

ODEs - 104285. Semester: Spring. Year: 2011

By Mikhail Zhitomirskii

Amado 723, tel. 4026, email: mzhi@tx, office hours: Sunday 16:30-17:30

TA: Maxim Gurevich (max@tx) **Grading HW:** Alon Dmitryuk (alond@tx)

Tests, grades

Midterm 1: April 12 (Tuesday), lecture time, mohen 15 %

Midterm 2: May 17 (Tuesday), lecture time, mohen 15 %

Test on homeworks: June 13 (Monday), tirlgul time, mohen 15 %

Final A: June 27 (Monday), Final B: September 25 (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 will be devoted to qualitative theory (how to get valuable information about solutions of ODE's without solving them).

Main topics:

1. Examples of ODEs. Existence and uniqueness theorems. Prolongation of solutions.
2. Complete theory of ODEs of the form $x'(t) = V(x(t))$
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)
6. Complete theory of linear ODEs of k th order with constant coefficients
7. Stable and unstable singular points of non-linear system of ODE's.
8. Introduction to series solutions of ODEs
9. Introduction to boundary value problems.

Books The course is NOT based on any single book. Each of the books below contains some of the topics of the course (not necessarily in the same exposition) and many topics beyond the course.

1. Some of the lectures will be published in my homepage.
2. W.E. Boyce, R.C. DiPrima, Elementary differential equations..... (English)
3. D. London, ODE's (Technion, Hebrew)
4. E.A. Coddington, N. Levinson, Theory of ODEs
5. M. Braun, Differential equations and their applications (English)
6. I.G. Petrovski, Ordinary differential equations (English, Russian)
7. V.I. Arnol'd, ODE's (English, Russian)