COURSE TITLE: GEMAN500M A	**Credits: 4**
2 lecture + 1 practice session pr week.	
Requirements: Two tests must be passed with at least 50% score. On the contrary case a comprehensive exam is required. Solutions of extra problem sets can increase an at least 2 grade.	
Second semester	
Prerequisites: Calculus, Linear Algebra.	
Course objectives: The theory of differential equations is a basic tool of diverse fields of science. Students of this course should be able to understand the behaviors and to derive solutions of differential equations. The analysis of differential equations includes numerical, geometrical and analytical methods. The course covers linear and nonlinear, and also ordinary and partial differential equations. Nonlinear equations are studied by their linearization around the equilibrium solution. A short introduction to complex functions is presented. Laplace and Fourier methods are applied both to ordinary and partial equations. Topics: 1. Geometric interpretation and numerical solution, Euler method. 2. Error estimation of numerical methods. Solution by Taylor series. 3. Solutions' qualitative behavior. Linearization. 4. Solution of linear ODE. Eigensystems of matrices. 5. Matrix exponentials, Jordan decomposition. 6. Complex functions, Cauchy formula. 7. Laplace transform. 8. Inhomogeneous linear differential equations. Frequency and impulse responses. 9. Numerical methods. 10. Heat equation, conservation laws. 11. Special solutions of partial differential equations. Plane waves. 12. Wave equations. 13. Laplace equation. 14. Calculus of variations, finite elements. The order of the topics is tentative.	
Literature: 1. Lecture notes of the course, 2. Paul's Online Math Notes: Differential Equations: http://tutorial.math.lamar.edu/Classes/DE/DE.aspx 3. MIT OCW: Differential Equations 18.03, https://ocw.mit.edu/courses/mathematics/18-03-differential-equations-spring-2010/	

4.Dennis G. Zill: Differential Equations with Boundary-Value Problems, 8th Edition, ISBN-13: 978-1111827069.

5. W. Trench: Elementary Differential Equations with Boundary Values Problems,

(free textbook, http://digitalcommons.trinity.edu/mono/9/)

6. Peter Olver: Introduction to Partial Differential Equations, Springer, 2013.

Instructor: Dr. Varga Péter