School of Mathematics

Course 216 — Ordinary Differential Equations 2006-07
(SF Mathematics & TP)

Lecturer: Dr. John Stalker

Requirements/prerequisites:

Duration: 11 weeks.

Number of lectures per week: 3 including tutorials

Assessment:

End-of-year Examination: Annual examination in May/June.

Description:

The course covers introductory material from the theory of ordinary differential equations. There are three main parts of the theory of ODE's:

- finding exact solutions,
- qualitative description of solutions, and
- finding (approximate) numerical solutions.

The course concentrates on the first two.

A much more detailed outline follows. This is preliminary. Please look at `http://www.maths.tcd.ie/~stalker/216` for updates.

- Introduction
  - Terminology
    - Order of an Equation
    - Scalar Equtions vs. Systems
    - Linear vs Nonlinear
  - Invariants
  - Symmetry
- Examples
  - Trigonometric Functions
  - Elliptic Functions
  - Van der Pol's Equation
  - Legendre Equation
  - Bessel's Equation
  - Celestial Mechanics

- The Gronwall Inequality
- Well Posedness
  - Existence
    - Local
    - Global
  - Uniqueness
  - Continuous Dependence on Initial Conditions
  - Stability
- First Order Linear Systems
  - Matrix Viewpoint
  - Existence
  - Uniqueness
  - Homogeneous Equations
  - Inhomogenous Equations
  - Linear Constant Coefficient
  - Method of Undetermined Coefficients
- Stability
  - Definition
  - Stability Criterion for Linear Constant Coefficient Systems
  - Autonomous Systems
  - Lyapunov's Method

Textbooks: The course will roughly follow the book The Qualitative Theory of Ordinary Differential Equations, an Introduction by Fred Brauer and John A. Nohel. Buying the book is not strictly required, but it would be agood idea.

September 25, 2006