ÓBUDA UNIVERSITY
JOHN VON NEUMANN FACULTY OF INFORMATICS

Institute of Biomatics and Applied Artificial Intelligence						
Name of the subject:	Code of the subject:	Credits:	Weekly hours:			
				lec	sem	lab
Fundamental Mathematical Methods	NIMFM1SANK	4	full-time			
Responsible person for the subject:			Classification:			
Subject lecturer(s): Dr Kósi Krisztián						
Prerequisites:						
Way of the assessment:	Exam					

Course description	
Goal:	The main aim is to provide the Students with the most important mathematical methods on which the modern nonlinear control applications are based. Besides the purely mathematical point of view actual implementation issues are considered, too.
Course description:	The beginning of the course, concentrates on mathematical methods. It shows the connections between classical math subjects (like calculus, linear algebra), and the modern nonlinear control theory. Then shows detailed examples, from theory to implementation, using two modern methods (VSSM, RFPT). The last part shows some another interesting example, how mathematics is related to computer science, like fractals, genetic algorithms, multidimensional scaling.

Lecture schedule	
Education week	Topic
1.	Introduction to LaTeX and Julia language
2.	Mathematical background
3.	Mathematical background
4.	Numerical Methods
5.	Laplace Transform, First Order Differential Equations
6.	Second Order Differential Equations
7.	Series of Functions
8.	Metric Space,
9.	Fixed Point Iteration, Modelling and Simulation
10.	Introduction to non-linear robotics, Lyapunov's stability definitions and theorems
11.	Robust Control, VSSM
12.	Adaptive Control, RFPT
13.	MIMO Systems
14.	Presentations

Mid-term requirements	
Conditions for obtaining a mid-term grade/signature	**If someone absent at lecture and lab, and more than 30%, will have denied from the course.** **Every homework is 1 point get 50% or more from the homework for the signiture.** **(just the overall points matters)** Can be get Offered grade: • Homework results overal is or above 62%. • Create a home project: solve a non-trivial problem, code it in Julia, create minimum 5 page paper in IEEE format , and held a 10 min long presentation in the last class.

Assessment schedule

Education week	Topic

Method used to calculate the *mid-term grade* (to be filled out only for subjects with mid-term grades)

Type of the replacement	
Type of the replacement of written test/mid-term grade/signature	

Type of the exam (to be filled out only for subjects with exams)
written exam

Calculation of the exam mark (to be filled only for subjects with exams)
Achieved result **Grade** **88%-100% excellent (5)** **75%-88<% good (4)** **62%-75<% average (3)** **50%-62<% satisfactory (2)** **0%-50<% failed (1)**
Final grade calculation methods:

References	
Obligatory:	**Lecture Notes**
Recommended:	System and Control Theory - József K. Tar - László Nádai - Imre J. Rudas. TYPOTEX 2012, ISBN 978- 963-279-676-5 Applied Nonlinear Control, Slotine and Li, Prentice-Hall 1991 M. Oberguggenberger, A. Ostermann.: Analysis for Computer Scientists. In: Undergraduate Topics in Computer Science. Springer-Verlag Ltd. London, 2011 Elements of the Theory of Functions and Functional Analysis - A.N. Kolmogorov, S.V. Fomin
Other references:	