JEFFERSON COLLEGE

COURSE SYLLABUS

MTH172
LINEAR ALGEBRA

3 Credit Hours

Prepared by: Imran Shah
Date: November 2012

Ms. Shirley Davenport, Dean, Arts & Science Education
Ms. Linda Abernathy, Division Chair, Math, Science, and Business
MTH 172: Linear Algebra

I. CATALOGUE DESCRIPTION

A. Prerequisite: MTH134/134H with a “C” or better, MTH141
   Pre-calculus with a “C” or better, COMPASS college algebra score of at least
   46 within the past two years, COMPASS trigonometry score of at least 31
   within the past two years, or ACT math score of 25 or higher within the past
   two years and reading proficiency

B. 3 Credit hours

C. Linear Algebra is concerned with the study of matrices, vectors, vector spaces,
   linear transformations, Eigenvalues and Eigenvectors. Properties of the matrix
   and matrix operations are studied to develop it as a means to solve mathematical
   problems from a linear algebra point of view. The course also covers the matrix as
   an application to solve problems that arise in other disciplines including physics,
   chemistry, natural sciences, and social sciences. (F)

II. EXPECTED LEARNING OUTCOMES WITH ASSESSMENT MEASURES

<table>
<thead>
<tr>
<th>Expected Learning Outcomes</th>
<th>Assessment Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students will compare and contrast solving problems with linear and nonlinear Algebra</td>
<td>Homework assignments/class presentation</td>
</tr>
<tr>
<td>methods in terms of the speed of obtaining a solution.</td>
<td>Quizzes</td>
</tr>
<tr>
<td></td>
<td>Final exam</td>
</tr>
<tr>
<td>Students will develop tools to do algebraic manipulations needed in the</td>
<td>Homework assignments</td>
</tr>
<tr>
<td>calculus sequence, using linear algebra.</td>
<td>Class discussion</td>
</tr>
<tr>
<td></td>
<td>Quizzes</td>
</tr>
<tr>
<td></td>
<td>Final exam</td>
</tr>
<tr>
<td>Students will justify the purpose of learning linear algebra solving tools to handle the</td>
<td>Homework assignments/class presentation</td>
</tr>
<tr>
<td>algebra that lies behind basic calculus-related problems.</td>
<td>Class discussion</td>
</tr>
<tr>
<td>Students will express vectors as columns of numbers in a matrix and conceptualize the</td>
<td>Homework assignments</td>
</tr>
<tr>
<td>vector spaces of any dimension without a visible geometric structure.</td>
<td>Quizzes</td>
</tr>
<tr>
<td></td>
<td>Final exam</td>
</tr>
<tr>
<td>Students will apply the basis theory to translate a difficult mathematical problem into</td>
<td>Homework assignments</td>
</tr>
<tr>
<td>an easier one and translate the result back into the traditional context.</td>
<td>Quizzes</td>
</tr>
<tr>
<td></td>
<td>Final exam</td>
</tr>
<tr>
<td>Students will apply the theory of eigenvalues and eigenvectors with matrix theory on</td>
<td>Homework assignments</td>
</tr>
<tr>
<td>problems related to math, as well as other disciplines.</td>
<td>Quizzes</td>
</tr>
<tr>
<td></td>
<td>Final exam</td>
</tr>
</tbody>
</table>
III. OUTLINE OF TOPICS

A. Linear equations in linear algebra
   1. Systems of linear equations
   2. Row reduction and echelon forms
   3. Vector equations
   4. The matrix equation $Ax = b$
   5. Solution sets of linear systems
   6. Applications of linear systems
   7. Introduction to linear transformations
   8. The matrix of a linear transformation
   9. Linear models in business, science, and engineering

B. Matrix algebra
   1. Matrix operations
   2. The inverse of a matrix
   3. Characteristics of invertible matrices
   4. Partitioned matrices (optional)
   5. Matrix factorizations (optional)
   6. Leontief input-output models
   7. Applications to computer graphics
   8. Subspaces of $\mathbb{R}^n$
   9. Dimension and rank

C. Determinants
   1. Introduction to determinants
   2. Properties of determinants
   3. Cramer’s Rule, volume and linear transformations (optional)

D. Vector spaces
   1. Vector spaces and subspaces
   2. Null spaces, column spaces, and linear transformations
   3. Linear independent sets, bases
   4. Coordinate systems
   5. The dimension of a vector space
   6. Rank
   7. Change of basis
   8. Applications to different equations (optional)
   9. Application to Markov Chains

E. Eigenvalues and Eigenvectors
   1. Eigenvalues and Eigenvectors
   2. The characteristic equation
   3. Diagonalization
   4. Eigenvectors and linear transformations
5. Complex Eigenvalues
6. Discrete dynamical systems, Leslie Matrices (optional)

F. Orthogonality and least squares
1. Dot product, length, orthogonality of vectors
2. Orthogonal sets
3. Orthogonal projections (optional, not needed for transfer)
4. Gram Schmidt Process (optional, not needed for transfer)
5. Least squares problems (optional, not needed for transfer)

IV. METHOD OF INSTRUCTION

Lecture

V. REQUIRED TEXTBOOK


VI. REQUIRED MATERIALS

Graphing calculator (TI 83/84)

VII. SUPPLEMENTAL REFERENCES

None

VIII. METHODS OF EVALUATION

A. Homework assignments, 40%

B. Quizzes, 30%

C. Final exam (comprehensive), 30%

IX. ADA AA STATEMENT

Any student requiring special accommodations should inform the instructor and the Coordinator of Disability Support Services (Library; phone 636-481-3169).

X. ACADEMIC HONESTY STATEMENT

All students are responsible for complying with campus policies as stated in the Student Handbook (see College Website, [http://www.jeffco.edu/jeffco/index.php?option=com_weblinks&catid=26&Itemid=84](http://www.jeffco.edu/jeffco/index.php?option=com_weblinks&catid=26&Itemid=84)).