**University of Management and Technology**



**School of Science**

***Department of Mathematics***

**Course Code: MTH711**

**Course Title:** Operator Theory -I

**Program: PhD**

**Course Outline Updated**

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| **Schedule** |  | **Pre-requisite** |  | |
| **Course Coordinator** | Dr. Naeem Saleem | **Contact** | Ext 3498  Cell: 03214262145 | |
| **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. Convergence, Cauchy sequence, completeness. 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. Hilbert spaces and related examples of Hilbert spaces 8. Orthogonality. 9. Representation of functionals on Hilbert spaces 10. Hilbert-adjoint operator. 11. Normal, self-adjoint and unitary operators. 12. Mid-Term Exam 13. Fundamental Theorems for Normed and Banach spaces 14. Spaces: Zorn’s Lemma 15. Hahn-Banach Theorem: Real and Complex version 16. Adjoint operators. Reflexive spaces 17. Uniform boundedness theorem and its applications 18. Strong, weak and weak\* topologies Convergence of sequences of operators and functional 19. Open mapping and closed graph theorems 20. Spectral Theory of linear operators in normed spaces | | | |
| **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](https://www.amazon.com/Walter-Rudin/e/B00456TAWE/ref=dp_byline_cont_book_1) 3. Elements of the Theory of Functions and Functional Analysis by: [A. N. Kolmogorov](http://doverpublications.ecomm-search.com/search?keywords=A.%20N.%20Kolmogorov), [S. V. Fomin](http://doverpublications.ecomm-search.com/search?keywords=S.%20V.%20Fomin)   **We will also discuss maximum possible latest research paper on the techniques non-linear functional analysis** | | | |
| **Assignments** | 2 Assignments | **Project** | | 1 project from advanced topics and/or research papers |
| **Presentation** | 1 research paper from group of at most 2 students | **Final**  **Examination** | | 1 Final Examination |
| **Attendance**  **Policy** | According to university policy | | | |
|  | **Grading Policy** | | | |
| **Assignments** | 20% | **Project** | | 20% |
| **Presentation** | 30% | **Final**  **Examination** | | 30% |