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 hours.**

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).

•Calculus Early Transcendentals (Eighth Ed.) by James Stewart. Published by Brooks/Cole Cengage Learning (2016), ISBN: 9781285741550. The students need only chapter 16.

Evaluation:

a. Two midterm Exams: 45%

b. Final Exam: 30%

c. Project: 15%

d. Homework: 10%.

Addendum to the Syllabus due to Covid19 and Distance Learning.

"*In certain instances, at the discretion of the instructor, a student may be asked to demonstrate his/her ability of conceptually understanding the work he/she submitted. In such instances, the instructor may ask any student for a written or oral (live video session) clarification or explanation of solutions to any assignment, including homework, quizzes, tests, final exam, etc.*"

"*Solutions submitted by students for any assignment in this course, including homework, quizzes, tests, final exam, etc., must be based on the covered material. Solutions that are based on material that was not or will not be covered in this course, or will be covered but has not been covered yet, will not be accepted and will receive no credit.*"

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	Variety of Systems of linear equations	2
4.1-4.4	Determinant: Basic concepts, methods and properties	2
4.5, 12.8	Some applications of determinant: Cross products and Jacobian	1.5
5	The inverse of square 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: Calculus Early transcendentals by James Stewart	
16.1	Vector Fields	1
16.2	Line Integrals	2
16.3	The Fundamental Theorem for Line Integrals	2
16.4	Green's Theorem	2
16.5	Curl and Divergence	2
16.6	Parametric Surfaces and their Areas	2
16.7	Surface Integrals	3
16.8	Stokes' Theorem	2
16.9	The Divergence Theorem	2
	Final Exam	