Budapest University of Technology and Economics
Faculty of Transportation Engineering and Vehicle Enginee

1. Subject name	**Analitical Methots in System Technique II.**				
2. Subject name in Hungarian	Analitikus módszerek a rendszertechnikában II.				
3. Code	**BMEKOVJD002**	**4. Evaluation type**	**exam grade**	**5. Credits**	**4**
6. Weekly contact hours	**2 (0) Lecture**	**0 (0) Practice**	**0 (0) Lab**		
7. Curriculum	**PhD Programme**	**8. Role**	**Basic course**		
9. Working hours for fulfilling the requirements of the subject					**120**
Contact hours	28	**Preparation for seminars**	30	**Homework**	0
Reading written materials	30	**Midterm preparation**	0	**Exam preparation**	32
10. Department	**Department of Aeronautics and Naval Architectures**				
11. Responsible lecturer	Dr. Zobory István				
12. Lecturers	Dr. Zobory István				
13. Prerequisites	**recommended: BMEKOVJD001 - Analitical Methots in System Technique I.**				

14. Description of lectures

Algebraic and trigonometric form of complex numbers. Euler-relation. Defining complex functions. The complex function as mapping. Differentiability of complex functions. The Caucy-Riemann differential equations. Integration of complex functions. Integral theorems. Integration along a given curve with respect to arclength. Harmonic functions. Elements of Laplace- and Fourier transform. The concept and classification of differential equations. The general initial value problem. The equivalent integral equation. The Picard-Lindelöf iteration. The Lipschitz condition. Tracing back higher order differential equations to a first order set of differential equations. Solution methods for treating linear differential equations. Application of Laplace transform for the solution of differential equations. Numerical solution to differential equations: The Euler-method, the Heun-method, the Runge-method and the Runge-Kutta method. Differential-equation systems. Solution to the homogeneous part of the linear differential equation via treating an eigenvalue-problem. Test function method for the solving inhomogeneous set of differential equations. The general solution and the particular solutions. Tracing back higher order differential equation systems to a first order linear differential equation system. Numerical solution to differential equation systems. Stability of the solution to differential equations and differential equation systems in the case of perturbing the initial values or the coefficients. Stability analysis for linear differential equations, the Hurwitz-criterion. Stability analysis for non-linear differential equations. The method of Ljapunov.. Construction of Lajapunov functions. The basic lemma of the variation calculus. The Euler-Lagrangean equation. Direct methods of the variation calculus. Euler-method based on broken lines. The Ritz-method.

15. Description of practices

16. Description of labortory practices

17. Learning outcomes

A. Knowledge B. Skills

- Students must know comprehensively, interpret in a constructive way and apply in his research activities in an innovative way the following elements of analysis methods: relationships in complex function theory; analytical and numerical solution methods to linear or non-linear differential equations and equation systems; methods of function variation theory.

C. Attitudes D. Autonomy and Responsibility

- Students must pursue to get knowledge of the new scientific results, the latter are applied with responsibility and initiates new resource activities in new fields of knowledge in an innovative way

18. Requirements, way to determine a grade (obtain a signature)

Regular participation at the lectures and written exam.

19. Opportunity for repeat/retake and delayed completion

According to the TVSZ.

20. Learning materials

Zobory, I.: Analitikus módszerek a rendszertechnikban II. Egyetemi jegyzet. BME Vasúti Járművek és Járműrendszeranalízis Tanszék. Budapest, 2011.
2. Brown, F.T.: Engineering System Dynamics. Taylor & Francis, Boca Raton, London, New-York, 2007

Effective date	27 November 2019	**This Subject Datasheet is valid for**	Inactive courses