



Department of Mathematics  
**Syllabus Math 107, Second Semester 1437/1438 H**

**Course Code:** Math 107

**Course Title:** Matrices and Vectors

**Instructor and coordinator:**

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**Text Books:**

1. Linear Algebra by H. Anton  
( any book on Linear Algebra from Library 512.5 )
2. Calculus by Swokowski, Olinick and Pence, 6<sup>th</sup> Ed, PWS publishing Co.  
( any book on Calculus from Library 515.15 )

**Additional Material:**

Lecture Notes on  
Linear Algebra, Vector and Several Variables Calculus  
by Khawaja Zafar Elahi

**Course Objectives:**

1. Matrices and their use in solving system of linear equations
2. Determinants and applying them in various geometrical and systems of linear equations problems
3. Vector Algebra ,vector valued functions
4. Calculus of several variables, Partial differentiations and their application in Mathematics and Engineering

**Course Learning outcomes:**

1. Understanding of system of linear equations, matrices, calculus of vectors and several variables.
2. Improve students' theoretical and analytical skills by going inside the depth of different applications of system of linear equations.
3. Can solve and understand the solutions of system of linear equations, understand the ideas of matrices and be able to work out problems.
4. Understand vector algebra, applying the concepts of Vector Algebra to derive equation of line and plane, and to find volume of parallelepiped.
5. The student has to have the ability to handle vector valued functions its derivative and integrals.
6. The student has to have the ability to handle function of several variables. Understand the Concept of Gradient and apply it for the applications in several variables.

## Weekly Course Details

### **Linear Algebra**

#### WEEK 1

##### Chapter 1: System of Linear Equations

- 1.0 Basic Definitions of Matrices
- 1.1 System of linear equation
- 1.2 Methods for solving system of linear equations
- 1.3 Gauss Elimination Method

#### WEEK 2

- 1.4 Gauss Jordan Method
- 1.5 Row Echlon form
- 1.6 Reduced Row Echlon form
- 1.7 Homogeneous system

#### WEEK 3

##### Chapter 2: Matrices

- 2.1 Properties of Matrices and Algebra of matrices
- 2.2 Scalar Multiplication
- 2.3 Matrix Multiplication
- 2.4 Inverse of 2x2 matrix
- 2.5 Power of Matrix
- 2.6 Elementary Matrix
- 2.7 Methods of finding inverse of matrix
- 2.8 Solving Linear system by Inverse Matrix

#### WEEK 4

##### Chapter 3: Determinant

- 3.1 Determinant
- 3.2 By Direct Multiplication
- 3.3 By cofactor
- 3.4 By row operation

#### WEEK 5

- 3.5 Properties of Determinantal function
- 3.6 Minor and cofactors, Inverse by cofactors
- 3.7 Cramer's Rule

### **Calculus**

#### WEEK 6

##### Chapter 10: Vectors and the Geometry of Space

- 10.1 Vectors in the Plane
- 10.2 Vectors in Space
- 10.3 The Dot Product

#### WEEK 7,8

- 10.4 The Cross Product
- 10.5 Lines and Planes in Space
- 10.6 Surfaces in Space

#### WEEK 9

##### Chapter 11: Vector-Valued Functions

- 11.1 Vector-Valued Functions
- 11.2 Limits, Derivatives
- 11.3 Velocity, Acceleration.

#### WEEK 10

- 11.4 Curvature, Unit Tangent Vector, Principal Normal Vector
- 11.5 Tangential and Normal Components of Acceleration

#### WEEK 11

##### Chapter 12: Functions of Several Variables and Differentiation

- 12.1 Functions of Several Variables
- 12.2 Limits and Continuity

#### WEEK 12

- 12.3 Partial Derivatives

#### WEEK 13

- 12.4 Tangent Planes and Linear Approximations, Increments and Differentials
- 12.5 The Chain Rule
- 12.6 The Gradient and Directional Derivatives

#### WEEK 14

- 12.7 Extrema of Functions of Several Variables
- 12.8 Constrained Optimization and Lagrange Multipliers

#### WEEK 15

#### Revision WEEK

### **Midterm Examinations:**

**Midterm Exam I: Date:**

**Midterm Exam II: Date:**

#### **Final Exam**

#### **Useful on line material:**

1. <https://www.khanacademy.org/math/>
2. [ocw.mit.edu](http://ocw.mit.edu) > Courses > Mathematics
3. [mathworld.wolfram.com](http://mathworld.wolfram.com) > ... > Linear Algebra > General Linear Algebra
4. [www.sosmath.com/matrix/matrix.html](http://www.sosmath.com/matrix/matrix.html)
5. [http://www2.warwick.ac.uk/fac/sci/maths/undergrad/ughandbook/content/ma106/elementary\\_linear\\_algebra\\_10th\\_edition.pdf](http://www2.warwick.ac.uk/fac/sci/maths/undergrad/ughandbook/content/ma106/elementary_linear_algebra_10th_edition.pdf) (**Linear Algebra by H. Anton (Soft copy)**)

**Material covered in first 7 week**

**Material covered in 8<sup>th</sup> to 14<sup>th</sup> week**