University: University of Žilina	
Faculty: Faculty of Mechanical Engineering	
Course ID: 2Y016	**Course name:** Finite Element Method I
Course obligation: Compulsory **Completion:** Exam	
Profile course: yes **Core course:** yes	
Form, extent and method of teaching activities:	
Number of classes per week in the form of lectures, laboratory exercises, seminars or clinical practice	Lectures: 1 classes Seminars: 0 classes Lab.exercises: 2 classes
Methods by which the educational activity is delivered	Present form of education
Applied educational activities and methods suitable for achieving learning outcomes	**Lectures:** systematic theoretical problem interpretation of the issue, defining basic principles, solution of sample examples, comment on the solution, repetition of learned issues, continuous examination, interactive exercises with.
Number of credits: 5	
Study workload: 145 hours;	
Recommended semester/term of study: summer, 1. year	
Study degree: 2	
Required subsidiary courses: Prerequisites: Mathematics Co-requisites:	

Course requirements:

Continuous assessment / evaluation:

Evaluation of student activity and correctness of procedures of solving examples in exercises.

Final assessment /evaluation:

The test is in the form of presentation of the results of solving the given examples, max 60 points.
In particular, an understanding of the physical nature of the problems solved and a critical assessment of the results are evaluated. Results processing and output quality, logical structure and graphical processing are also evaluated.

Resulting subject classification:

Grade A: minimum 93 points
Grade B: minimum 85 points
Grade C: minimum 77 points
Grade D: minimum 69 points
Rating E: minimum 61 points
FX rating: less than 61 points
To enroll for an exam the student must have at least 20 points.

Forms and methods of assessment	Predetermined weight %	Area of knowledge, skills and competence
Continuous evaluation of the activity, student portfolio, presentation of results during the semester project defense	40 %	range of knowledge, activities and the correctness of solving tasks during the semester, professional knowledge, working with various information sources, self-study, ability to discuss and defend the results achieved, individual/team work, working with commercial software based on MKP
exam (professional level and correctness of the solution in defending the semester project)	60 %	method of presentation, logical structure, graphic processing of the presentation and oral speech during the presentation, professional knowledge, quality of outputs, appropriateness of the used solution procedures through created programs, processing and evaluation of results, discussion

Course outcomes:
Finite Element Method (FEM) is the most widespread in engineering. Upon completion of the course, students will acquire practical skills in solving linear problems of statics and dynamics of structures, including solutions of heat transfer and thermoelasticity problems. These skills will enable him to quickly and reasonably apply the theoretical knowledge gained from FEM and to critically evaluate results from commercial FEM programs. The student will learn to reliably model structures with respect to accuracy of results, solution convergence, etc.

Course scheme:
- Introduction, elasticity equations and boundary conditions.
- Derivation stiffness matrices for bar and beam elements.
 Isoparametric formulation.
- Higher order elements.
- Boundary conditions and statically equivalent loads.
- Plate elements based on Kirchhoff and Mindlin theory.
- Thin and thick shell elements.
- Special element types.
- Stress smoothing, error estimation and adaptive networking.
- Dynamic analysis of structures, derivation of relations for mass matrix.
- Modal analysis with and without damping.
- Harmonic and transient analysis.
- Subject summary and other perspectives.

Literature:

1. ZIENKIEWICZ, O.C. –TAYLOR, R.L.: The Finite Element Method, Vol. 1-2, 1989, 1991.
2. Sága, M., Žmindák, M., Dekýš, V., Sapietová, A., Segľa, Š.: Vybrané metódy analýzy a syntézy mechanických sústav. VTS pri ŽU v Žiline. 2009, 360s. ISBN 978-80-89276-17-2.
3. Ivančo, V. – Vodička, R. : Numerické metódy mechaniky telies a vybrané aplikácie . Technická univerzita v Košiciach, 2012.
4. MURÍN, J.: Metóda konečných prvkov pre prútové a rámové konštrukcie. STU Bratislava, 1999.
5. Bucalem, M.L – Bathe, K.J.: The Mechanics of Solid and Stuctures- Hierarchical Modeling and the Finite Solution. Springer –Verlag, 2011.
6. Arnold, M. – Schielen, W., (eds.): Simulation Techniques for Applied Dynamics, CISM Courses and Lectures, vol. 507, Springer, 2008.
7. HARRIS, T.A. a kol. 2007. Rolling Bearing Analysis – Essential Concepts of Bearing Technology. CRC Press, 2007. ISBN 0-8493-7183-X

Instruction language: english

Notes:

Course evaluation:
Total number of evaluated students: 3

A	B	C	D	E	FX
66.67 %	33.33 %	0.00 %	0.00 %	0.00 %	0.00 %

Course teachers:
Lecture: Ing. Pavol Novák, PhD.
Lecture: prof. Ing. Milan Sága, Dr.
Laboratory: Ing. Marián Handrik, PhD.
Laboratory: Ing. Pavol Novák, PhD.

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Approved by: prof. Ing. Milan Sága, Dr.