King Fahd University of Petroleum and Minerals
College of Computing and Mathematics
Mathematics Department
MATH 432 Syllabus

Instructor: Zaid Sawlan
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Semester 232

- **Course Code and Name:** Math 432, Applied Matrix Theory
- **Course Credit Hours:** 3-0-3
- **Textbook:** Linear Algebra and its Applications by Gilbert Strang, Fourth Edition.
- **Reference:** Matrix Theory by Joel N. Franklin.
- **Course Content:** Review of the theory of linear systems. Eigenvalues and eigenvectors. The Jordan canonical form. Bilinear and quadratic forms. Matrix analysis of differential equations. Variational principles and perturbation theory: the Courant minimax theorem, Weyl's inequalities, Gershgorin's theorem, perturbations of the spectrum, vector norms and related matrix norms, the condition number of a matrix.
  Course Prerequisite: MATH 208 or MATH 225
- **Course Learning Outcomes:**
  Upon completion of the course, students should be able to:
  1. Apply matrix theory to solve systems of linear ODEs.
  2. Recognize different classes of matrices and their properties.
  3. Use Rayleigh Principle to minimize/maximize quotients of quadratic functions.
  4. Perform the Gram-Schmidt orthogonalization process.
  5. Discuss simple functions of matrices.
  6. Apply the notion of condition number to discuss relative errors.

Grading Policy:

	Date	Material	Percentage
Major Exam I	Week 5	Chapters 1 and 2	20%
Major Exam II	Week 10	Chapters 3, 4 and 5	20%
Final Exam	TBA	**Comprehensive**	35%
Homework	---	on Blackboard	10%
Class work	---	----	15%

Attendance:

Attendance is a University Requirement (see p. 38 of the Undergraduate Bulletin 2006-2009).

- If a student misses a class, he is responsible for any announcement made in that class.
- A DN grade will be awarded to any student who accumulates 9 unexcused absences.

Academic Integrity:

All KFUPM policies regarding ethics apply to this course. See the Undergraduate Bulletin.

Week	Date	Topics
1	Jan 14 - 18	Chapter 1: Introduction, Geometry of Linear Equations
2	Jan 21 - 25	Chapter 1: Triangular Factors and Row Exchanges, Inverses and Transposes
3	Jan 28 - Feb 1	Chapter 2: Vector Spaces and Subspaces, Linear Independence, Basis, and Dimension
4	Feb 4 - 8	Chapter 2: The Four Fundamental Subspaces, Graphs and Networks , Linear Transformations
5	Feb 11 - 15	Chapter 3: Orthogonal Vectors and Subspaces, Projections
6	Feb 18 - 21	Chapter 3: Orthogonal Bases and Gram-Schmidt, Fast Fourier Transform
Feb 22: Saudi Founding day		
7	Feb 25 - Feb 29	Chapter 4: Determinants, Properties and Applications of Determinants
8	Mar 3 - 7	Chapter 5: Diagonalization of a Matrix, Difference Equations and Powers A^k
9	Mar 10 - 14	Chapter 5: Differential Equations and e^{At}, Complex Matrices, Similarity Transformations
10	Mar 17 - 21	Chapter 6: Minima, Maxima and Saddle Points, Positive Definite Matrices
11	Mar 24 - 28	Chapter 6: Singular Value Decomposition, Minimum Principles
Mar 29 - Apr 18: Eid Al-Fitr Holidays		
12	Apr 21 - 25	Chapter 7: Computations with Matrices, Matrix Norm and condition number
13	Apr 28 - May 2	Chapter 7: Computation of Eigenvalues, Iterative Methods
14	May 5 - 9	Perturbation theory: the Courant minimax theorem
15	May 12 - 16	Weyl's inequalities, Gershgorin's theorem, perturbations of the spectrum
16	May 19	Review