In this thesis, we studied the nonlinear dust ion-acoustic (DIA) waves in a plasma that consists of cold and hot electrons, ions and immobile dust particles. In our study, we considered electrons as nonthermal which follow Cairns and kappa distributions, and compared the results from both the distributions. We derived Kadomtsev-Petviashvili (KP) and Kadomtsev-Petviashvili-Burger's (KPB) equations by using the reductive perturbation technique for nonlinear DIA waves. For KP equation, for Cairns and kappa distributions, we found that the width and amplitude of the solitary structures increase with the increase in cold electron population, dust density, temperatures of cold and hot electrons. Also the amplitude of the solitary structures increases significantly but width decreases with the decrease in nonthermal parameters for cold as well as hot electrons. Moreover, we obtained compressive as well as rarefactive structures for different values of cold electron density. We obtained similar results for KPB equation with slight variation for both the distributions. It is also found that soliton and shock structures are obtained in subsonic regime for kappa distributed plasma whereas these are obtained in supersonic regime for Cairns distributed plasma.