MA 222 - Differential Equations and Matrix Algebra II
Final Exam Study Guide, Winter 2003-04

Date of Final Exam: Monday, Feb 23 at 8:00AM

Format of Final Exam: The final exam will consist of two parts. The first part will be "by-hand" (paper, pencil and Laplace transform table only). The Laplace transform table will be provided. No computing devices (calculators/computers) will be allowed during the first part of the final exam. This part of the exam will cover both computational fundamentals as well as some conceptual interpretation, though the level of difficulty and depth of conceptual interpretation will take into account that this part of the exam will be shorter than the second part of the exam. The laptop, starting with a blank Maple work sheet, and a calculator, may be used during the second part of the exam. No "cheat sheets", prepared Maple worksheets or prepared programs on the calculator may be used. The exam is *not* open hard-drive. The second part of the exam will cover all skills: concepts, calculation, modeling, problem solving, interpretation.

Study Guide for Part I

- Converting higher order ordinary differential equations to first order systems.
- Structure of solutions of differential equations $x' = Ax$.
- Solving 2x2 homogeneous first order systems $x' = Ax$ as well as 2x2 nonhomogeneous systems $x' = Ax + b$ with constant forcing function b.
- Eigenvalue and eigenvector methods of solution.
- Finding and determining stability of critical points of linear and nonlinear systems of differential equations, as well as sketching phase portraits.
- Using the definition of the Laplace transform to determine the Laplace transform of a function.
- Finding Laplace and inverse Laplace transforms using the table.
- Solving a differential equation using Laplace transforms.
- Convolution, Heaviside function, Dirac delta function, and transfer functions.
- Finding coefficients for Fourier series, Fourier Sine series, and Fourier Cosine series.
- Sketching odd and even periodic extensions of a function defined on an interval, using the average value condition.

Study Guide for Part II

In addition to the topics listed in Part I,

- Applications of systems of differential equations (including tank, spring-mass, predator–prey, and competing species problems).
- Compute the Fourier series for a function and then determine number of terms needed to keep error below a given tolerance.