COURSE OUTLINE

MATH 361 – LINEAR ALGEBRA

Prepared By: DANIEL GAGLIARDI
A. **TITLE:** Linear Algebra

B. **COURSE NUMBER:** MATH 361

C. **CREDIT HOURS:** 3

D. **WRITING INTENSIVE COURSE:** N/A

E. **COURSE LENGTH:** 15 Weeks

F. **SEMESTER(S) OFFERED:** Spring or Fall Semester

G. **HOURS OF LECTURE, LABORATORY, RECITATION, TUTORIAL, ACTIVITY:**
This course will consist of three 50-minute lectures per week

H. **CATALOG DESCRIPTION:** This course is an introduction to the theory of finite dimensional abstract vector spaces and linear transformations. Topics include: systems of linear equations, matrices, matrix algebra, determinants and inverses, linear combinations and linear independence, abstract vector spaces, change of basis and coordinates, inner product spaces, orthonormal bases. We also consider linear transformations, isomorphisms, matrix representation of linear maps, eigenvalues and eigenvectors, diagonalization and similarity. The applications include computer graphics, Markov chains, chemistry, linear regression, network flow, electrical circuits, and differential equations.

I. **PRE-REQUISITES/CO-COURSES:** Calculus II (MATH 162) of permission of the instructor.

J. **GOALS (STUDENT LEARNING OUTCOMES):** By the end of the course, the student will be able to:

<table>
<thead>
<tr>
<th>Course Objective</th>
<th>Institutional SLO</th>
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<tbody>
<tr>
<td>a. Analyze systems of linear equations and develop solutions using matrices and augmented matrices</td>
<td>1) Communication</td>
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<td>2) Critical Thinking</td>
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<td>b. Analyze linear combinations of vectors in $\mathbb{R}^n$ and identify sets of vectors that are linearly independent</td>
<td>1) Communication</td>
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<td>2) Critical Thinking</td>
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<td>c. Determine if a set of vectors is a vector space, a subspace, or a basis for a vector space</td>
<td>1) Communication</td>
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<td>2) Critical Thinking</td>
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<td>d. Analyze linear transformations and construct matrices relative to a given basis</td>
<td>1) Communication</td>
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<td>2) Critical Thinking</td>
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<td>e. Compute eigenvalues and eigenvectors, determine if a matrix is diagonalizable, and solve systems of linear ordinary differential equations</td>
<td>1) Communication</td>
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<td>2) Critical Thinking</td>
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K. **TEXTS:** Introduction to Linear Algebra with Applications, Defranza/Gagliardi, Waveland Press, First Edition, (2014). A computer algebra system (such as Maple) will be used when appropriate.

L. **REFERENCES:** None

M. **EQUIPMENT:** Smart Classroom (computer projection and access to the internet)

N. **GRADING METHOD:** A-F

O. **MEASUREMENT CRITERIA/METHODS:**
- Quizzes
- Exams
- Projects
P. DETAILED COURSE OUTLINE:
I. Systems of Linear Equations and Matrices
   1. Systems of linear equations
   2. Matrices and elementary row operations
   3. Matrix Algebra
   4. The inverse of a square matrix
   5. Determinants

II. Linear Combinations and Linear Independence
   1. Vectors in Euclidean space
   2. Linear Combinations
   3. Linear Independence

III. Abstract Vector Spaces
   1. Definition of a vector space
   2. Subspaces
   3. Basis and dimension
   4. Coordinates and change of basis

IV. Linear Transformations
   1. Linear transformations
   2. The null space and range of a linear transformation
   3. Isomorphisms
   4. Matrix representation of linear transformations
   6. Similarity

V. Eigenvalues and Eigenvectors
   1. Eigenvalues and eigenvectors
   2. Diagonalization
   3. Diagonalize of Symmetric Matrices

VI. Inner product spaces (Optional)
   1. The dot product on Euclidean spaces
   2. Inner product spaces
   3. Orthonormal bases and the Gram-Schmidt process
   4. Orthogonal Complements

Q. LABORATORY OUTLINE: N/A