The piece of work in the thesis is in relation to nonlinear solitary waves under different physical situations in plasmas. The thesis consists of six chapters including the introduction. In the chapter introduction, a brief description of plasmas as regards how it occurs both in nature and laboratory is incorporated. Discussion on experimental devices to develop techniques to generate plasma with high temperature and its confinement for fusion reaction, is also made with reference to various tokamaks installed in different parts of the world. Besides, the validity of the fluid model for the study of nonlinear waves in plasmas is explained. It contains an elaborate history of the development of solitary waves (a kind of nonlinear waves arising out of the interaction between nonlinearity and dispersion that moves without changing its shape) with innumerable references. Furthermore, different nonlinear equations in connection with the studies of solitary waves have also been discussed together with their methods of solution.

In the latter chapters, we use these nonlinear equations in appropriate physical situations of plasmas and try to make physical plausibility and explanations. Interesting results in respective chapters are also cited.

In chapter 2, we investigate theoretically the propagation of ion acoustic solitons in a warm plasma in presence of negative ions and Boltzmann distribution of electrons through
the modified KdV equation. In the general procedure of derivation on the KdV equation, the physical quantities are expanded in terms of a small parameter $\epsilon (\epsilon \ll 1)$ retaining only terms up to second order. But for the consideration of higher order nonlinearity and to extract more inner ideas of the phenomena, we take the help of different set of stretched variables and derive the modified KdV equation setting the nonlinear coefficient of the KdV equation to zero which gives the critical density. We establish the existence of both compressive and rarefactive solitons at different critical densities for different temperature ratios when the mass ratio of the negative to the positive ions is greater than unity and the first order velocity perturbation of the positive ions bears a constant ratio to that of the negative ions. It is also demonstrated in this case that no modified KdV soliton exists at the critical density in a warm plasma with negative ions when the mass ratio is less than unity.

In chapter 3, a kind of hydromagnetic waves known as solitary Alfvén waves travelling along the direction of the unperturbed magnetic field is studied. It is related to low frequency ion oscillations in which the wave frequency ($\omega$) is well below the ion cyclotron resonance ($\omega_c$). An exact nonlinear Alfvén wave in a low-$\beta$ plasma where $\beta$ is the ratio of the kinetic to the magnetic pressure, has been investigated and both super and sub-Alfvénic rarefactive solitons are shown to exist depending upon the angle of inclination of the propagation vector to the direction of the magnetic field.
Chapter 4, is devoted to the study of fully nonlinear ion acoustic waves in presence of magnetic field with new emphasis on the drifting effect of the electrons. For the highly magnetized electrons, the fluid equation of motion together with the initial drift motion in the direction of the magnetic field is considered. It is demonstrated that only subsonic solitary ion acoustic waves with density hump and dip exist in different ranges with different velocities for the inclusion of the initial drift motion of the electrons. In each range of existence of solitons, the upper limit of the drift velocity is reported to acquire at the least value of $kz$.

In chapter 5, we consider the three dimensional propagation of the ion acoustic waves in a warm magnetoplasma without requiring any symmetry on the wave surfaces together with the Boltzmann distribution of the electrons. Considering the variation of the plasma parameters in all directions at the initial time, the existence of both compressive and rarefactive solitons has been established. Besides, these solitons are shown to be supersonic as well as subsonic depending upon the ion temperature. But it is demonstrated that in a two component cold plasma, solitons are always subsonic which may be both compressive and rarefactive.

The chapter 6 deals with the systematic study of the problem of Langmuir solitons for both the values of the mach number greater or less than unity. We have studied here the quasi-static slow plasma response to the Langmuir wave in which we consider two types of oscillations - high frequency Langmuir oscillation of the electrons and low frequency ion and electron
oscillations. In the domain of forced quasi-static modulation the low frequency perturbation of the ions has been considered to obey the Boltzmann distribution. The existence of only single hump Langmuir soliton has been established for both the values of the Mach number greater or less than unity.