

King Fahd University of Petroleum and Minerals
Department of Mathematics and Statistics
SYLLABUS 091 (Salim Messaoudi)

Course: Math 538
Title: Applied Functional Analysis
Textbook: Functional Analysis with Applications, A.H. Siddiqi, Khalil Ahmed, P. Manchanda, Anamaya Publishers, (2007)

References

1. Elements of Nonlinear Analysis, Michel Chipot
2. Nonlinear Functional Analysis, Klaus Deimling
3. Functional Analysis, Erdogan Suhubi,

Objectives: This course is designed to introduce the graduate students to some structures of infinite dimensional vector spaces, Various type of convergence in these spaces, Calculus in Normed spaces, and Applications to PDE's and Optimization

Outcomes By the end of the course, the students should be able to

- 1) Do some basic calculus in Normed spaces
- 2) Apply the fixed point theorem to solve some nonlinear problems
- 3) Find weak solutions for some elliptic problems
- 4) Find weak solutions for some variational inequalities

Main Topics Metric spaces, Banach spaces, Hilbert spaces, Sobolev spaces, PDE's and Variational inequalities, Weak convergence and weak solutions, Differentiation and integration in Banach spaces, Fixed point theorems and applications.

Important information

Oct. 14	Last day for dropping course(s) without permanent record
Nov. 11	Last day for dropping course(s) with grade of "W" thru Internet
Dec. 23	Last day for withdrawal from all courses with grade of "W" thru the Univ Registrar Office
Jan. 20	Last day for withdrawal from all courses with grade of "WP/WF" thru the University Registrar Office

Grading Policy

Office: 5-315 Tel: 860- 4570 E-mail: messaoud@kfupm.edu.sa
webpage http://faculty.kfupm.edu.sa/math/messaoud
Grading Policy: Midterm 35%; HW: 30%, Final 35% .

Weekly Coverage of the Course Material

Week	Date	Topic
1	Oct.3-7	The metric and the metric topology Various metric spaces
2	Oct. 10-14	Completeness of metric spaces Contraction mappings
3	Oct. 17-21	Normed Spaces Semi-Norms Series of Vectors
4	Oct. 24-28	Bounded Linear operators Continuous linear functionals Topological dual Strong and weak Convergence
5	Oct. 31-Nov. 4	Inner product and Hilbert Spaces Orthogonal subspaces
6	Nov. 7-11	Duals of Hilbert spaces Linear operators in Hilbert spaces
7	Nov. 14-18	Sobolev Spaces: Definitions of $W^{1,p}$, Extension, , Dual space.
		Eid Adha Break Nov. 19 -Dec. 4
8	Dec.5-9	Embeddings, Poincare's inequality
9	Dec. 12-16	Bilinear Forms and Lax- Milgram Lemma
10	Dec.19-23	Elliptic problems (Dirichlet and Neumann)
11	Dec.26-30	Variational Inequalities (Stampacchia Theorem), Applications
12	Jan. 02-06	Calculus in Normed Spaces: Frechet and Gateaux Derivatives
13	Jan. 09-13	Fixed Point Theorems
14	Jan.16-20	Applications to some nonlinear Elliptic Problems
15	Jan. 23-27	Catch up