Exam 1 Info

Date: March 3rd, 2016

Location: Normal classroom (TIL-258, Livingston Campus)

Time: In-class (8:40-10:00 am)

Notes:

1. You will be provided with a table of standard Laplace transforms, which is now on the website.
2. Calculators are **prohibited**. All calculations will be able to be completed by hand.
3. I will hold extra office hours on Wednesday evening. I plan to be in my office from 3-6 pm (Hill 216).

Suggestions:

1. Read over covered sections in the textbook, as well as notes from class.
2. Understand all assigned homework questions.
3. Solve other (unassigned) homework questions from the same section of the textbook.

Material:
All material up to and including what was covered on Thursday's (February 25th) course is fair-game for the exam. Roughly speaking, this is all Laplace Transform material, as well as Linear Algebra up to Section 8.8 (but excluding 8.7). You should also be familiar with the terminology from Section 7.6. Some key topics to review are given below. But be aware: this list is **not** exhaustive, and anything covered could appear on the exam. See the Course Calendar on the website for a complete schedule of the material covered.

Laplace Transform

(a) Definition of Laplace Transform. Be able to calculate for some basic functions from the definition.

(b) Inverse Laplace Transform. For all types of functions studied, you should be able to move from $F(s)$ to $f(t)$ (and the forward direction of course).

(c) Laplace Transform of derivatives. Especially in regards to solving first and second order ODEs.

(d) First and second translation theorems. Know how modulation by exponentials and translations related, for both $f(t)$ and $F(s)$.

(e) Piecewise functions. Know how to write a piecewise function as a linear combination of Heaviside functions $\mathcal{U}(t-a)$.

(f) Multiplication by powers of t and its effect on the Laplace Transform ($\mathcal{L}(t^n f(t))$).

(g) Convolutions. Both what they are, and how to take their Laplace Transform.

(h) Laplace Transform of an integral.

(i) Using the convolution theorem to solve **integral equations.**

(j) Dirac delta function and its Laplace Transform. Especially as a forcing term for ODEs.

(k) Using Laplace Transforms to solve simple (linear, constant coefficient) systems of ODEs.

(l) Be very comfortable with the Laplace table. You should be able to quickly identify the correct entry to use for each Laplace/inverse Laplace question.

Linear Algebra

(a) Basic vector space terminology introduced in Section 7.6.

(b) Basic matrix notation and properties: addition, (scalar and matrix) multiplication, transpose, etc.

(c) Types of matrices: diagonal, triangular, symmetric, identity, etc.

(d) Solving systems of linear equations, using augmented matrix form. Know about the number of solutions, free variables (parameters), etc. **This is very important, and used in most of this chapter, so really have it down.** Going from augmented matrix to a parameterized set of solutions. Equivalence of systems of linear equations and matrix vector equation ($A\vec{x} = \vec{b}$). Also, reduced row-echelon form.

(e) Row space, column space, and rank. How to use row operations to find a basis for the row space and the rank of a matrix.

(f) Determinants. Their calculation via a cofactor expansion and through row operations to a triangular matrix.

(g) Properties of determinants, such as the statement related to invertibility (nonzero determinant $\Leftrightarrow$ invertible). Also, how to compute the determinant of a product.

(h) Matrix inversion. Both ways of finding inverse: adjoint method and row reduction method. Equivalency between invertibility of number of solutions of corresponding homogeneous system of equations ($A\vec{x} = \vec{0}$).

(i) Eigenvalues and eigenvectors. Their defining equation, as well as the method for calculating them (characteristic equation and then augmented matrix). Finding complex eigenvalues/eigenvectors, and the relation between the eigenvalues of a matrix and its invertibility. Also, the be able to immediately (i.e. no work) calculate the eigenvalues of a triangular matrix.