Department: MATHEMATICAL SCIENCES Semester Hours: 4

Course Title and Number: MATH 240 - LINEAR ALGEBRA AND APPLICATIONS

Course Description: Matrix algebra and solutions of systems of linear equations, row reduction, matrix inversion, determinants. Vector spaces, linear dependence, basis and dimension, subspaces. Inner products, Gram-Schmidt process. Linear transformations, matrices of linear transformations. Eigenvalues and eigenvectors. Applications. Constructing and writing Mathematical proofs. Applications. A transition between beginning calculus courses and upper level mathematics courses.

PRQ: MATH 232.

Course Objectives:

- To understand and connect concepts of linear algebra with real world problems and other scientific disciplines.
- To value mathematics and develop an ability to communicate mathematics, both in writing and orally.
- To develop an appreciation of necessity of formal proofs, and their construction.
- To further develop mathematical reasoning, and to develop an ability to do proofs.
- To obtain facility in the use of linear algebra techniques.
- To provide a smooth transition between beginning calculus courses and upper division courses in mathematics.

Content:

- Solutions to systems of linear equations. The use of augmented matrices. Row operations, row-echelon and reduced row-echelon forms of matrices.
- Matrix algebra and inversion.
- The development and properties of the determinant function.
- Introduction to the theory of general (abstract) vector spaces with an emphasis on finite dimensional vector spaces. Subspaces, linear independence, basis and dimension.
- Linear transformations and matrix representations of linear transformations of finite dimensional vector spaces. The range, kernel and rank of a linear transformation.
- Introduction to abstract inner product spaces and their associated norm and distance functions. Investigation of orthogonality. The Gram-Schmidt process.
- Eigenvalues, eigenvectors and eigenspaces of a linear operator. Diagonalization and orthogonal diagonalization.

Course requirements: Written explanation of problem solutions and writing involving concepts. Discussion and presentation involving the construction of elementary proofs and problem solutions in class settings. Competency in the computational aspects of the course. Discussion involving the movement from the concrete to the abstract in mathematics.

Assessment Instruments: Judgment on student involvement and depth of contributions in class discussions and presentations. Computational facility on quizzes. Homework proof writing and problem solving. Short quizzes. Hour examinations. Final examination.

Current textbook:
Bernard Kolman and David R.Hill, **Elementary Linear Algebra**, 9th Edition, Prentice Hall, Upper Saddle River, New Jersey, (2008).