

ODEs - 104285. Semester: Spring. Year: 2013

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Tests, grades

Midterm: May 20 (Monday), lecture time, magen 30 %

Homeworks: every teaching-day-Monday you will have a HW assignment (exercises from my book) to be turned in by next Monday. Magen 15 %.

Final A: July 14 (Sunday), Final B: October 20 (Sunday)

Understanding of this course is by definition your ability to solve problems. This requires good knowledge of complex numbers, integrals (definite, indefinite, convergence), series (including functional series), linear algebra (eigenvalues, eigenvectors, diagonalization) and other topics you learned during the first two semesters.

Do NOT expect that this course is only about the ways to solve ordinary differential equations – I will devote to this note more than 1/2 of the course. At least 1/2 of the course and at least 1/2 of the tests will be devoted to qualitative theory (how to get valuable information about solutions of ODE's without solving them).

Main (but not all) topics:

1. Examples of ODEs. Existence and uniqueness theorems. Prolongation of solutions.
2. Complete theory of ODEs of the form $x'(t) = F(x(t))$
3. Complete theory of ODEs of the form $x''(t) = F(x(t))$ (including two body problem and math pendulum)
4. Classes of solvable first order ODEs.
5. Complete theory of linear systems of first order ODEs $\dot{x} = Ax, x \in \mathbb{R}^n$ (including phase portraits in \mathbb{R}^2 , stable and unstable subspaces, exponent of a matrix, simple cases of Jordan normal form)
6. Complete theory of linear ODEs of k th order with constant coefficients
7. Stability of singular points of non-linear systems of ODE's.

Books

The course is identical to my book which will be published in my homepage (in English). Every Monday evening (except non-teaching Monday) a part of the book covering all already given lectures will be available. The figures (drawing) in the book are very important. They will be published in a separate scanned file (also in my homepage). I also recommend to use the books

Uri Eliash, Introduction to ODEs. Math Faculty, Technion, 2009 (Hebrew)

W.E. Boyce, R.C. DiPrima, Elementary differential equations.... (English)

V.I. Arnol'd, ODE's (English, Russian) (masterpiece, but very difficult)