

# Abstract

In this thesis we study fractional evolution equations defined in abstract spaces specifically in Banach spaces. The main motivation behind is successfully growing applications of fractional calculus in many areas of science and engineering.

This thesis begins with introduction to some preliminary results concerning fractional calculus, functional analysis, semigroups and measures of noncompactness. Existence and uniqueness results are established for a class of fractional semilinear equations with abstract Volterra operators using Schauder fixed point theorem. We study the sufficient conditions which guarantee existence of mild solutions for fractional evolution equations with nonlocal initial condition. The existence of an optimal solution for a fractional control problem involving Caputo fractional derivative is obtained.

Also we give an existence result concerning global  $L^p$ -solutions for a class of fractional integral equations in separable Banach space. Several examples are given to illustrate usefulness and applications of our abstract results.