

King Fahd University of Petroleum & Minerals
 Department of Mathematical Sciences
 Course Syllabus, Term 061
MATH 535 [Functional Analysis I]
 (Course Instructor: *Q.H. Ansari*)

Textbook: Erdogan S. Suhubi, *Functional Analysis*, Kluwer Academic Publishers, 1991.
References: i. E. Kreyszig, *Introductory Functional Analysis with Applications*, John Wiley & Sons, 1989.
 ii. C. Groetsch, *Elements of Applicable Functional Analysis*, Marcel Dekker, 1980.
 iii. A.H. Siddiqi, *Applied Functional Analysis*, Marcel Dekker, 2004

Goals: The main objective of this course is to familiarize our students with basic concepts of functional analysis; it primarily deals with the basics of Banach & Hilbert Spaces. The fundamental results like Hahn- Banach Theorem, Riesz Representation Theorem, Banach Fixed Point Theorem etc. and their applications will be discussed.

Catalogue Description: Normed linear spaces, Banach spaces, Hilbert spaces, Banach Algebras (definitions, examples, geometric properties), bounded linear operators, 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).

Week	Date	Material
1	Sep 9-14	A brief introduction of metric spaces, Topological concepts and their examples
2	Sep 16-20	Normed spaces; Banach spaces; Examples and basic concepts.
3	Sep 24-27	Finite dimensional normed spaces and subspaces; Equivalent norms; Compact sets
4	Sep 30-Oct 04	Bounded linear operators and their examples; Continuous linear operators; Baire category theorem; Uniform boundedness principle.
5	Oct 7-11	The Open mapping theorem; Closed graph theorem.
Oct 12 - 27, 2006: Eid al-Fitr Vacation		
6	Oct 28-Nov 1	The Hahn-Banach theorem and its consequences,
7	Nov 4-8	Banach contraction theorem and its applications
8	Nov 11-15	Topological dual; Reflexive Banach spaces
9	Nov 18-22	Strong and weak topologies; Strong & weak convergences
10	Nov 25-29	Inner product spaces; Hilbert spaces; Examples
11	Dec 2-6	Orthogonal subspaces; Orthogonal complements; Orthogonal projection; Orthogonal sets
12	Dec 9-13	Dual of Hilbert spaces, The Riesz representation theorem
13	Dec 16-20	Linear operators in Hilbert spaces; Adjoint operators; Symmetric operators; Self-Adjoint operators
Dec 21, 2006 – Jan 5, 2007: Eid al-Adha Vacation		
14	Jan 6-10	Forms and variational equations; Lax-Milgram theorem
15	Jan 13-17	Banach algebras; Examples; Properties; Resolvent sets; Spectrum

- KFUPM attendance policy will be enforced.
- **Evaluation Policy:** Exams I & II: 20% each; Final exam (comprehensive): 40%, Presentation & Assignments: 20%.