Prefix, Number and Name of Course: MAT 404  Applications of Linear Algebra

Credit Hours: 3
In Class Instructional Hours: 3  Labs: 0  Field Work: 0

Catalog Description:
Prerequisites: MAT 202, MAT 263 and MAT 264
Selected applications of linear algebra to diverse fields such as biology, economics and ecology, as well as to other areas of mathematics including curve fitting, geometry and numerical analysis. Theory of eigenvalues/eigenvectors developed and applied to areas such as genetics, population growth, demography, conic sections, differential equations and recursive sequences.

Reasons for Revision:

The newly proposed course MAT 390, Operations Research, incorporates and expands on some of the topics of the “old” MAT 404. This revision addresses and updates current work in other key applications of linear algebra. The course continues to serve the following purposes for our program:

1. To provide a continuation of MAT 202 so that the student has an opportunity to work with some of the many concrete applications of linear algebra
2. To offer the student a deeper and more comprehensive understanding of linear algebra
3. To enable the student to further develop skills, mathematical insights, and approximation techniques with graphing calculators and computer algebra systems.

Student Learning Outcomes:

<table>
<thead>
<tr>
<th>Students will:</th>
<th>Course Content References:</th>
<th>Assessment:</th>
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</thead>
<tbody>
<tr>
<td>1. solve eigenvalue problems by hand and (for larger problems) by use of current technology.</td>
<td>II</td>
<td>1. Individual homework assignments, projects, exams.</td>
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<tr>
<td>2. apply linear algebra to formulating and solving problems in diverse real-life fields.</td>
<td>I, III</td>
<td>2. Group work in class, individual homework assignments, projects, exams.</td>
</tr>
<tr>
<td>3. apply linear algebra to solving problems in other fields of mathematics.</td>
<td>I, III</td>
<td>3. Group work in class, individual homework assignments, projects, exams.</td>
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Course Content:

I. Selected Applications in Linear Algebra
   A. Equations through specified points
   B. Markov chains
   C. Polygonal areas
   D. Least squares fitting to data
   E. Geometry of linear operators
   F. Cubic spline interpolation
   G. Graph theory
   H. Leontief economic models
   I. Forest management
   J. Computer graphics
   K. Cryptography

II. Eigenvalues/Eigenvectors
   A. Computing eigenvalues and eigenvectors
   B. Diagonalizing matrices
   C. Triangularizing matrices
   D. Orthogonal Diagonalization
   E. Scaled power method

III. Selected Applications of Eigenvalues/Eigenvectors
   A. Conic sections, quadric surfaces
   B. Genetics
   C. Age-specific population growth
   D. Harvesting animal populations
   E. Recursive sequences
   F. Linear systems of first-order differential equations

Resources

Classic Scholarship in the Field:

MD: The Johns Hopkins University Press
Hall
NJ: Prentice Hall
PWS Publishing
Jovanovich
Tucker, A. (1988). A Unified Introduction to Linear Algebra: Models, Methods and 
Theory. New York: Macmillan
and Bartlett

Current Scholarship in the Field:

Prentice-Hall
Brooks/Cole
River, NJ: Prentice Hall

Periodicals:

College Mathematics Journal
The American Mathematical Monthly
Mathematics Magazine
The Journal of Undergraduate Mathematics and Its Applications (COMAP)
Electronic and/or Audiovisual Resources:


Linear Algebra toolkit for students: http://www.math.odu.edu/~bogacki/cgi-bin/lat.cgi