

**King Fahd University of Petroleum and Minerals**  
**Department of Mathematics and Statistics**

Math 535 Syllabus 162

Instructor: Dr. Abdelkader Boucherif

**Course:** Math 535  
**Title:** Functional Analysis  
**Textbook:** Functional Analysis, Erdogan Suhubi, Kluwer Academic Publishers, (2003)

**Objectives:** This course is designed to introduce the students to the structures of infinite dimensional vector spaces and transformations, which are frequently called operators, between such spaces. Properties of such spaces that come from the algebraic structures will be discriminated from those which come from topology and ultimately, metrics and norms.

**Main Topics** Normed linear spaces, Banach spaces, Hilbert spaces, Banach algebras (definitions, examples and geometric properties) bounded linear operators, convex sets, linear functionals, duality, reflexive spaces, weak topology and weak convergence, Banach fixed point theorem, Hahn-Banach theorem, uniform boundedness principle, open mapping theorem, closed graph theorem, representation of functionals on Hilbert spaces (Riesz Representation Theorem).

**Grading Policy**

Final Exam shall be comprehensive.		
<b>Office:</b> 5-417	<b>Tel:</b> 860- 4194	<b>E-mail:</b> <a href="mailto:aboucher@kfupm.edu.sa">aboucher@kfupm.edu.sa</a>
<b>Grading Policy:</b> HW: 25%, Midterm 35%, Final 40%.		

### Weekly Coverage of Course Material

Week	Date	Section	Topic
1	5-7 Feb.	2.2 2.3 2.4	Linear Vector Spaces Subspaces Linear independence and dependence
2	12-14 Feb.	2.5 2.7 2.10	Basis and Dimension Linear Transformations Linear functionals. Algebraic dual
3	19-21 Feb.	5.2 5.3 5.4	The metric and the metric topology Various metric spaces Topological properties of metric spaces
4	26-28 Feb.	5.5 5.6 5.7	Completeness of metric spaces Contraction mappings Compact metric spaces
5	5-7 March	6.2 6.3 6.4	Normed Spaces Semi-Norms Series of Vectors
6	12-14 March	6.5 6.6 6.7	Bounded Linear operators Equivalent Normed Spaces Bounded below operators
7	19-21 March	6.8 6.9 6.10	Continuous linear functionals Topological dual Strong and weak topologies
8	26-28 March	6.11 6.12 6.13	Compact operators Closed operators Conjugate operators
***	2-6	April	Midterm Break
9	9-11 April	6.14 7.2	Classification of continuous linear operators Inner product spaces
10	16-18 April	7.2	<b>Continued.</b>
11	23-25 April	7.3 7.4	Orthogonal subspaces Orthonormal sets and Fourier series
12	30 April- 2 May	7.5 7.6	Duals of Hilbert spaces Linear operators in Hilbert spaces
13	7-9 May	7.7 8.2 8.3	Forms and variational equations The resolvent set and the spectrum The resolvent operator
14	14-16 May	8.4 8.5	The spectrum of a bounded operator The spectrum of a compact operator
15	21-23 May	8.6 8.7	Functions of operators Spectral theory in Hilbert spaces.