Ordinary Differential Equations 1 & 2

(Modules F1.3YT2 and F1.3YU3)

Lecturer - Robert Weston CM T27

Aims of Course

The course aims to give an understanding of linear and nonlinear ordinary differential equations and systems of equations and to show how ordinary differential equations are important in mathematical modelling.

Assessment

This is a two module course which runs through the second and third terms with a single 3 hour exam at the end of third term. The overall mark for the course is made up of 15% from continuous assessment and 85% from the final exam. The continuous assessment element will consist of two class tests in term two and one in term three. Details will follow later.

Students failing the course may attempt a resit examination in Aug./Sep. 2008. The assessment in this resit will be based completely on a three hour paper. The resit provides the opportunity for students to gain extra credits towards their degree but the mark scored will not be used for the eventual classification of the Honours Degree.

Students may, as of right, leave the class after the first module by taking a shorter exam at the end of second term. However, they must contact their head of department not later than the eighth week of term 2 to arrange this, and cannot then continue with the rest of the class or stay on the Honours course.

Lectures will take place for the first 9 weeks of term 2 and the first 5 weeks of term 3. A class test will be held in week 10 of term 2 and revision sessions will be held after the end of lectures in term 3.

Calculators in examinations: Students must supply their own calculators in university examinations and only the following calculators may be used in mathematics examinations

Casio fx-85WA Casio fx-85MS (available in campus shop)

Thus you will not be allowed to use a calculator with graphics or text-retrieval facilities in the examination.

Syllabus

Introduction to differential equations: Revision of first order equations, exact equations, existence and uniqueness of solutions, direction fields, exactly solvable second order equations.

Linear systems of ODEs: Fundamental sets of solutions, equations with constant coefficients, Wronskians, inhomogeneous equations, variations of parameters, solution of linear systems by matrix methods.

Laplace transforms: Calculation of transforms, solution of linear equations and systems, inverse transforms, equations with discontinuous or impulsive forcing terms, convolutions.

Boundary value problems: Existence and uniqueness of solutions, Green's functions

Sturm Liouville problems: Eigenvalues and eigenfunctions, orthogonality of eigenfunctions, eigenfunction expansions.

Phase Planes: Equilibrium points, phase planes for nonlinear second order equations, the pendulum equation, phase planes for linear systems, classification of equilibrium points, stability.

Nonlinear systems: Connections between phase planes for linear and nonlinear systems, application to predator-prey and competing species systems, Lyapunov functions.

Website

More information about the modules can be found at

http://www.ma.hw.ac.uk/~robertw/F13YT2/

Useful textbooks

W E Boyce and R C DiPrima, *Elementary Differential Equations and Boundary Value Problems,* John Wiley.

J C Robinson, *An Introduction to Ordinary Differential Equations*, Cambridge Univ. Press