
S2	student is able to calculate reactions of mechanical system by solution of equations using numerical methods	CAE_U01, CAE_U02	T2A_U09, T2A_U16, T2A_U17
S3	student can describe a set of numerical data using fit-curves methods	CAE_U01, CAE_U02	T2A_U09, T2A_U16, T2A_U17
S4	student can solve the equation of motion with one degree of freedom by means of numerical methods	CAE_U01, CAE_U02	T2A_U09, T2A_U16, T2A_U17
S5	student is able to model and solve the optimization problem	CAE_U01, CAE_U02	T2A_U09, T2A_U16, T2A_U17
SOCIAL COMPETENCES			
SC1	student is able to think and act in a creative and enterprising way	CAE_K06	T2A_K06

1. TEACHING METHODS

multimedia lecture, laboratory classes

2. METHODS OF EXAMINATION

colloquium, project

3. COURSE CONTENT

Specify the content separately for each type of classes in accordance with point I.B.	Lectures Representation of Numbers and Digital Arithmetic. Programming and Computational Software. Linear Algebraic Equations Solving: Gauss Elimination, LU Decomposition and Matrix Inversion. Curve Fitting: Least-Squares Regression, Interpolation, Fourier Approximation. Numerical Differentiation and Integration: Newton-Cotes Integration Formulas. Ordinary Differential Equations: Runge-Kutta Methods. Partial Differential Equations: Finite Difference, Finite-Element Method. Optimization: Multidimensional Unconstrained Optimization, Constrained Optimization. Laboratories Introduction to Scilab. Modelling of the statically determinate forces system. Solving of statically determinate system of equations to find forces and reactions. Fitting a straight line to a set of data using least-

	squares regression. Using non-linear regression to fit dates. Plotting the displacement versus time for different values of damping coefficient of one degree damped spring-mass system. Building mathematical model of optimization tasks. Solving a linear and nonlinear optimization tasks.

4. VALIDATION OF LEARNING OUTCOMES

(Each learning outcome from the list requires validation methods to ensure that it was achieved by a student.)

Learning outcome	Form of assessment (for example:)					
	Oral examination	Written examination	Colloquium	Project	Report	……
K1			x			
K2			x			
K3			x			
K4			x			
K5			x			
K6			x			
K7			x			
K8			x			
S1				x		
S2				x		
S3				x		
S4				x		
S5				x		
SC1				x		

5. LITERATURE

Basic literature	Scilab Tutorials: http://www.scilab.org/resources/documentation Fundamental Numerical Methods and Data Analysis: http://ads.harvard.edu/books/1990fnmd.book/
Supplementary literature	Numerical methods with MATLAB : implementations and applications, Recktenwald, Gerald W. Prentice-Hall, 2000. Numerical methods for engineers : with software and programming applications, Chapra, Steven C., Canale, Raymond P. , McGraw-Hill, 2002.

6. TOTAL STUDENT WORKLOAD REQUIRED TO ACHIEVE EXPECTED LEARNING OUTCOMES EXPRESSED IN TIME AND ECTS CREDITS

Student's activity	Student workload– number of hours (for example:)
Participation in classes indicated in point	45
Preparation for classes	20
Reading assignments	15
Preparation for colloquium	20
Total student workload	100
Number of ECTS credits allocated by the lecturer	**4**
Final number of **ECTS credits (determined by the Programme Council for the Field of Study)**	**4**