Syllabus and grading policy for Math 6308-A, Spring 2014

Differential equations has been a basic modeling tool for 300 years. It is the preferred modeling method for many problems (e.g. motion of mechanical systems, electrical currents in circuits, etc.) Hence, there are a variety of questions and tools that have been developed.

We will try to review these methods and accommodate different interests. *It is important that you give as much feedback as possible.* The first two weeks will be devoted to get people of different backgrounds on an even keel.

Textbooks

The official textbook for the class is C. Chicone, Ordinary differential equations, Springer (available from the library).

There are also a set of notes by S.N. Chow, J. Hale, Y. Yi which will be made available to the students.

Chapters of other books or notes by the instructor will be made available as needed. (notably we have posted some notes on computational methods)

Tentative syllabus

In the previous semester, we have covered (at the level of the above mentioned set of notes).

0) Examples and motivations, background in multivariable calculus, real analysis, manifolds.

1) The functional analysis point of view: Existence, uniqueness, continuation, smooth dependence on parameters.

2) Applications to numerical analysis (depending on interests)

3) Systems of linear equations, homogeneous, non-homogeneous.

4) Stability of equilibria.

5) Time dependent linear equations. Floquet theory.

6) Fixed points, Hartman-Grobman theorem, Invariant manifolds.

7) Existence of symbolic dynamics.

In this semester, we will continue covering topics more or less at the level of the notes. We hope to have input from the students on topics to cover. **Give as much feedback as possible**

1) Bifurcations

2) Perturbations of invariant manifolds, Melnikov theory.

3) Invariant curves and limit cycles.

4) Mappings of the circle

5) Rotations of the circle and on the torus

6) Averaging theory. Invariant measures.

7) Anosov systems and structural stability.

Workload

• We will assign homework . It is important to do it because you cannot learn mathematics without doing things. It will not be graded.

• Students are supposed to prepare a report on a topic of interest to them that can be negotiated with the instructor. The main goal is that this is useful. It should entail at least 20 hours of reading and preparation. It could be either theoretical or numerical explorations. It could be done in groups of two people, but there should be an statement that both had shared evenly the work.

A one page proposal is due before February 28.

The report should be handed before the last day of classes.

The instructor will have regular office hours M, W, 11:00-12:00. Other appointments can be made. (it is better to do them orally meeting after class than by e-mail). Since there are people with different background and interests, feedback is extremely important.

• Besides the class, there are regular seminars involving the problems discussed both in the school of Mathematics and in the school of Physics. You are encouraged to attend them. Specially the CDSNS Colloquium and the Dynamical Systems Working Seminar Wed. Also there are several seminars in the Physics Department. Follow the calendar.