

**PELLISSIPPI STATE COMMUNITY COLLEGE  
MASTER SYLLABUS**

**INTRODUCTION TO LINEAR ALGEBRA  
MATH 2010**

**Class Hours: 3**  
**Laboratory Hours: 0**

**Credit Hours: 3**  
**Revised: Fall 2017**

**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.

**Prerequisite**

MATH 1920

**Textbook(s) and Other Course Materials**

Textbook:

Anton, Howard. *Elementary Linear Algebra*. 11<sup>th</sup> ed. Hoboken: John Wiley & Sons, Inc., 2014. Print.

Personal Equipment:

A calculator with matrix capabilities.

Optional Resource:

Student Solutions Manual for textbook.

**Week/Unit/Topic Basis**

<b>Week</b>	<b>Topic</b>
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|----|---|
| 1. | Systems of Linear Equations. Gaussian Elimination. Matrices and Matrix Operations.                        |
| 2. | Rules of Matrix Arithmetic. Inverse of Square Matrices. Matrix Solutions of Linear Systems.               |
| 3. | Diagonal, Triangular and Symmetric Matrices. LU Factorization. Matrix Transformations.                    |
| 4. | Test 1. Determinants. Evaluation by Cofactor Expansion and Row Reduction.                                 |
| 5. | Determinant Properties. Vectors in 2-, 3-, and $n$ -space.  |
| 6. | Norm and Vector Arithmetic. Dot Product and Projections. Orthogonality.                                   |
| 7. | Test 2. Real Vector Spaces. Subspaces. Linear Independence.   |
| 8. | Coordinates, Basis and Dimension. Row Space, Column Space, and Null space. Rank and Nullity.              |
| 9. | Basic Matrix Transformations in $\mathbb{R}^2$ and $\mathbb{R}^3$ . Properties of Matrix Transformations. |

10. Test 3. Eigenvalues and Eigenvectors. Diagonalization.
11. Inner Products. Angle and Orthogonality in Inner Product Spaces.
12. Orthonormal Bases. Best Approximation; Least Squares.
13. Test 4. Orthogonal Matrices. Orthogonal Diagonalization.
14. General Linear Transformations. Kernel and Range. Isomorphisms. Inverse Linear Transformations. Matrices of General Linear Transformations. Similarity.
15. Final exam.

### Course Goals

NOTE: Roman numerals after course goals reference the General Education Goals of the Mathematics Program.

The course will

- 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  $n$ -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

### Expected Student Learning Outcomes

NOTE: Capital letters after Expect Student Learning Outcomes reference the course goals listed above.

The student will

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. Solve applications 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. Determine the orthogonal projection of a vector onto another vector or plane in 2- and 3-space. C
9. Find norms and distances between vectors in Euclidean  $n$ -space. B, D.
10. Determine if two vectors are orthogonal in  $n$ -space. B, D
11. Determine if a subset of a vector space is a subspace. D
12. Determine whether a set of vectors is linearly independent or dependent. C, D
13. Determine if a set of vectors in a vector space span the space. C, D
14. Find bases and determine the dimension of finite-dimensional vector spaces. C, D
15. Find bases for the row, column, and null space of a matrix. D
16. Determine rank and nullity for a matrix. D
17. For a matrix linear transformation, find its standard matrix, domain, and codomain. D, E
18. Find compositions and inverse linear transformations. D, E
19. Understand the geometry of matrix operations on  $R^3$  and  $R^2$ . D, E

20. Compute eigenvalues and eigenvectors. B, D, G
21. Use similar matrices to diagonalize a matrix. B, D, G
22. Compute norms and distances in inner product spaces. C, D, F
23. Determine if two vectors are orthogonal in an inner product space. C, D, F
24. Use the best approximation method to find a least-squares fit to paired data. A, B, F, H
25. Find the kernel and range of a general linear transformation. E
26. Determine if a general linear transformation is one-to-one or onto. E

## **Evaluation**

### **Testing Procedures**

Students are evaluated primarily on the basis of tests, quizzes, homework and the comprehensive final exam. Four tests are shown in the weekly schedule above. A minimum of four tests (excluding the final exam) is recommended.

### **Laboratory Expectations**

None

### **Field Work**

None

### **Other Evaluation Methods**

As assigned by instructor.

### **Grading Scale**

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

## **Policies**

### **Attendance Policy**

The Pellissippi State Mathematics Department faculty expect registered students to attend all scheduled instructional activities. As a minimum, students must be present for at least 75 percent of their scheduled classes in order to receive credit for the course. Individual instructors' policies may be more specific and posted in the class syllabus.

### **Academic Dishonesty**

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.

Please see the Pellissippi State Policies and Procedures Manual, Policy 04:02:00 Academic/Classroom Conduct and Disciplinary Sanctions for the complete policy.

### **Accommodations for Disabilities**

Students that 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 Disability Services (DS) in order to receive accommodations in this course. [Disability Services](#) (<http://www.pstcc.edu/sswd/>) may be contacted via [Disability Services email](#) or by visiting Alexander 130.