This thesis is an outcome of the researches carried out by the author under the supervision of Dr. K. K. Singh, Professor of Mathematics, North-Eastern Hill University, Shillong. The thesis has been divided into five chapters and each chapter has been subdivided into a number of sections.

The first chapter is introductory. It gives, in brief, an idea about Shock Waves, Fundamental Equations of a Non-Ideal Gas, Fundamental Equations of Mixture of a Non-Ideal Gas and Small Solid Particles, Radiative Transfer Equations and The Concept of Self-Similarity, as used in the thesis.

In the chapter II, we have obtained similarity solutions for one-dimensional unsteady flow of a dusty gas behind a strong spherical shock wave with time dependent energy-input. The dusty gas is assumed to be a mixture of small solid particles and a non-ideal gas, in which solid particles are continuously distributed. In order to get some essential features of the shock propagation, the solid particles are considered as a pseudo-fluid and it is assumed that the equilibrium flow condition is maintained in the flow-field, and that the viscous stress and heat conduction of the mixture are negligible. Solutions are obtained, in both the cases, when the flow is isothermal or adiabatic. It is observed that the assumption of zero temperature gradient brings a profound change in the velocity distribution as compared to that of the adiabatic flow; whereas the pressure and density distributions are little affected. Effects of a change in the value of the parameter of non-idealness of the gas in the mixture $\tilde{b}$, the mass concentration of solid particles in the mixture $k_p$, the
ratio of the density of solid particles to the initial density of the gas $G_1$ and the index for the time dependent energy law $s$ on the strength of the shock and on the flow field behind it are investigated. It has been found that the non-idealness of the gas in the mixture $\bar{b}$, the mass concentration of solid particles in the mixture $k_p$ and the ratio of the density of solid particles to the initial density of the gas $G_1$ have significant effects on the flow variables, on the shock strength and on the location of the piston. Also, an increase in the index for the time dependent energy law $s$ increases the shock velocity and all the flow variables at any point in the flow field behind the shock front.

In the chapter III, we have considered the similarity solutions for one-dimensional unsteady adiabatic flow of a dusty gas behind a spherical shock wave with time dependent energy-input under the influence of a gravitational field. The gravitational field is due to a heavy nucleus at the origin (Roche Model). The dusty gas is assumed to be a mixture of small solid particles and a non-ideal gas. It is assumed that the equilibrium flow condition is maintained in the flow-field, and that the viscous stress and heat conduction of the mixture are negligible. The total energy of the flow-field behind the shock is increasing. In order to obtain similarity solutions the density of the undisturbed medium is assumed to be constant. The effects of an increase in the mass concentration of solid particles $k_p$, the ratio of the density of the solid particles to the initial density of the gas $G_1$, the gravitational parameter $G_0$ and the parameter of non-idealness of the gas $\bar{b}$ on the flow-field and on the shock strength are investigated. It has been found that an increase in the value of the parameter of non-idealness of the gas in the mixture $\bar{b}$ and the gravitational parameter $G_0$ increase the distance of inner expanding surface
from the shock front, i.e. to decrease the shock strength and an increase in the value of $G_1$ decreases the distance of inner expanding surface from the shock front and hence increases the shock strength. Also, an increase in the value of $k_p$ decreases the shock strength for lower values of $G_1$ and increases it for higher values of $G_1$.

In the chapter IV, we have investigated the propagation of a cylindrical shock wave in a rotating axisymmetric flow of a mixture of a non-ideal gas and small solid particles with heat conduction and radiation heat flux, which has a variable azimuthal fluid velocity together with a variable axial fluid velocity. The shock is assumed to be driven out by a piston moving with time according to power law. The fluid velocities in the ambient medium are assumed to be varying and obey power laws. The density of the ambient medium is assumed to be constant. The shock wave is isothermal, the heat conduction is expressed in terms of Fourier’s law and the radiation is considered to be of the diffusion type for an optically thick grey gas model. The thermal conductivity $k$ and the absorption coefficient $\alpha_R$ are assumed to vary with temperature and density. In order to obtain similarity solutions the angular velocity of the ambient medium is assumed to be decreasing as the distance from the axis increases. Similarity solutions are obtained and the effects of variation of the parameter of non-idealness of the gas in the mixture $\bar{b}$, the mass concentration of the solid particles in the mixture $k_p$ and the ratio of the density of solid particles to the initial density of the gas $G_1$ are investigated. It has been found that the non-idealness of the gas in the mixture has decaying effect on the shock wave, and an increase in $G_1$ increases the shock strength. Also, an increase in $k_p$ decreases the shock strength.
In the chapter V, we have discussed the propagation of a spherical shock wave in a dusty gas with heat conduction and radiation heat flux, in the presence of a gravitational field due to heavy nucleus at the center (Roche Model). The shock is assumed to be driven out by a piston (an inner expanding surface) and the dusty gas is assumed to be a mixture of a non-ideal gas and small solid particles. In order to get some essential features of the shock propagation, small solid particles are considered as a pseudo-fluid and it is assumed that the equilibrium flow condition is maintained in the flow-field. The shock wave is isothermal, the heat conduction is expressed in terms of Fourier’s law and the radiation is considered to be of diffusion type for an optically thick grey gas model. The thermal conductivity $k$ and the absorption coefficient $\alpha_R$ are assumed to vary with temperature and density. In order to obtain similarity solutions the density of the undisturbed medium is assumed to be constant. Similarity solutions are obtained, and the effects of variation of the parameter of non-idealness of the gas in the mixture $\tilde{b}$, the mass concentration of solid particles in the mixture $k_p$, the ratio of density of solid particles to the initial density of the gas $G_1$ and the gravitational parameter $G_0$, on the flow-field behind the shock, are obtained. It has been found that the non-idealness of the gas in the mixture and the presence of gravitational field have decaying effect on the shock wave and an increase in $G_1$ increases the shock strength. Also, an increase in $k_p$ decreases the shock strength for lower values of $G_1$ and increases it for higher values of $G_1$. 