MA304 Course Outline Fall 2002

Title: Differential Equations for Engineering and the Sciences
Prerequisite: MA265 and MA266
Texts:
1. Elementary Differential Equations and Boundary Value Problems, Boyce and Diprima, John Wiley and Sons, 7th Edition
2. Ordinary Differential Equations using MATLAB, Polking and Arnold, Prentice Hall, 2nd Edition

MA304 is an elective course for mathematically oriented students in engineering and science. The students are predominantly juniors in their fifth semester. MA304 covers systems of first order linear and nonlinear equations, series solutions and partial differential equations. MATLAB is used for plotting and linear algebra.

The prerequisiste, MA265 and MA266, presently covers linear equations, a partial treatment of first order systems. Part of the goal of MA304 is to complete these topics with a minimum of overlap. See comments for added detals, and a list of suggested assignments below.

Outline

Chapter and Sections	Topics	Hours
5.1-5.5	series solutions	7
7.3-7.9	linear systems of ODEs	9
9.1-9.5	nonlinear systems of ODEs	7
10.1-10.8	PDEs and Fourier series	12
8.1-8.3	numerical methods	4

Comments

(1) The outline leaves 5 hours for tests and review.
(2) Most of the students will have seen MATLAB in their Freshman Engineering Tools Course. Each MATLAB assignment should take 1-1 1/2 weeks to complete.
(3) In Chapter 5, primary emphasis is to deal with ordinary points.
(4) In Chapter 7, have your students use pplane5 to plot trajectories for 2×2 systems. This software is loaded into the MATLAB file in the labs.
(5) In Chapter 9, focus on nonlinear equilibrium point identification and local analysis.
(6) One idea is to teach Chapter 10 right after Chapter 5 so that PDE section is not short-shrifted.
(7) In Chapter 8, give an overview of the Euler, Improved Euler and Runge-Kutta methods emphasizing their mathematical basis. Use the Taylor series idea to develop numerical solvers.