PELLISSIPPI STATE COMMUNITY COLLEGE
MASTER SYLLABUS

MATRIX ALGEBRA
MATH 2010

Class Hours: 3.0 **Credit Hours: 3.0**

Laboratory Hours: 1.0 **Date Revised: Spring 2011**

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:
Anton, Howard, *Elementary Linear Algebra*. (10th ed.) John Wiley & Sons, Inc.
References:
Anton, Howard & Rorres, Chris, *Elementary Linear Algebra Applications Version* (8^{th} edition) John Wiley & Sons, Inc.
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.

Week	Topic
1	Systems of Linear Equations. Gaussian Elimination. Matrices and Matrix Operations. Laboratory #1, Introduction to computer algebra system. .
2	Rules of matrix arithmetic. Inverse of square matrices. Laboratory #2, Matrix solutions of linear systems.
3	Diagonal, triangular and symmetric matrices. Applications of linear systems. LU Factorization. Laboratory #3, Applications.
4	Test 1. Determinants. Evaluation by cofator expansion and row reduction.
5	Determinant properties. Cramer's Rule. Laboratory #4, Working with determinants. Vectors in 2-, 3-, and *n*-space.
6	Norm and vector arithmetic. Dot Product and projections. Orthogonality. Equations of lines and planes. Cross Product. Laboratory #5, Geometry in 2-space and 3-space.

7 Test 2. Real Vector Spaces. Subspaces. Linear Independence.

8 Basis and Dimension. Laboratory #6, Linear dependence and independence. Row Space, Column space, and Nullspace.

9 Rank and nullity. Linear transformations from *n*-space to *m*-space. Test 3.

10 Properties of Linear Transformations. Laboratory #7, Dynamical systems and Markov Chains. Eigenvalues and Eigenvectors. Diagonalization.

11 Inner Products. Angle and Orthogonality in inner product spaces. Orthonormal bases. Laboratory #8, Gram-Schmidt Process.

12 Best Approximation; Least Squares. Laboratory #9 Least squares fitting to data.

13 Orthogonal matrices. Orthogonal diagonalization. Test 4.

14 General Linear Transformations. Kernel and Range. Isomorphisms. Inverse Linear Transformations. Matrices of General Linear Transformations. Similarity. Laboratory #10, Similar Matrices.

15 Final Exam.

II. Course Objectives*:

A. Build the skills to analyze and solve linear systems of equations. VI.1,2,4,5

B. Guide students to understand matrix notation, operations, and properties. VI.1,5,6

C Guide students to understand vectors in 2- and 3-space and their properties. VI.1

D. Guide students to understand and utilize vector spaces. VI.1,4

E. Guide students to understand general linear transformations. VI.1

F. Guide students to understand and utilize inner product spaces. VI.1,2,4

G. Guide students to understand the eigenvalue problem and its applications. VI.1-5

H. Lead students to discover the application of linear algebra. VI.1-5

*Roman numerals after course objectives reference goals of the Mathematics program (Career Program Goals and General Education Goals are listed http://www.pstcc.edu/departments/curriculum_and_instruction/syllabi/)

III. Expected Student Learning Outcomes*:*:

The student should be able to:

1. Use Gaussian and Gauss-Jordan elimination to solve a linear system. A,B

2. Use LU factorization to solve linear systems A,B

3. Perform Matrix Operations. B

4. Determine if a matrix is invertible and if so, find its inverse. B

5. Perform network analysis using linear systems. A,B,H

6. Use row reduction and cofactor expansion to find the value of a determinant. B

7. Find angles between vectors and vector lengths in 2- and 3-space. C

8. Find equations of lines and planes in 2- and 3-space. C

9. Determine the orthogonal projection of a vector onto another vector or plane in 2- and 3-space. C

10. Find norms and distances between vectors in Euclidean *n*-space. B,D.

11. Determine if two vectors are orthogonal in *n*-space. B,D

12. Determine if a subset of a vector space is a subspace. D

13. Determine linear independence or dependence of a set of vectors. C,D

14. Determine if a set of vectors in a vector space span the space. C,D

15. Find bases and determine the dimension of finite-dimensional vector spaces. C,D

16. Find bases for the row, column, and null space of a matrix. D

17. Determine rank and nullity for a matrix. D

18. For a matrix linear transformation, find its standard matrix, domain, and codomain. D,E

19. Find compositions and inverse linear transformations. D,E

20. Understand the geometry of matrix operations on R^3 and R^2. D,E

21. Use matrix methods to analyze dynamical systems and Markov Chains. A,B,C,D,E,H

22. Compute eigenvalues and eigenvectors. B,D,G

23. Use similar matrices to diagonalize a matrix. B,D,G

24. Compute norms and distances in inner product spaces. C,D,F

25. Determine if two vectors are orthogonal in an inner product space. C,D,F

26. Use the Gram-Schmidt Process to find orthonormal bases. C,D,F

27. Use the best approximation method to find a least-squares fit to paired data. A,B,F,H

28. Identify orthogonal matrices. B

29. Find the kernel and range of a general linear transformation. E

30. Determine if a general linear transformation is one-to-one or onto. E

31. Compute compositions and inverses of general linear transformations. E

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

IV. Evaluation:

A. Testing Procedures: 85% of grade

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: 15% of grade

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 reports.

C. Field Work: None

D. Other Evaluation Methods: None

E. Grading Scale:

93	-	100	A
88	-	92	B+
83	-	87	B
78	-	82	C+
70	-	77	C
60	-	69	D
Below 60			F

V. Policies:

A. Attendance Policy:

Pellissippi State expects students to attend all scheduled instructional activities. As a minimum, students in all courses (excluding distance learning 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 the Learning Division, may have requirements that are more stringent. In very specific circumstances, an appeal of the policy may be addressed to the head of the department in which the course was taken. If further action is warranted, the appeal may be addressed to the vice president of the Learning Division.

B. Academic Misconduct:

Academic misconduct committed either directly or indirectly by an individual or group is subject to disciplinary action. Prohibited activities include but are not limited to the following practices:
• Cheating, including but not limited to unauthorized assistance from material, people, or devices when taking a test, quiz, or examination; writing papers or reports; solving problems; or completing academic assignments.
• Plagiarism, including but not limited to paraphrasing, summarizing, or directly quoting published or unpublished work of another person, including online or computerized services, without proper documentation of the original source.
• Purchasing or otherwise obtaining prewritten essays, research papers, or materials prepared by another person or agency that sells term papers or other academic materials to be presented as one's own work.
• Taking an exam for another student.
• Providing others with information and/or answers regarding exams, quizzes, homework or

other classroom assignments unless explicitly authorized by the instructor.

• Any of the above occurring within the Web or distance learning environment.

C. Accommodations for Disabilities:

Students who need accommodations because of a disability, have emergency medical information to share, or need special arrangements in case the building must be evacuated should inform the instructor immediately, privately after class or in her or his 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, 132, 134, 135, 131 or by phone: 539-7153 or TTY 694-6429. More information is available at www.pstcc.edu/departments/swd/.

D. Other Policies

Make-up work: Instructor's discretion about make-up tests and/or assignments.

Cell phones: Cell phones are to be either turned off or put in vibration mode while in class. Instructor discretion as to penalty.