MA304 Course Outline Fall 2004

Title: Differential Equations for Engineering and the Sciences
Prerequisite: MA265 and MA266
Text books:
1. Elementary Differential Equations and Boundary Value Problems, Boyce and DiPrima, John Wiley and Sons, 8th Edition
2. Ordinary Differential Equations using MATLAB, Polking and Arnold, Prentice Hall, 3rd 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, partial differential equations and numerical methods. MATLAB is used for plotting and linear algebra.

The prerequisite, MA265 and MA266, presently covers linear equations and 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 details 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 five hours for tests and review.
(2) There are eight MATLAB assignments. Each MATLAB assignment should take 1-1 1/2 weeks to complete. Most of the students will have seen MATLAB in their Freshman Engineering Tools Course.
(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 the PDE sections are 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.

MA304 Suggested Assigments Fall 2004

Text book assignments

Section	Problems
5.1	3, 5, 7, 13, 17, 21, 22, 23
5.2	1, 2, 5, 8, 9
5.3	1, 6, 7, 10
5.4	2, 4, 5, 6, 14
5.5	1, 2, 3, 4, 5, 6, 7, 8, 13, 14
7.3	6, 12, 14, 15, 17, 19, 20, 22
7.5	1, 3, 5, 13
7.6	3, 6, 9, 18
7.7	2, 6
7.8	1, 3, 6, 7
7.9	1, 3, 5, 7
9.1	3, 4, 5, 6
9.2	5, 6, 7, 8
9.3	5, 6, 7, 8
9.4	1, 8
9.5	1, 3
10.1	1, 7, 14, 15, 16, 17
10.2	9, 10, 14, 18
10.3	1, 6, 8, 9
10.4	10, 11, 15, 17, 18
10.5	1, 4, 5, 7, 9, 12, 17, 18, 19
10.6	1, 2, 9, 10
10.7	1(a)(b), 5(a)(b)
10.8	1(a)(b), 2, 5
8.1	1(a)
8.2	1(a)
8.3	1(a)

MATLAB assignments

Assignments	Related Chapter
1, 2, 3	Introductory
4	Chapter 7
5	Chapter 9
6, 7	Chapter 10
8	Chapter 8