Obuda University John von Neumann Faculty of Informatics	Institute of Applied Mathematics

Name and code: NIMFM1SANK Fundamental Mathematical Methods
Credits*: 4*

2022/23 year I. semester

Subject lecturers: Dr Kósi Krisztián				
Prerequisites (with code):				
Weekly hours:	Lecture: 1	Seminar.:	Lab. hours: 1	Consultation:
Way of 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.	Extra content
14.	Presentations

Midterm requirements

Education week	*Topic*

Final grade calculation methods

Achieved result	Grade
88%-100%	excellent (5)
75%-88<%	good (4)
62%-75<%	average (3)
50%-62<%	satisfactory (2)
0%-50<%	failed (1)

Signature requirements: If someone absent at lecture and lab, and more than four times 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)

Regular exam.

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.

Type of exam

written exam

Type of replacement

The worst midterm can be retaken in the last week.

References

Mandatory:

Lecuter 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