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 Title of Thesis

Types of Stability of Dynamic Equations on Time Scales

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### ABSTRACT

The theory of time scales was introduced by Hilger, in order to unify continuous and discrete analysis. Preliminary studies on some basic applications of calculus on time scales were presented by Agarwal and Bohner. The study of dynamic equations on time scales has been established in order to unify the study of differential and difference equations. Stability theory is a very important problem in the theory and applications of differential equations. The most fundamental concepts of stability were introduced by Lyapunov in the late 19<sup>th</sup> century.

In This thesis is devoted to studying many types of stability of some dynamic equations on time scales of third order. Specially, Hyers-Ulam, Hyers-Ulam-Rassias and many types of (Lyapunov's First or Direct Method) stability of dynamic equations on time scales.

In Chapter ١, we give a brief introduction to the calculus on time scales. We present the definition and many properties of the generalized exponential function  $e_A(t, t_0)$  in time scales. In section (١.٥), we introduce the concept of a rd-continuous matrix, a regressive matrix and the time scale matrix exponential. Finally, we state some results of the operator exponential function  $e_A(t, s)$  in Banach spaces.

In Chapter ٢, we present definitions and theorems of Hyers-Ulam and Hyers-Ulam-Rassias stability of differential equations. Also, we exhibit some results of Hyers-Ulam and Hyers-Ulam-Rassias stability for the first and second order dynamic equations on time scales.

In Chapter ٣, This chapter is devoted to exhibiting a study on Lyapunov stability. We introduce many results concerning with many types of stability of solutions of dynamic equations on time scales.

In Chapter ٤, we obtain our results concerning with Hyers-Ulam and Hyers-Ulam-Rassias stability for two dynamic equations on time scales of third order.

In Chapter ٥, we establish in this chapter new results about Lyapunov stability of the same equations mentioned in Chapter ٤. We investigate many types of stability (stability, uniform stability, exponential stability, uniform exponential stability, h-stability and uniform h-stability).