

Abstract

The aim of this thesis is to explore the intrinsic properties of Gallai graph $\Gamma(G)$ of a simple graph G (introduced in [25]) in the context of combinatorial commutative algebra. We use $\Gamma(G)$ to introduce a simplicial complex $\Delta_\Gamma(G)$ namely Gallai simplicial complex of a graph G . We introduce the concept of Gallai-indices, and give its characterization for various classes of graphs like wheel graph W_{n+1} , friendship graph F_n . More importantly, we show that the face ring of Gallai simplicial complex of wheel graph $\Delta_\Gamma(W_{n+1})$ is Cohen-Macaulay. The Gallai simplicial complex of friendship graph $\Delta_\Gamma(F_n)$ is shellable. At the end, we give formulation of the f -vectors of wheel graph W_{n+1} and friendship graph F_n , and using these Propositions along with Theorem 2.2.10 we find the Hilbert series of wheel graph W_{n+1} and friendship graph F_n .