Systems of ODEs: MATH 106A Fall 2008

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Office hours: MW noon to 1:30pm or by appointment

Textbook Diferential equations by Blanchard, Devaney, and Hall, Third Edition

Web page with syllabus, homeworks, lecture notes and exams:
http:// www.math.technion.ac.il/∼mzhi click TEACHING, 106A

Homeworks the web page, each Monday evening. Due on next Monday, 9am

Lecture Notes in the web page I will publish certain topics which cannot be found in the textbook

Grading Homeworks: 10% , Quizzes: 10% , Midterm 1: 20 % , Midterm 2: 20 %, Final 40 %

On each Friday Lecture = practice section. We will discuss and solve several problems, similar to homework and test problems. On many Fridays there will be short quizzes.

The syllabus gives a general idea of progress of the class. There will be variations depending how fast certain topics are understood. Certain topics might be skipped. Few topics might be added.

Sept 26 - Oct 3: Introduction. Examples. Autonomous and non-autonomous systems. From ODE of order n to a system of first order equations. From a system of ODEs of order n to a system of first order equations. Linear and non-linear systems. Matrix-vector notations for linear systems.

Autonomous systems of two ODEs. Phase plane. Vector fields and direction fields. Phase (solution) curves. Phase portraits. Equilibrium points. Periodic solutions. Straight line solutions. An idea about stability.

Oct 6 - 17: Solving a linear system of n equations. The vector space of real-valued solutions. Its dimension. Its basis in the case of n real eigenvalues. Its basis in the case of repeated eigenvalues (for $n = 2$ and $n = 3$ only). The case that some of the eigenvalues are not real. The vector space of complex-valued solutions. From complex-valued to real-valued solutions.

Oct 20: Exam 1

Oct 22 - 31: Phase planes for linear systems. Linear transformation of the phase plane. Phase portraits: saddles, sinks, sources, focuses (spiral sinks and sources), centers. Phase portraits in the case of zero or repeated eigenvalue. The trace-determinant plane.

Nov 3-7: The exponential matrix. Solving linear systems via the exponential matrix. Computing the exponential matrix.

Nov 10-14: Non-autonomous linear equations and systems.

Nov 17: Exam 2

Nov 19 - Dec 5: Nonlinear systems. Linearization. Equilibria analysis. Stability. Bifurcations. Separatrices. Using nullclines. Hamiltonian systems.

Dec 9, 7:30pm - 10:30 pm: **Final Exam**