

Information sheet for the course Numerical Methods

University: <i>Alexander Dubček University of Trenčín</i>	
Faculty: <i>Faculty of Industrial Technologies in Púchov</i>	
Course unit code: <i>MI-I-V-1</i>	Course unit title: <i>Numerical Methods</i>
Type of course unit: <i>optional</i>	
Planned types, learning activities and teaching methods: <i>Lecture: 2 hours weekly/26 hours per semester of study; face to face</i> <i>Seminar: 0</i> <i>Laboratory tutorial: 0</i>	
Number of credits: <i>2</i>	
Recommended semester: <i>2nd semester in the 1st year full-time</i> <i>2nd semester in the 2nd year part-time</i>	
Degree of study: <i>the 2nd degree of study (Engineer's degree)</i>	
Course prerequisites: <i>none</i>	
Assessment methods: <i>Lecturers</i>	
Learning outcomes of the course unit: <i>Numerical methods most frequently used in engineering practice. Students have knowledge about knowledge modeling using the finite element method (FEM) in other areas of technology such as: temperature fields in structures, bodies and fluids, fluid flow, vibration fluid interaction fields of various kinds, elasto-hydro-dynamics and lubrication acoustic, piezoelectric and magnetic fields.</i>	
Course contents: <i>Numerical Computations and algorithms, their compliance and stability. Errors in numerical calculations. The basic concepts of linear algebra, special nuts. Systems of linear equations - LU decomposition, Cholesky method, modified (LDL) Cholesky decomposition. Systems with banded matrices. Iterative methods for solving - superrelaxační method, the method of greatest slope. Errors solutions of systems of linear equations. Singular value decomposition and its applications. Eigenvalues and eigenvectors. Position estimate eigenvalues. Partial eigenvalue problem - a power method and Rayleigh share. Detailed problem of eigenvalues - LR decomposition method, the method of orthogonal transformations - Jacobi, Householderova - Givens method, QR decomposition method. Numerical integration - Gaussian integration formula. Systems of nonlinear equations - Newton-Raphson method. Numerical solution of differential equations. Boundary value problems for ordinary differential equations - method strel'by. Prenos heat-governing equations, boundary and initial podmienky. Konvekcia and radiation. Types of thermal analysis. Stationary and transient analysis. Associated problems. Formulation of the stationary thermal analysis. Variation and Galerkin formulation. Derivation of 2D and 3D finite element analysis for temperature. Special types of elements. Advancements solution temperature problems in finite element programs (COSMOS, ANSYS). Basic equations. Navier-Stokes equations. Constitutive relations. Types of analyzes: laminar or turbulent. Temperature or adiabatic. Compressible or incompressible. Newtonian or non-Newtonian Potential and stream function. Galerkin formulation of the potential-flow. The discretization of the Navier-Stokes equations, continuity equation and energy equation. Hydrodynamic</i>	

lubrication. Formulation of the acoustics. Wave acoustic field with structures.

Recommended of required reading:

Riečanová, Z.: Numerické metody a štatistika. Alfa, Bratislava 1987.

Míka, S.: Numerické metody - lineárna algebra, ZČU, Plzeň, 1996.

Práger, M.: Numerická analýza, ZČU, Plzeň, 1995.

Přikryl, P.: Numerické metody - aproximácia funkcií a matematická analýza, ZČU, Plzeň, 1996

Míka, S.-

Přikryl, P.: Numerické metody riešenia obyčajných diferenciálnych rovníc - okrajové úlohy, ZČU, Plzeň, 1994.

Kaukič, M.: Numerická analýza I., MC Energy, Žilina, 1998.

Buchanan, L. - Turner: Numerical Methods and analysis. McGraw Hill, 1992.

Bačová, B.- Kříž, F.: Matlab – laboratorne cvičenie, EDIS, Žilina 1998.

Zienkiewicz, O.C.- Taylor, R.L: The Finite Element Method, Vol. 1-2, 1989, 1991.

Bathe, K.J.: Finite Element Procedures. Englewood Cliffs, 1996.

Kassab, A.- Aliabadi, M.H.: Coupled Field Problems, WITpress, 2001.

Language: *Slovak*

Remarks:

Evaluation history:

A	B	C	D	E	FX

Lecturers: *doc. RNDr. Ladislav Matejíčka, CSc.*

Last modification: *31.03.2014*

Supervisor: *prof. Ing. Darina Ondrušová, PhD.*