Department of Mathematics
Faculty of Mathematics & Computer Science
M.Sc. (Applied Mathematics), 3rd Semester

Course Code	AM 301
Course Title	Functional Analysis
Course Credits	04

Course Objectives:
The contents of this course form an essential setting for application courses, e.g., Fourier Analysis, ODE, PDE etc.

Minimum Pre-requisites:

Basic knowledge of real/complex analysis and metric spaces will be useful.

Course Structure:

Normed Spaces and Banach Spaces. Definitions, properties, compactness, linear operators, linear functionals, finite dimensional cases, spaces of operators, dual spaces.

Inner Product Spaces and Hilbert Spaces. Definitions, properties, orthogonal sets and complements, Legendre polynomials, Hermite polynomials, Laguerre polynomials, representation of functionals on Hilbert spaces, Hilbert adjoint operator, Self adjoint, unitary and normal operators.

Fundamental Theorems and Convergence. Hahn Banach Theorem, Uniform Boundedness Theorem, Open Mapping Theorem, Closed Graph Theorem, strong convergence, weak convergence, weak* convergence, adjoint operator, reflexive spaces.

Applications. Banach fixed point theorem, approximation in normed spaces, convexity, uniform approximation, Chebyshev polynomials, approximation in Hilbert spaces, splines.

Spectral Theory. Spectral theory in finite dimensional normed spaces, regular value, resolvent, spectrum, spectral properties of bounded linear operators, spectral mapping theorem for polynomials, spectrum and spectral radius for complex Banach spaces.

Reading Suggestions:

- **E. Kreyszig,** *Introductory Functional Analysis with Applications,* John Wiley & Sons (Asia) Pte. Ltd., Singapore, 2010.
- **G.F. Simmons,** *Introduction to Topology and Modern Analysis,* Tata McGraw Hill Pvt Ltd., 2004.
- **J.B. Conway,** *Functions of One Complex variable*, Springer-Verlag, 1978.

Evaluation and Weightage:

- Mid-Term Examination (20%): During the middle of the session, there will be a written examination.
- Assignments (20%): In all 4 assignments will be given, one in each month.
- Quiz/Presentations (20%): As per the lecture schedule, Quiz session will be organized and students will be asked to make presentations. The topics will be assigned during the lectures.
- Term-End Examination (40%): At the end of the session, there will be another written examination.