MATH 348 - Advanced Engineering Mathematics April 22, 2008

Final Exam Review Sheet, Spring 2008

The final exam will be held on May 3rd from 10:15am-12:15am in the CTLM room 102. There will be no notecards or calculators. The exam will consist of 10 questions. Two of these questions will be from previous material. One of these two questions will concern Fourier series representations of periodic functions while the other will have you solve a wave equation on a bounded domain in the presence of frictional forces. The remaining questions will be devoted to linear algebra and none of these questions will directly test your conceptual understanding of linear algebra. The following is a list of important topics, which you should use to guide your review for the final exam.

1. **Chapter 7 - Linear Systems, Determinants, Row Reduction, Vector Spaces**

   7.1 Matrices, Vectors: Addition and Scalar Multiplication From this section the student should understand:

   - The definition of matrices, vectors and scalars.
   - The definition of matrix addition and scalar-matrix multiplication.

   From this section the student should be able to:

   - Determine the coefficient matrix associated with a linear system of equations.
   - Add and subtract matrices and vectors.
   - Multiply matrices and vectors by scalars.

   7.2 Matrix Multiplication:
   From this section the student should understand:

   - The definition of matrix multiplication.
   - The matrix vector representation of linear system of equations.

   From this section the student should be able to:

   - Multiply matrices.
   - Form the matrix vector representation of linear systems of equations.

   7.3 Gauss Elimination:
   From this section the student should understand:

   - The augmented matrix representation of a linear systems of equations.
   - The rules of row-reduction.
   - The algorithm of Gaussian elimination.

   From this section the student should be able to:

   - Write down augmented matrices associated with linear systems of equations.
   - Solve linear systems through row-reduction.
   - Determine inverse matrices through row-reduction.

   7.4 Rank of a Matrix, Vector Space:
   From this section the student should understand:

   - The definition of linear combination.
   - The definition of Column Space, Row Space and Null Space of a matrix.
   - The rank of a matrix.

   From this section the student should be able to:

   - Compute the basis and dimension of the column space, row space and null space of a matrix.
   - Compute the rank of a matrix via row-reduction.

   7.5 Solutions of Linear Systems:
   From this section the student should understand:

   - The three possible general solutions to a linear system of equations.

   From this section the student should be able to:

- Compute the type of general solution to a linear system via row-reduction.

7.7 Determinants.
From this section the student should understand:
- The definition of determinants by cofactor expansion.
- The interpretation of determinant in terms of matrix inverse existence.

From this section the student should be able to:
- Compute the determinant of a matrix.

7.8 Inverse of a Matrix and Gauss-Jordan Elimination:
From this section the student should understand:
- Computation of inverses via row reduction.

From this section the student should be able to:
- Compute inverses via row reduction.

2. **Chapter 8 - Eigenvalues, Eigenvectors and Diagonalization**

8.1 Eigenvalues, Eigenvectors.
From this section the student should understand:
- The eigenvalue, eigenvector equation and the two auxiliary equations used to derive its solutions.

From this section the student should be able to:
- Compute eigenvalues and eigenvectors of square matrices.

8.4 Eigenbasis and Diagonalization
From this section the student should understand:
- The eigenbasis of a matrix.
- Geometric and Algebraic multiplicity.
- Eigenbasis and their connection to diagonalization.

From this section the student should be able to:
- Compute the eigenbasis of a matrix.
- Compute the geometric and algebraic multiplicity of an eigenvalue.
- Using the eigenbasis compute the diagonalization of a matrix.