COLLIN COLLEGE EXPANDED GENERIC COURSE SYLLABUS

COURSE INFORMATION

Course Number: MATH 2373
Course Title: Matrices, Vectors, and Linear Programming
Credit Hours: 3
Lecture Hours: 3
Lab Hours: 0

Prerequisite
MATH 1314; or equivalent.

Course Description
Not for science majors. A study of matrices, vectors, determinants, inverses, system of linear equations, and linear programming with applications.

Textbook/Supplies
Linear Algebra with Applications, 9th Edition by Gareth Williams, Jones and Bartlett.

Supplies: Graphing calculator required.

STUDENT LEARNING OUTCOMES (SLO)

Upon completion of this course the students should be able to do the following:

1. Be able to solve systems of linear equations with applications using Gauss-Jordan elimination, matrix inversion, and determinants. (Empirical/Quantitative Skills)
2. Be able to perform basic operations on vectors, determinants and inverses. (Empirical/Quantitative Skills)
3. Determine if a set of vectors is linearly independent and whether it forms a basis for a vector space. (Communication Skills)
4. Be able to solve Linear Programming problems by using the geometrical approach method and the Simplex method (Critical Thinking Skills)
5. Be able to solve problems from operation research in business and economics (Communication Skills).

REQUIRED CORE OBJECTIVES FOR MATHEMATICS

As per the Texas Higher Education Coordinating Board, mathematics students must develop and demonstrate the following three required core objectives:

- Critical Thinking Skills - creative thinking, innovation, inquiry, and analysis, evaluation and synthesis of information.
- Communication Skills - effective development, interpretation and expression of ideas through written, oral and visual communication.
- Empirical and Quantitative Skills - manipulation and analysis of numerical data or observable facts resulting in informed conclusions.

METHOD OF EVALUATION

Course requirements

Attending class**,** completing homework assignments**,** and completing required exams.

Course format

Lecture and guided practice.

A minimum of four proctored exams and a proctored comprehensive final exam will be given. Homework and/or quizzes may be used in place of one exam or in addition to exams. The weight of each of these components of evaluation will be specified in the individual instructor's addendum to this syllabus. All out-of-class course credit, including home assignments, service-learning, etc. may not exceed 25% of the total course grade; thus, at least 75% of a student's grade must consist of proctored exams, and no student may retake any of these exams.

COURSE POLICIES

College-wide policies are pre-loaded into the Concourse Syllabi and are not duplicated in the Expanded Generic Syllabi for each course.

Instructor specific policies should be added to the Concourse Syllabus.

COURSE CONTENT

Proofs and derivations will be assigned at the discretion of the instructor. The student will be responsible for knowing all definitions and statements of theorems for each section outlined in the following modules.

Module 1: Systems of Linear Equations

The student will be able to:

1. Solve systems of two linear equations. SLO 1
2. Recognize a linear equation in *n* variables. SLO 1
3. Solve systems of three linear equations using Equation Method and Analogous Matrix Method. SLO 1
4. Use the Gauss-Jordan method of forward elimination to arrive at the echelon form. SLO 1
5. Use back-substitution to get the reduced echelon form and Gaussian elimination to solve a system of linear equations. SLO 1
6. Solve a homogeneous system of linear equations. SLO 1
7. Represent a vector as a directed line segment. SLO 1 & 2
8. Perform basic vector operations in R^2. SLO 1 & 2
9. Perform basic vector operations in R^n. SLO 1 & 2
10. Determine subspaces of R^n. SLO 1 & 2
11. Determine Basis and Dimension in R^n. SLO 1 & 2
12. Determine Dot Product, Norm, Angle, and Distance. SLO 1 & 2

Module 2: Matrices, Determinants

The student will be able to:

1. Add, subtract matrices, and multiply a matrix by a scalar. SLO 1
2. Multiply two matrices. SLO 1
3. Use properties of matrix operations to solve matrix equations. SLO 1
4. Determine the transpose of the matrices and prove the properties of transpose. SLO 1
5. Prove that a matrix is symmetric. SLO 1
6. Determine the trace of a matrix. SLO 1
7. Determine possible chronological orderings of the graves and the pottery types using matrix multiplication, transpose, and symmetric matrices. SLO 1
8. Use an inverse matrix to solve a system of linear equations. SLO 1
9. Use matrix multiplication to encode and decode messages. SLO 1
10. Use matrix algebra to analyze Leontief Input-Output models in Economics. SLO 1 & 5
11. Identify a stochastic matrix and use it in Population Movements Models. SLO 1 & 5
12. Use the n-step transition matrix in Markov Chain Models. SLO 1 & 5
13. Sketch the digraphs and find the distance matrix of the digraph. SLO 1 & 5
14. Sketch a communication network using the adjacency matrix. SLO 1 & 5
15. Construct the digraph that describes group relationships. SLO 1 & 5
16. Compute Determinants of 2 x 2 and 3 x 3 matrices. SLO 1 & 2
17. Use Properties of Determinants. SLO 1 & 2
18. Find the determinant of the triangular matrices. SLO 1 & 2
19. Determine whether a matrix has an inverse using determinants. SLO 1 &2
20. Find the inverse of a matrix. SLO 1
21. Solve systems of linear equations using Cramer's rule. SLO 1

Module 3: Vector Spaces, Inner Product Spaces

The student will be able to:

1. Define a vector space and recognize some important vector spaces. SLO 3
2. Determine subspaces of R^2 and R^3. SLO 3
3. Write a vector as a linear combination of other vectors. SLO 3
4. Determine whether the sets of vectors are linearly dependent or independent. SLO 3
5. Use Properties of Bases to identify if the given sets of vectors are bases of R^2 and R^3. SLO 3
6. Determine the ranks of matrices using the definition of rank. SLO 3
7. Find bases for the subspaces of R^3 and R^4. SLO 3
8. Find the coordinate vector if **u** relative to the given basis. SLO 3
9. Determine the least squares lines for the data points. SLO 3
10. Determine the least squares parabola for the data points. SLO 3

Module 4: Numerical Methods, Linear Programming

The student will be able to:

1. Use Gaussian Elimination to solve the systems of equations. SLO 4
2. Use the Method of LU Decomposition to solve the systems of equations. SLO 4
3. Solve the linear programming problems. SLO 4
4. Use the Simplex Method to solve a linear programming problem. SLO 4
5. Determine the basic and nonbasic variables, the entering variables and departing variables for a linear programming problem. SLO 4