University of Management and Technology

School of Science

Department of Mathematics

Course Code: MTH511

Course Title: Advanced Functional Analysis -I

Program: MS
Course Outline Updated

Schedule		Pre-requisite	
Course Coordinator	Dr. Ghulam Murtaza	**Contact**	Ext 3341 Cell: 03007830051
Course Description	In this course, we will discuss the basics of functional analysis and how to analyze different problems from different filed of studies and suggest some optimal solution to the problems. **TOPICS:** 1. Basic concepts related to metric spaces, open set, closed set, neighborhoods. 2. Normed spaces, examples of normed spaces. 3. Properties of normed spaces. 4. Finite dimensional normed spaces. 5. Banach spaces and properties of Banach spaces. 6. Continuous linear transformations. Further properties of continuous linear transformation. 7. Linear Operators and Linear Functionals on finite dimensional spaces; 8. Hilbert spaces and related examples of Hilbert spaces 9. Orthogonality. 10. Representation of functionals on Hilbert spaces 11. Hilbert-adjoint operator. 12. Normal operators. 13. Self-adjoint and unitary operators **14. Mid-Term Exam** 15. Fundamental Theorems for Normed and Banach spaces 16. Spaces: Zorn's Lemma 17. Normed spaces of operator spaces; 18. Normed spaces of dual spaces; 19. Hahn-Banach Theorem: Real version 20. Hahn-Banach Theorem: Complex version 21. Uniform boundedness theorem and its applications 22. Strong, weak and weak* topologies 23. Open mapping and closed graph theorems		

Expected Outcomes	- Able to apply and extend the several theoretical results to real word problems. - Comparative analysis can be made amongst the latest techniques - Able to read, understand and explore research articles about the latest techniques of non-linear analysis.
Text Book(s)	1. A Course in Functional Analysis, 2nd ed. by John B. Conway. 2. Introductory Functional Analysis with Applications by Erwin Kreyszig
Reference books/ research Papers:	1. Linear Functional Analysis by Bryan P. Rynne and Martin A. Youngson 2. Functional Analysis 2nd Edition by Walter Rudin 3. Elements of the Theory of Functions and Functional Analysis by: A. N. Kolmogorov, S. V. Fomin **We will also discuss maximum possible latest research paper on the techniques non-linear functional analysis**

Quiz/assignments	3-4	**Project**	1 project from advanced topics and/or research papers
Presentation	1 research paper from group of at most 3 students	**Midterm Examination**	1 midterm Examination
		Final Examination	1 final Examination
Attendance Policy	According to university policy		

Grading Policy			
Quiz/assignments	15%	**Midterm Examination**	20%
Presentation/ Project	25%	**Final Examination**	40%