SPRINGFIELD TECHNICAL COMMUNITY COLLEGE

ACADEMIC AFFAIRS

Course Number: MATH 439 Department: Mathematics

Course Title: Linear Algebra Semester: Spring Year: 1999

Objectives/Competencies

Course Objective	Competencies
1. The skills basic to the study of Gaussian Elimination.	1. Solve a system using Gaussian Elimination. 2. Determine if a given matrix is in row-echelon form and reduced row-echelon form. 3. Find a solution set of a system of linear equations represented by an augmented matrix. 4. Determine if a given matrix is elementary. 5. Perform row operations using elementary matrices. 6. Find the inverse of a square matrix. 7. Find the inverse of a matrix using the adjoint.
2. The skills basic to the study of matrix operations.	1. Perform fundamental operations with matrices including addition, subtraction, scalar multiplication, and multiplication. 2. State, prove, and apply properties of matrices. 3. Find the transpose of a given matrix.
3. The skills basic to the study of determinants.	1. Evaluate a determinant by its definition. 2. Evaluate a determinant by first reducing it to triangular

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	form. 3. Evaluate a determinant by cofactor expansion. 4. Solve a linear system using Cramer's Rule.
4. The skills basic to the study of vectors and vector spaces.	1. State the definition and perform the following vector operations: addition, subtraction, scalar multiplication, magnitude, dot product, and projection. 2. Solve vector equations. 3. Write a given vector as a linear combination of a set of vectors. 4. State and apply the definition of a vector space. 5. Verify properties of a vector space given a set and two defined operations. 6. Show that a given subset of a vector space is a subspace. 7. Show that a given set of vectors is linearly independent. 8. Show that a given set of vectors spans a vector space. 9. Show that a given set of vectors is basis for a vector space. 10. Find the dimension of a vector space. 11. Determine the rank of a matrix. 12. Find a basis for the row space and column space of a given matrix. 13. Determine the number of solutions of a linear system based on the rank of its coefficient matrix. 14. Express the vector as a coordinate vector in terms of another basis. 15. Find and apply the transition matrix with respect to

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	different bases of a vector space. 16. Find the unit vector in the direction of a given vector. 17. Find the distance between two vectors. 18. State and prove the properties of the dot product. 19. Find the angle between two vectors. 20. Determine if two vectors are orthogonal. 21. State and prove the Triangle Inequality. 22. State the definition of an inner product space. 23. Find the orthogonal projection of one vector onto another. 24. State and prove the properties of a general inner product space. 25. Determine if a set of vectors is orthogonal. 26. Apply the Gram-Schmidt Process to a set of vectors. 27. Compute and apply the cross product of two vectors. 28. State and prove properties of the cross product.
5. The skills basic to the study of Linear Transformations.	1. Determine if a function is a linear transformation and find its domain and range. 2. State and prove properties of linear transformations. 3. State the definition of and compute the kernel of a linear transformation. 4. State the definition of rank and nullity of a linear transformation. 5. State the definition of one-to-one and onto linear transformation. 6. Define isomorphism. 7. Find the matrix associated with a given linear

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6. The skills basic to the study of Eigenvalues, Eigenvectors, and Eigenspaces.	transformation. 8. State the definition and describe composition of a linear transformation. 9. Find the inverse of a linear transformation. 10. State definition of similar matrices. 11. State properties of similar matrices. 1. Find the characteristic polynomial, eigenvalues, and basis for its eigenspace for a given matrix. 2. Determine if a matrix is diagonalizable. 3. If a matrix is diagonalizable, compute matrices S and B such that the diagonal form D = SBS to the minus 1 power. 4. Find for an nxn symmetric matrix n linearly independent eigenvectors and determine that those associated with distinct eigenvalues are distinct. 5. Find for an nxn symmetric matrix and orthogonal matrix Q and a diagonal matrix D such that D = Q to the minus 1 power AQ. 6. Apply eigenvalue analysis to the solution of problems involving difference equations, Fibonacci sequence, and population growth.