LaGuardia Community College
City University of New York
Department of Mathematics, Engineering, and Computer Sciences

MAT 212 : Linear Algebra and Vector Analysis for Engineers

Prerequisite : MAT 203 **Credits/Contact hours :** 3

Instructional Objectives :
This course serves as an extension of the traditional calculus sequence and contains additional topics relevant to students majoring in engineering. Topics include matrix algebra, systems of linear equations and Gaussian elimination method, determinant of a matrix, eigenvalues and eigenvectors, parametric curves and surfaces, arc length, line and surface integrals, fundamental theorem for line integrals, curl and divergence, Green's theorem, Stokes' theorem and Divergence theorem. Major applications will be developed.

Performance Objectives :

During this course, the students will acquire the ability :

- To represent systems of linear equations as matrix equations and to obtain solutions by matrix methods such as Gaussian elimination.
- To recognize algebraic properties of matrices and to perform matrix operations such as addition and multiplication.
- To find inverse of matrix where possible.
- To compute the determinant of square matrices using various methods.
- To determine spanning sets, bases and the corresponding dimension, and coordinate systems for such spaces.
- To determine linear independence or dependence of sets of vectors.
- To find eigenvalues and eigenvectors for 2×2 and 3×3 matrices.
- To use eigenvector methods to solve a system of first-order ordinary differential equations.
- To find arc lengths, areas of surfaces, and volumes of solids.
- To describe parametrized surfaces, surface areas.
- To compute line integrals, recognize and apply the fundamental theorem for line integrals.
- To recognize vector fields, and find curl and divergence.
- To compute work, flux and mass integrals on curves, surfaces and solids.
- To state and apply Green's, Stokes' and Divergence theorems.
- To solve application problems using vector calculus and linear algebra.

Textbooks :

- *Linear Algebra for Calculus* by K. Heuvers et al. Published by Thomson Brooks/Cole (1995).

- *Essential Calculus (First Ed.)* by James Stewart. Published by Thomson Brooks/Cole (2007). The students need only chapter 13 in this course which they can download for $8.49 from http ://www.cengagebrain.com/shop/isbn/9780495014423

Evaluation :

a. Two midterm Exams 40%
b. Final Exam 30%
c. Project 20%
d. Homework 10%

Section	Topic	Hours
	Part I :(*Linear Algebra for Calculus* by K. Heuvers)	
1	• Matrices and Matrix Algebra	1
2	• Solving systems of linear equations by row reduction	2
3	• Varieties of Systems of Linear Equations	2
4.1-4.4	• Determinant : Basic concepts, methods and properties	2
4.5, 12.8	• Some applications of Determinants : Cross products and Jacobian	1.5
5	• The Inverse of a Matrix	1.5
6.2	• Coordinates and Change of coordinates	1
7.1-7.2	• The eigenvalue problem (with applications to systems of ODEs)	3
	Part II : (*Essential Calculus* by James Stewart)	
13.1	• Vector Fields	1
13.2	• Line Integrals	2
13.3	• The Fundamental Theorem for Line Integrals	2
13.4	• Green's Theorem	2
13.5	• Curl and Divergence	2
13.6	• Parametric Surfaces and Their Areas	2
13.7	• Surface Integrals	3
13.8	• Stokes' Theorem	2
13.9	• The Divergence Theorem	2
	• Final Exam	