MATH 418 Modeling with Linear Algebra

Course objectives:
The course has two objectives:
(1) Students should learn the basic theory of vector spaces, inner product spaces, linear transformations, and matrix theory.
(2) Students should apply this theory to real-world applied problems. Students should come to the realization that linear algebra is an indispensable tool for solving problems in applied mathematics.

Usual course content:
The course consists of two major components: the theory of linear algebra and applications of that theory. We begin with the theory of general vector spaces, subspaces, linear independence and dependence, basis and dimension, rank and nullity. We move on to inner product spaces, orthonormal bases, least squares, eigenvalues and eigenvectors, matrix diagonalization, and linear transformations. Using this theory, we solve applied problems in the areas of computer graphics, equilibrium temperature distributions, cryptography, forest management, computed tomography, genetics, age-specific population growth, and harvesting of animal populations.

Technology:
Although a course in computer programming is not listed as a prerequisite for MATH 418, students are expected to use either a computer or programmable calculator to write numerical algorithms, in the programming language of their choice, for some of the homework assignments.

Students who may benefit:
Any undergraduate student or beginning graduate student interested in applied mathematics should find MATH 418 interesting. The course typically attracts undergraduate and graduate students in mathematics, computer science, physics, chemistry, and economics.

Follow up courses:
The highest linear algebra requirement for the following courses is only MATH 122 Elementary Linear Algebra. However, MATH 418 Modeling with Linear Algebra will enhance the student's appreciation for the content of MATH 436 Introduction to Numerical Analysis and MATH 461 Linear Regression Analysis.