University: University of Žilina in Žilina	
Faculty: Faculty of Mechanical Engineering	
Course ID:	**Course name:** Numerical Methods and Statistics (NMS)
Course obligation: Electorial **Completion:** Exam	
Profile course: - **Core course:** yes	
Type, extent, and methods of teaching activities:	
Number of classes per week in the form of lectures, laboratory exercises, seminars or clinical practice	Lectures: 2 Seminars: 2 Laboratory exercises: 0
Methods by which the educational activity is delivered	Present form of education
Applied educational activities and methods suitable for achieving learning outcomes	Lectures: lectures with problem-based teaching, interactive lectures with discussion, and lectures with multimedia support. Exercises: problem-based teaching, problem-based explanation, peer learning, buzz groups, peer learning, and feedback delivery. Seminars are conducted in computer classrooms where students will work with the MATLAB software.
Number of credits: 4	
Study workload: The workload for this subject is set at 104 hours per semester, with 52 hours (2 hours per week for 13 weeks + 2 hours per week for 13 weeks) allocated to direct teaching. The remaining 52 hours per semester are dedicated to self-study and independent creative work by the student, providing ample opportunity for students to consolidate their learning and pursue their interests in the subject matter.	
Recommended semester/term of study: 2. year, summer semester	
Study degree: 1	
Required subsidiary courses:	
Course requirements: A point-based system is used to assess the subject of Numerical Methods and Statistics. The final score is determined by adding the points earned by a student during the semester, primarily through exercises, and the points earned on the final exam. The total points available for the subject are 100, with 40 points allocated to exercises and 60 points to the final exam. **Continuous assessment / evaluation:** Throughout the semester, students will be required to complete three term papers, with each carrying a maximum of 10 points, and an expert presentation that will be evaluated along with the overall work done by the student during exercises, also with a maximum of 10 points. The maximum number of points that a student can earn for their work during the semester is 40. To be eligible for the final exam, a student must achieve a minimum of 24 points. **Final assessment /evaluation:** The exam consists of a written test, which includes solving problems and testing theoretical knowledge, with a maximum of 60 points. The points obtained during exercises (maximum of 40) are added to the points earned during the exam (maximum of 60), resulting in the final grade for the subject. Final Evaluation Grid: Grade A: 93 - 100 points Grade B: 85 – 92 points Grade C: 77 - 84 points	

Grade D: 69 - 76 points
Grade E: 61 - 68 points
Grade FX: less than 61 points

The method used to evaluate a student's work during the semester and the final exam will be specified by the subject teacher at the beginning of the semester. The final grade, which expresses the student's study performance for completing the subject, is determined by the regulations outlined in Section 9 of the Study Regulations for the 1st and 2nd level of university studies at the University of Žilina.

Assessment matrix of educational outcomes:

Forms and Methods of Assessment	Predetermined weight	Area of knowledge, skills, and competences
Three papers	30%	professional knowledge, work with information, independent work
One presentation	5%	soft skills
Student portfolio	5%	professional knowledge, work with information, discussion, teamwork
Exam: test	60%	professional knowledge

Course outcomes:

The students have a strong foundation in the field of mathematical statistics and numerical methods, as they can define and explain fundamental concepts. Moreover, they possess the skills to analyze and replicate basic methods of numerical calculations and statistical analyses. This knowledge also allows them to use relevant statistical and numerical methods effectively in their future professional education and specialization in different engineering areas. Additionally, the student can identify the suitability of individual statistical and numerical mathematical methods for analyzing specific technical issues, utilizing them with ease alongside appropriate engineering software, such as in the analysis of experimental data.

Course scheme:

- Introduction to MATLAB software.
- Discrete and continuous random variables, numerical characteristics, distribution function, probability density.
- Random variable distributions (binomial, Poisson, geometric, normal, exponential, chi-squared, Student's t, Weibull).
- Descriptive statistics. Random sample and its numerical characteristics.
- Basics of estimation theory - point estimation, interval estimation.
- Testing of statistical hypotheses.
- Linear regression and correlation.
- Basic concepts of numerical mathematics. Numerical problems and algorithms, their conditioning and stability. Errors in numerical computations. Numerical solution of equations - root separation, an overview of methods.
- Iterative and Newton's method. Systems of nonlinear equations - Newton-Raphson method.
- Solution of systems of linear equations - overview of methods. Jacobi and Gauss-Seidel methods.
- Function interpolation. Lagrange and Newton forms of interpolation polynomials. Numerical differentiation.
- Function approximation - method of least squares.
- Numerical integration - trapezoidal and Simpson's rule.
- Numerical solution of Cauchy problem for ordinary differential equations - Euler and Runge-Kutta methods.

Literature:

[1] Buchanan, J.L. – Turner, P.R.: *Numerical methods and analysis*, International series in pure and applied mathematics, 1992, ISBN 0-07-008717-2.

[2] Ralston, A., Rabinowitz, P.: *A First Course in Numerical Analysis,* Second Edition (Dover Books on Mathematics), Dover Publications, 2001, p. 624, ISBN 978-0486414546.

[3] Montgomery, Douglas C. - Runger, George C.: *Applied statistics and probability for engineers: a study guide to accompany,* 7th ed.- Hoboken, NJ : Wiley, 2018, p. 148, ISBN 978-1-119-68890-7.

[4] Mendenhall, W.- Sincich, T.: *Statistics for Engineering and the Sciences,* 4. Edition - New Jersey : Prentice-Hall, 1995, p. 1182, ISBN 0-02-380581-1.
[5] David Houcque: *INTRODUCTION TO MATLAB FOR ENGINEERING STUDENTS*, Northwestern University, https://www.mccormick.northwestern.edu/documents/students/undergraduate/introduction-to-matlab.pdf

Instruction language: English

Notes:

Course evaluation
Total number of evaluated students: 0

A	B	C	D	E	FX
0 %	0 %	0 %	0 %	0 %	0 %

Teacher:
Lectures, seminars: doc. RNDr. Božena Dorociaková, PhD.
Seminars: RNDr. Zuzana Malacká, PhD.

Last updated:

Guarantor: doc. RNDr. Božena Dorociaková, PhD.

Approved by: