Obuda University John von Neumann Faculty of Informatics				Institute of Applied Mathematics
Name and code: Dynamical systems - regular: NAMPD1AENM part time: NAMPD1AEEM				**Credits*: 5*** *2021/22 year I. semester*
Subject lecturers: Vilmos Zoller, dr.habil.				
Prerequisites (with code):	Differential equations - NAMDE1AENM			
Weekly hours: regular:2/0/2 part time: 1/0/1	Lecture: 2(1)	Seminar.: 0	Lab. hours: 2 (1)	Consultation: 0
Way of assessment:	exam			
Course description:				
Goal: Introduction to the theory of PDEs and their solution methods with the help of generalized functions (distributions).				
Course description: Initial and boundary value problems for hyperbolic and parabolic equations, weak solutions to elliptic boundary problems, Generalized functions, Bessel functions, fundamental solutions, Cauchy problems.				

Lecture schedule	
Education week	*Topic*
1.	First-order equations, linear in their principal parts.
2.	Classification of second-order PDEs, linear in their principal parts in two variables. The wave operator and the first-order Klein-Gordon operator.
3.	The heat operator, the Laplace operator and the Helmholz operator. The Cauchy-Riemann operator and the Schrödinger operator. The Bernoulli-Euler beam operator. Initial and boundary value problems for hyperbolic equations.
4.	Initial and boundary value problems for parabolic equations. Elliptic boundary problems.
5.	Metric and topological spaces.
6.	Topological vector spaces.
7.	Locally integrable functions, ground functions. Generalized functions (distributions). Singular distributions.
8.	Derivation of distributions. Multiplication by a smooth function. Direct product of distributions.
9.	Convolutions of functions and distributions. Rapidly decreasing and slowly increasing functions and distributions. Fourier transforms of functions. Inhomogeneous linear coordinate transformation of distributions.
10.	Fourier transforms of distributions. Fundamental solutions, particular solutions to inhomogeneous equations.
11.	Fundamental solutions to ordinary linear differential operators with constant coefficients. Fundamental solutions to first-order PDEs. Fundamental solutions to the wave operator and the one-dimensional Klein-Gordon operator. Bessel functions of order 0. Fundamental solution to the heat operator.

12.	Fundamental solutions to the Laplace operator, the Cauchy-Riemann operator and the Helmholz operator.
13.	Cauchy problems.
14.	Preliminary exam.

Midterm requirements

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Final grade calculation methods

Achieved result	Grade
85%-100%	excellent (5)
70%-84<%	good (4)
55%-69<%	average (3)
40%-54<%	satisfactory (2)
0%-39<%	failed (1)

Type of exam

written

Type of replacement

written

References

Obligatory: V.I. Arnold, Lectures on Partial Differential Equations. Springer, Berlin, 2004

Recommended: T.v. Kármán, M.A. Biot, Mathematical Methods in Engineering, McGraw-Hill, 1940

V.S: Vladimirov, Equations of Mathematical Physics, Dekker/NewYork, 1971

A.N. Tychonov and A.A. Samarski. Partial differential equations of mathematical physics**,** Holden-Day, San Francisco, 1964

Foundations of the Classical Theory of Partial Differential Equations, ed. by Yu.V.Egorov and M.A.Shubin, Encyclopaedia of Mathematical Sciences 30, Springer, 1998