

## **MTH 645 - Advanced Ordinary Differential Equations (Fall 2008)**

When: Monday, Wednesday, and Friday 11:00AM-11:50AM

Where: MATH 250

**Instructor:** Avner Peleg

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Office hours (tentative): Monday 3:00PM-4:30PM, Wednesday 3:00PM-4:00PM.

**Textbook:** Differential Equations and Dynamical Systems, Third edition, L. Perko, Springer (2001).

**Prerequisites:** MTH 306, MTH 309, and MTH 241 or MTH 431 (Introduction to Real Variables I) all with grade of C or higher.

**Tentative syllabus:** Chapters 1-4 in L. Perko's book.

### **Course description:**

(1) Linear systems with constant coefficients: existence and uniqueness theorem, complex and repeated eigenvalues, stability theory.

(2) Nonlinear systems - local theory: existence and uniqueness theorem, linearization, the stable manifold theorem, stability and Liapunov functions, classification of equilibrium points, center manifold theory, gradient and Hamiltonian systems.

(3) Nonlinear systems - global theory: global existence and uniqueness theorems, limit sets and attractors, periodic orbits and limit cycles, the Poincaré map, Poincaré-Bendixson theorem, van der Pol and Lienard equations.

(4) Nonlinear systems - bifurcation theory: bifurcations at nonhyperbolic equilibrium points, Hopf bifurcations and bifurcations of limit cycles, homoclinic bifurcations.

**Homework:** Homework will be assigned each week. Selected homework problems on each assignment will be graded. Homework is an important component of the course and is worth 25% of the final grade.

Notice that: (1) Late homework will not be accepted. (2) It is your responsibility to show your work and to present it in readable form. Unreadable answers or answers without justification will not receive credit.

**Exams:** There will be one midterm exam and a final exam. The midterm exam is scheduled for Friday, October 17. It will take place in the classroom during regular class time. The time, date, and location of

the final exam will be announced when they become available. The weight of the midterm exam is 30%, and the weight of the final is 45%.

<b>Grade:</b>	Homework	25%
	Midterm	30%
	Final	45%

The final number grade will be translated to a letter grade, and the translation will not be worse than:

85-100	A
70-84	B
60-69	C
50-59	D
0-49	F

The boundaries for plus/minus grades (A-, B+, B-, etc.) will be determined only after the final exam.

**Course web site:** <http://www.math.buffalo.edu/~apeleg/mth645.html>

This web site will be updated with announcements, homework assignments and other useful resources. It is highly recommended that you visit the web site on a regular basis.

**Maple:** Maple is a symbolic mathematics software package that we will use a few times to solve equations and graph solutions. The Maple software is on all CIT public computers on campus. You can also buy a student version of Maple for your own computer at UBMicro. An introduction to Maple and examples of the use of Maple in solving ordinary differential equations are available on the following web site: <http://www.math.buffalo.edu/306/index.php>.

**Attendance:** Students are expected to attend every scheduled class. All students attending the class must be registered for the class.

**Make-up exams: there will be no make-up exams.** If due to severe circumstances beyond your control (car accident, illness, etc.), you will not be able to take the exam, please call me immediately (before the exam) and let me know your situation. If you have really good reason and can present convincing documentation as to why you are not able to take the exam, your final grade will be calculated without taking into account that particular exam.

**Academic Integrity:** Students are expected to behave in accordance with the university policy on Academic Integrity. The guiding principle of academic integrity is that a student's submitted work must be the student's own. Cheating and plagiarism will result in formal charges.

**Incomplete:** A grade of incomplete (I) will be assigned only under extraordinary circumstances, which are beyond the student's control (like a non-elective surgery during the last week of class).

**Students with disabilities:** If you have a diagnosed disability (physical, learning or psychological), which will make it difficult for you to carry out the coursework as outlined, or requires accommodations such as recruiting note takers, readers, or extended time on exams and/or assignments, please advise me during the first two weeks of the course, so that we may review possible arrangements.

**Studying strategy:** Please note that this course turns out to be difficult. Below are some tips on how to do well in the course.

- (1) Review background material at the beginning of the semester.
- (2) Study regularly throughout the semester.
- (3) Read each topic in the book before class.
- (4) Review the theory afterwards using your notes and the book.
- (5) Do the homework regularly.
- (6) Seek help from me when you don't understand something.

**Some important dates:**

Mon Sep 1: No class (Labor Day).

Fri Sep 5: (a) Last day to add/drop the course (no record will appear on your transcript if you drop the course). (b) Last day to file "Petition to make up an Incomplete" with the Math Department.

Fri Nov 7: Last day to resign from the course (an "R" will appear on your transcript).

Wed Nov 26 through Sun Nov 30: no class (Fall Recess).

Fri Dec 5: Last MTH645 class.