ODEs - 104285. Semester: Spring. Year: 2012

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Tests, grades

Midterm 1: May 9 (Wednesday), lecture time, mohen 15 %
Midterm 2: June 6 (Wednesday), lecture time, mohen 15 %
Homeworks (will be published each Thursday), mohen 15 %
Final A: July 2 (Monday), Final B: October 16 (Tuesday)

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 (but not all) topics:

1. Examples of ODEs. Existence and uniqueness theorems.
Prolongation of solutions.
2. Complete theory of ODEs of the form $x'(t) = V(x(t))$
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 $\mathbb{R}^2$, stable and unstable subspaces, exponent of a matrix, simple cases of Jordan normal form)
6. Complete theory of linear ODEs of kth order with constant coefficients
7. Stability of singular points of non-linear systems of ODE's.

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 (English)
2. Uri Eliash, Introduction to ODEs. Math Faculty, Technion, 2009 (Hebrew)
3. W.E. Boyce, R.C. DiPrima, Elementary differential equations..... (English)
4. V.I. Arnol'd, ODE's (English, Russian) (masterpiece, but very difficult)