MATH 348 - Advanced Engineering Mathematics September 23, 2009
Exam I Review Sheet

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.
- When a matrix can be orthogonally diagonalized.

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.
- Using the normalized eigenbasis compute the orthogonal diagonalization of a self-adjoint matrix.