

King Fahd University of Petroleum & Minerals

Department of Mathematics and Statistics

Course Syllabus

MATH 535 [Functional Analysis I]

Semester I-2014-2015(141)

(Course Instructor: A. R. Khan)

Textbook: E.S.Suhubi, *Functional Analysis*, Kluwer Academic Publishers, 2003.

References:

1. E. Kreyszig, *Introductory Functional Analysis with Applications*, John Wiley & Sons, 1989.
2. C. Groetsch, *Elements of Applicable Functional Analysis*, Marcel Dekker, 1980.
3. B. Bollobas, *Linear Analysis*, Cambridge University Press, 1990.

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, Uniform Boundedness Principle, Open Mapping and Closed Graph theorems, Riesz Representation Theorem, Banach Fixed Point Theorem and their applications will be discussed.

Catalogue

Description: Normed linear spaces, Banach spaces, Hilbert spaces, Banach Algebras (definitions, examples, 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).

| Week | Date | Material |
|--|------------|--|
| 1 | Sep 1-4 | Metric space; Topological concepts; Examples |
| 2-3 | Sep 7-18 | Normed spaces; Banach spaces; Examples and Basic concepts. |
| 4 | Sep 21-25 | Bounded linear operators and their examples |
| Eid al-Adha Vacations 28 Sep – 9 Oct , 2014 | | |
| 5 | Oct. 12-16 | Finite dimensional normed spaces and subspaces |
| 6 | Oct 19-23 | Dual spaces; Examples; Banach fixed point theorem |
| 7 | Oct 26-30 | Hahn-Banach theorem; Consequences and applications |
| 8-9 | Nov 2-13 | Baire's category theorem and uniform boundedness principle |
| 10 | Nov 16-20 | Open mapping and closed graph theorems; their applications |
| 11 | Nov 23-27 | Reflexive spaces; Weak topology and weak convergence |
| 12-13 | Dec 1- 11 | Inner product spaces; Hilbert spaces; Examples |
| 14 | Dec 14-18 | Riesz representation theorem; Applications |
| 15 | Dec 21-25 | Banach algebras; Examples; Properties |

- KFUPM attendance policy will be enforced.
- **Evaluation Policy:** Exams II & I: 22% each; Final exam (comprehensive): 36%, Presentation & Assignments: 20%.
- **Office: 5-505 [Phone # 2237] Email: arahim@kfupm.edu.sa**
- **Office Hours:** Sunday, Tuesday, Thursday [1.10-2.00 P.M. & 3.10-4.00 P.M.]