Summary

The phenomena of electron - atom collisions, especially $\bar{e} - H$ and $\bar{e} - He$ collisions, have been investigated in this thesis. Apart from the information of the structure of the atom, the collision process is of importance in view of its applications in different branches of Physics like Atmospheric Physics, Plasma Physics and Astrophysics. The production of power from controlled thermonuclear fusion and the recent development of laser beams require extensive study and application of atomic collision processes. The investigation of resonance phenomena in atomic scattering has become a subject of great interest to atomic physicists. The resonances play an important role in impurity scattering effects in metals and crystals.

The present thesis consists of two chapters.

In Chapter I we have presented a short review of the important works allied to our investigations on the problems of $\bar{e} - H$ and $\bar{e} - He$ collisions with special reference to atomic resonance phenomena at the end of the chapter.

Chapter II contains six sections. Sections A and B deal with the investigations carried out on the elastic scattering of slow electrons by hydrogen atom. Variational method of Hulthén has been employed to calculate the $S$ wave phase shifts. To make allowance for the polarisation effect we have considered the virtual excitation from $1s$ state to $2s$ and $2p$ states in our
formulation. In Section A we have neglected the exchange effect and in Section B this effect has been taken into account, by properly antisymmetrising the total wave function. The occurrence of pronounced resonance levels in both the calculations are the remarkable features of our investigations.

In Section C we have calculated the S wave phase shifts in elastic scattering of electron by atomic hydrogen applying the variational method of Hulthén. The integro - differential equation of Temkin and Lamkin in the adiabatic exchange approximation has been solved. Calculations have also been performed for the polarisation potential of Ob'edkov.

Section D deals with the problem of elastic and inelastic scattering of electrons by atomic hydrogen for high energy region in Ochkur approximation.

In Section E, using the variational method of Hulthén we have investigated the effect of polarisation on the elastic scattering of electron by helium atom. We have neglected the exchange effect and have considered the virtual excitation from 1's state to 2's state only of helium atom.

In Section F we have carried out the investigation on the problem of e - He scattering taking proper account of the exchange effect. Here virtual excitations from 1's state to 2's and also to 2^3s states of helium atom have been considered.
In most of our problems we have used Hulthén variational method to calculate phase shifts. Physical intuition plays an important role and with proper choice of wave function Hulthén variational method yields good results. The difficulties of solving numerically the coupled integro-differential equations have been avoided in our variational treatment. Our variational formulation in $e - H$ collision problem of Chapter II (Sections A and B) has been able to reveal the resonance levels. By proper modifications in our variational trial wave function in $e - H$ scattering, a detailed knowledge of the structure and refinement in the position of resonance level may be achieved.

By applying Ochkur approximation to the problem of elastic and inelastic scattering of electron by hydrogen atom, we find that, taking the exchange effect into consideration, this approximation is simple and yields reasonably good results.