PELLISSIPPI STATE TECHNICAL COMMUNITY COLLEGE
MASTER SYLLABUS

MATRIX ALGEBRA
MATH 2010 (formerly MTH 2510)

Class Hours: 3.0  Credit Hours: 3.0
Laboratory Hours: 1.0  Revised: Spring 07

Catalog Course Description:
Topics include solutions of systems of linear equations and Euclidean vector operations. Concepts of linear independence, basis and dimension, rank and nullity are defined and illustrated. Additional topics include eigensystems and general linear transformations. A computer laboratory component is required.

Entry Level Standards: None

Prerequisite: MATH 1920

Textbook(s) and Other Reference Materials Basic to the Course:

Textbook:

References:

Personal Equipment:
A calculator with matrix capabilities.

I. Week/Unit/Topic Basis:
Included in the topics listed below are laboratory problems to be completed individually or in groups using the computer aided algebraic system.

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Systems of Linear Equations. Gaussian Elimination. Matrices and Matrix Operations. Laboratory #1, Introduction to computer algebra system. Matrix operations.</td>
</tr>
</tbody>
</table>
6 Real Vector Spaces. Subspaces. Linear Independence. Laboratory #5, Linear Dependence and Independence.

7 Basis and Dimension. Row Space, Column space, and Nullspace.


10 Applications of Eigenvalues and Eigenvectors. Laboratory #7, Eigenvalue Applications. Test 4.

11 General Linear Transformations. Kernel and Range.


13 Best Approximation; Least Squares. Laboratory #8, Least Squares Fitting to Data.

14 Iterative Solution of Large Scale Linear Systems. Laboratory #9, Gauss-Seidel Methods.

15 Final Exam.

II. Course Objectives*:

A. Analyze the major aspects of linear systems. VI.1-5

B. Determine if a system of equations has a unique solution, no solution, or multiple solutions. VI.1-5

C. Calculate the solutions of a consistent linear system of equations. VI.1-5

D. Perform geometry in two-space and three-space. VI.1-5

E. Determine linear independence or dependence of a set of vectors. VI.1-5

F. Form bases and determine dimension of linear spaces and subspaces. VI.1-5

G. Describe the major aspects of inner-product spaces and the Gram-Schmidt process. VI.1-5

H. Consider basic properties and applications of eigenvalues and eigenvectors. VI.1-5

I. Determine a complete set of eigenvectors and eigenvalues for a linear space. VI.1-5

*Roman numerals after course objectives reference TBR’s general education goals.

III. Instructional Processes*:

Students will:

1. Use computer software and/or graphing calculator to solve problems involving matrices and determinants. Technological Literacy Outcome

2. Actively explore real-world problems through labs and/or projects such as least squares fitting to data. Mathematics Outcome, Active Learning Strategy, Transitional Strategy
3. Translate geometry problems in 2- and 3-space into more general vector space problems which can then be solved. *Mathematics Outcome*

4. Learn how to generalize the geometry and vector space language of 2- and 3-space into n-dimensional space. *Mathematics Literacy Outcome*

5. Incorporate written descriptions of the mathematical procedures employed and/or the results attained into computer and/or graphing calculator labs. *Communication Outcome*

*Strategies and outcomes listed after instructional processes reference TBR's goals for strengthening general education knowledge and skills, connecting coursework to experiences beyond the classroom, and encouraging students to take active and responsible roles in the educational process.

### IV. Expectations for Student Performance*

Upon successful completion of this course, the student should be able to:

1. Use Gaussian elimination to solve a linear system. *C*

2. Use echelon or row reduction to find the rank of a linear system. *A, B, C*

3. Use an advanced calculator and/or a computer algebraic system to perform matrix operations. *B, C, E*

4. Use row reduction to find the value of a determinant. *B, C*

5. Use geometric vectors in 2-space and 3-space to find angles, lengths, lines, planes and projections. *D*

6. Use inner products to find orthogonal bases. *E, F*

7. Change the basis of a linear system. *E*

8. Compute eigenvalues and eigenvectors. *H*

9. Compute the dimensions of the kernel and range of a linear transformation. *E*

10. Use similar matrices to diagonalize a matrix. *A*

11. Use numerical methods to find a least-squares fit to data. *A*

12. Use numerical methods to solve large linear systems. *A*

*Letters after performance expectations reference the course objectives listed above.

### V. Evaluation:

**A. Testing Procedures:**

Students are evaluated primarily on the basis of tests, laboratories, quizzes, homework and the comprehensive final exam. Six tests are shown in the weekly schedule above. A minimum of five tests is recommended.

**B. Laboratory Expectations:**

Laboratory experiments/projects will be directly related to specific academic activities and will reflect the theoretical concepts of the course. The design of the laboratory work can be in the form of major projects (a minimum of four is recommended) or shorter weekly "experiments" accompanied by lab
C. Field Work: None

D. Other Evaluation Methods: None

E. Grading Scale:

<table>
<thead>
<tr>
<th>Score Range</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>93 - 100</td>
<td>A</td>
</tr>
<tr>
<td>88 - 92</td>
<td>B+</td>
</tr>
<tr>
<td>83 - 87</td>
<td>B</td>
</tr>
<tr>
<td>78 - 82</td>
<td>C+</td>
</tr>
<tr>
<td>70 - 77</td>
<td>C</td>
</tr>
<tr>
<td>60 - 69</td>
<td>D</td>
</tr>
<tr>
<td>Below 60</td>
<td>F</td>
</tr>
</tbody>
</table>

VI. Policies:

A. Attendance Policy:

Pellissippi State Technical Community College expects students to attend all scheduled instructional activities. As a minimum, students in all courses must be present for at least 75 percent of their scheduled class and laboratory meetings in order to receive credit for the course. Individual departments/programs/disciplines, with the approval of the vice president of Academic and Student Affairs, may have requirements that are more stringent. Excessive absences may lower the final grade.

B. Academic Dishonesty:

Individual instructors must distribute their policies on academic dishonesty and calculator use during the first week of classes. In addition to other possible disciplinary sanctions that may be imposed as a result of academic misconduct, the instructor has the authority to assign either (1) an F or a zero for the assignment or (2) an F for the course.

C. Accommodations for Disabilities:

If you need accommodations because of a disability, if you have emergency medical information to share, or if you need special arrangements in case the building must be evacuated, please inform the instructor immediately. Please see the instructor privately after class or in his/her office. Students must present a current accommodation plan from a staff member in Services for Students with Disabilities (SSWD) in order to receive accommodations in this course. Services for Students with Disabilities may be contacted by going to Goins 127 or 131 or by phone: 694-6751 (Voice/TTY) or 539-7153.

Posted: February 15, 2007