

# KING FAHD UNIVERSITY OF PETROLEUM & MINERALS

## Department of Mathematics & Statistics

MATH 590- Special Topics in Mathematics

Linear Algebra

Course Syllabus

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**Textbook:** Serge Lang, Linear Algebra, 3<sup>rd</sup> Edition (Springer), 1987

**Objectives:** The course is designed to provide students with the mathematical rigor and skills necessary for more advanced Algebra courses.

**Assessment:**

- Exam 1: 20% (Chapters 1, 3, 4)
- Exam 2: 20% (Chapters 5, 7)
- Homework and other Assignments: 20%
- Final Exam: 40% (Comprehensive; Date and Location: To Be Announced)

**Instructor:**

Dr. Manal Alotibi ([manal.alotibi@kfupm.edu.sa](mailto:manal.alotibi@kfupm.edu.sa))

**Office hours:**

Sunday and Tuesday: 11:30 am -2:30 pm (or set an appointment if needed)

Number of Classes	Chapter	Sections	Suggested Homework
4	Vector Spaces	1.1 Definitions 1.2 Bases 1.3 Dimension of a Vector Space 1.4 Sums and Direct Sums	1.1: 2, 4, 8b, 10, 12 1.2: 1g, 3b, 6b 1.4: 1, 2
3	Linear Mappings	3.2 Linear Mappings 3.3 The Kernel and Image of a Linear Map 3.4 Composition and Inverse of Linear Mappings	3.2: 1e, 1f, 1g, 3, 15, 18b 3.3: 5, 12, 14,17,18 3.4: 2, 7, 10, 17,19
2	Linear Maps and Matrices	4.1 Linear Map Associated with a Matrix 4.2 Matrix Associated with a Linear Map	4.2: 1d,1f, 6, 8
7	Scalar Products and Orthogonality	5.1 Scalar Products 5.2 Orthogonal Bases, Positive Definite Case 5.4 Bilinear Maps and Matrices 5.5 General Orthogonal Bases 5.6 The Dual Space and Scalar Products 5.7 Quadratic Forms 5.8 Sylvester's Theorem	5.1: 1, 2, 3 5.2: 2b, 5 (assume 3), 6a, 9, 10 5.4: 1, 2, 5b, 5e, 6 5.5: 1, 3 5.6: 1, 3, 4, 6 5.7: 2,3,4 5.8: 1a, 1c, 3
3	Symmetric, Hermitian, and Unitary Operators	7.1 Symmetric Operators 7.2 Hermitian Operators 7.3. Unitary Operators	7.1: 1, 6, 8, 15 7.2: 1, 5, 7, 11
6	Eigenvectors and Eigenvalues	8.1 Eigenvalues and Eigenvectors 8.2 The Characteristic Polynomial 8.3 Eigenvalues and Eigenvectors of Symmetric Matrices 8.4. Diagonalization of a Symmetric Linear Map 8.5 The Hermitian Case 8.6. Unitary Operators	8.1: 1, 3, 4, 7 8.2: 8a, 8d, 9, 10, 14 8.4: 1, 2, 3, 11, 18, 19 8.5: 1, 3, 6, 10
2	Polynomials and Matrices	9.1 Polynomials 9.2 Polynomials of Matrices and Linear Maps	9.2: 1, 2, 3, 4, 5
2	Triangulation of Matrices and Linear Maps	10.1 Existence of Triangulation 10.2 Theorem of Hamilton-Cayley	10.1: 1, 2, 5, 7
1	Review		