MINNESOTA WEST COMMUNITY & TECHNICAL COLLEGE
COURSE OUTLINE

DEPT. MATH **COURSE NUMBER: 2210**

NUMBER OF CREDITS: 4 **Lecture: 4 Lab: 0 OJT 0**

Course Title:
Linear Algebra

Catalog Description:
Linear Algebra introduces systems of matrix linear equations, linear transformations, matrix operations, vector spaces, eigenvalues and eigenvectors, orthogonality, and applications.

Prerequisites or Necessary Entry Skills/Knowledge:
MATH 1122

FULFILLS MN TRANSFER CURRICULUM AREA(S) ***(Leave blank if not applicable)***

☒Goal 4: Mathematics/Logical Reasoning: By meeting the following competencies:

*Goal area 4 is met by pre-requisite course of MATH 1121

Topics to be Covered (General)
Linear Equations in Linear Algebra
Matrix Algebra
Determinants
Vector Spaces
Eigenvalues and Eigenvectors
Orthogonality and Least Squares
Symmetric Matrices and Quadratic Forms
Applications
Numerical Linear Algebra

Student Learning Outcomes
Solve systems of linear equations using matrix methods including Gaussian Elimination, Gauss-Jordan Elimination, and by matrix equation representation.
Perform operations on matrices including addition, subtraction, multiplication, transposition, and inversion.
Identify symmetric, skew-symmetric, lower triangular, upper triangular, triangular, scalar, and diagonal matrices and apply their basic properties.
Create and recognize row equivalent matrices and equal matrices.
Write LU and elementary matrix factorizations of square matrices where defined.

Interpret the determinant of a matrix and its properties, and apply them to linear independence, areas, volumes, orientation, invertibility, Cramer's Rule, and the adjoint of a matrix.
Identify a vector space from the axioms and prove that a non-empty subset of a vector space is a subspace.
Prove or disprove that a given finite set of vectors is linearly independent
Determine whether a vector is in the span of a finite collection of vectors.
Create a basis for a nonzero finite dimensional vector space and find its dimension.
Compute the coordinate vector of a vector relative to a finite basis.
Construct bases for the row, column and null space of a matrix. Relate their dimensions to one another, and to the rank and nullity of the matrix.
Express the solution to AX = B as a translation of the null space of A when AX = B is consistent.
Construct matrix representations for linear transformations relative to various bases when the domain and codomain are finite dimensional over the same field, and create change of basis matrices.
Evaluate inner products, construct and identify orthogonal sets of vectors and orthogonal matrices, and illustrate the Gram-Schmidt process.
Compute, explain, and apply key properties and definitions related to eigenvalues and eigenvectors of a matrix.

Is this course part of a transfer pathway: Yes ☒ No ☐

***If yes, please list the competencies below**

Linear Algebra (if applicable - one of three options)	*MATH 2210: Linear Algebra*
1. Solve systems of linear equations using matrix methods including Gaussian Elimination, Gauss-Jordan Elimination, and by matrix equation representation.	*1*
2. Perform operations on matrices including addition, subtraction, multiplication, transposition, and inversion.	*2*
3. Identify symmetric, skew-symmetric, lower triangular, upper triangular, triangular, scalar, and diagonal matrices and apply their basic properties.	*3*
4. Create and recognize row equivalent matrices and equal matrices.	*4*
5. Write LU and elementary matrix factorizations of square matrices where defined.	*5*
6. Interpret the determinant of a matrix and its properties, and apply them to linear independence, areas, volumes, orientation, invertibility, Cramer's Rule, and the adjoint of a matrix.	*6*
7. Identify a vector space from the axioms, and prove that a non-empty subset of a vector space is a subspace.	*7*
8. Prove or disprove that a given finite set of vectors is linearly independent.	*8*
9. Determine whether a vector is in the span of a finite collection of vectors.	*9*
10. Create a basis for a nonzero finite dimensional vector space and find its dimension.	*10*
11. Compute the coordinate vector of a vector relative to a finite basis.	*11*
12. Construct bases for the row, column and null space of a matrix. Relate their dimensions to one another, and to the rank and nullity of the matrix.	*12*
13. Express the solution to Ax = b as a translation of the null space of A when Ax = b is consistent.	*13*
14. Construct matrix representations for linear transformations relative to various bases when the domain and codomain are finite dimensional over the same field, and create change of basis matrices.	*14*
15. Evaluate inner products, construct and identify orthogonal sets of vectors and orthogonal matrices, and illustrate the Gram-Schmidt process.	*15*
16. Compute, explain, and apply key properties and definitions related to eigenvalues and eigenvectors of a matrix.	*16*

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