Davenport University
Department of Computer Information Science

1. MATH205, Applied Linear Algebra

2. 3 credits

3. Course coordinator: Tim Pennings/Gabriela Ziegler

4. Textbook No book purchase is necessary as a book fee was paid with registration and the materials will be available in the online Blackboard course.

5. Specific course information
    a. Catalog description: This course introduces the fundamentals of linear algebra (i.e., the notation and algebra of vector spaces and matrices). Because these items have the ability to handle masses of data as a single unit with relative ease, they are of particular interest to those in computer science. Those applications to programming (e.g., 3-D game design, simulation, and biometric security) will serve as context throughout the course. Topics include matrix operations, linear transformations, vector spaces, and 3D geometry.
    b. Prerequisites: MATH140 and MATH135 or MATH150

    c. Required course

6. a. Course Learning Outcomes:

1. Perform the following matrix operations: addition, subtraction, scalar multiplication and multiplication.
2. Find the inverse, transpose, and determinant of a matrix and perform LU-Factorization.
3. Solve a system of equations using augmented matrices, row operations, and Gaussian Elimination. Use linear systems to model and analyze applied situations.
4. Perform Linear Transformations (translations, reflections, projections, rotations, dilations, and contractions) using matrices.
5. Solve problems using applications of matrices such as coding, graph theory, and computer graphics.
6. Perform the following vector operations: sum, difference, dot product, scalar multiplication, cross products, and normalizing.
7. Solve problems dealing with 3-D geometry such as finding bounding boxes or bounding spheres, and finding intersections of geometric shapes in 3-D.
8. Compute eigenvalues and eigenvectors of a matrix.
9. Utilize technology as appropriate to perform matrix operations.

b. Student Outcomes assessed by MATH205

1. To analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.

c. Mapping of Course Learning Outcomes to Student Outcomes

Course Learning Outcomes 3, 5, and 7 → ABET SO 1

7 Course Content:

Topic or Subtopic (Number of hours devoted to a topic are shown in parenthesis)

1. MATLAB (4)
2. Matrices and Matrix Operations (1.5)
3. Row Operations and Dependent systems (1.5)
4. Inverse of Matrix and LU-Factorization (3)
5. Image processing (2)
6. Determinants Cofactor Expansion and Cramer's rule (3)
7. Introduction to Vectors (2)
8. Vectors in 3D, Cross Product, Linear Transformations (3)
9. Computer graphics (3)
10. Parametric Equations, 2-D Lines (3)
11. 3-D Lines, Planes, Intersection of Lines and Planes (6)
12. Introduction to Eigenvalues and Eigenvectors (1.5)
13. Principle Component Analysis (1.5)