TTK, Mathematics BSc, Differential equations 1. Spring, 2024

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**Oral exam** (Dr. Peter Moson) - PLANNED

1. First order ordinary differential equations (ODEs). Definition of the solution. Equivalent integral equation. Theorem of existence & uniqueness. Orthogonal trajectories.
2. A Gronwall-Bellman-Bihari lemma (proof). A Lipschitz condition. Proof of the unicity.
3. Approximate solution of first order ordinary differential equations (ODEs). (NEWTON, EULER, PICARD methods).
4. Exact ODEs. Multiplier method.
5. Fist order autonomous ODEs (trajectories, integral curves).
6. Second order ODEs. Reducible equation. Examples (gravity, harmonic oscillator).
7. Linear second order ODEs (structure of the solutions, variation of constants).
8. Linear second order equations with constant coefficients. Method of undetermined coefficients.
9. Laplace transformation. Application to the solutions of ODEs.
10. Systems of ODEs. Theorem of existence & uniqueness.
11. Linear systems. Maximal interval of solutions.
12. Linear systems with variable coefficients. Homogeneous, non-homogeneous case. Wronski determinant.
13. Linear systems with constant coefficients.
14. Autonomous systems. Trajectories do not intersect each other. Phase portraits of planar linear systems with constant coefficients.
15. Nonlinear autonomous systems. Poincaré's theorem.
16. Lyapunov stability. Examples.
17. Lyapunov stability by the first approximation. Routh-Hurwitz criterion.
18. Continuous dependence on initial values. parameters.
19. Differentiable dependence on initial values. Variational system
20. * (Joker).