King Saud university



Department of Mathematics

**Math 107, First Semester 1437/38 H**

**Course Code:** Math 107

**Course Title:** Matrices and calculus

**Instructor:**

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**Text Books:**

1. Linear Algebra by H. Anton

(any book on Linear Algebra from Library 512. 5 )

1. Calculus by Swokowski, Olinick and Pence, 6th Ed, PWS publishing Co.

(any book on Calculus from Library 515.1 5 )

**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 systems of linear equations
2. Determinants and their applications
3. Vector Algebra, vector valued functions
4. Several variables calculus, partial differentiation and applications

**Weekly Course Details**

**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.**3Velocity, 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

**Linear Algebra**

**Calculus**

**WEEK 6**

**Chapter 10: Vectors and Geometry of Space**   
**10.1** Vectors in the plane   
**10.2**  Vectors in three dimensions   
**10.3** The dot product

**WEEK 7,8**

**10.4** The cross product   
**10.5**  Lines and planes   
**10.6**  Surfaces

**WEEK 9**

**Chapter 11: Vector-Valued Functions**   
**11.1**  Vector-valued functions   
**11.2**  Limits and derivatives

**11.**3 Velocity and 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 1**

**Chapter 1: Systems of Linear Equations**

1.0 Basic definition of a matrix

* 1. Systems of linear equations
  2. Solving systems of linear equations
  3. Gauss Elimination method

**WEEK 2**

* 1. Gauss -Jordan method
  2. Row- Echelon form
  3. Reduced Row- Echelon form
  4. Homogeneous systems

**WEEK 3**

**Chapter 2: Matrices**

2.1 Properties and Algebra of matrices

2.2 Scalar multiplication

2.3 Matrix multiplication

2.4 Inverse of 2x2 matrices

2.5 Powers of a matrix

2.6 Elementary matrices

2.7 A method for finding the inverse of a matrix

2.8 Linear systems and matrix invertibility

**WEEK 4**

**Chapter 3: Determinants**

3.1 Determinant

3.2 By direct multiplication

3.3 By cofactors

3.4 By row operations

**WEEK 5**

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| 3.5 Properties of the determinant function  3.6 Minors and cofactors, inverse by cofactors  3.7 Cramer’s rule |

**WEEK 15**

**Revision**

**Midterm Examinations:**

**Midterm Exam I: Date: WED 02.02.1438 7 to 8:30 pm**

**Midterm Exam II: Date: WED 29.03.1438 7 to 8:30 pm**

**Useful online material:**

1. <https://www.khanacademy.org/math/>
2. ocw.mit.edu › Courses › Mathematics
3. 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> (**Linear Algebra by H. Anton (Soft copy))**