Abstract
Integral equations occur naturally in many fields of mechanics and mathematical physics. They also arise as representation formulae for the solution of differential equations. Indeed, a differential equation can be replaced by an integral equation which incorporates its boundary conditions. Integral equations also form one of the most useful tool in many branches of pure analysis, such as the theories of fundamental analysis and stochastic processes. Many physics problems which are usually solved by differential equations method can be solved effectively by integral equation methods.

The research reported in this thesis deals with different types of integro-differential equations. Existence and uniqueness of solutions of nonlinear integro-differential equations are first discussed. Next, the problem of existence of existence of mild solutions to a second order integro-differential equations have been studied. Next, existence of mild solutions to a second order partial differential equations with nonlocal conditions through fixed point theory have been established. Then, we examine the existence of solutions to nonlinear mixed Volterra-Fredholm integro-differential equations. Finally, nonlocal problems for delay integro-differential equations in Banach spaces are studied in detail.

Our approach here is based on the fixed point theorems such as Banach contraction principle, Leray-Schauder alternative and Schaefer's. Examples and applications are provided to illustrate the theory.