Objective and Scope of the Thesis

One of the most important achievements in the field of stationary transport theory is the discovery of H' and X' and Y' function for problems in semi-infinite and finite media. It is found that all most all problems can be reducible to the solution of certain relations involving those functions. A great volume of literature is available on this matter. Various authors used various techniques to deduce these functions. A complete investigation of various analytic properties with existence problem has been discussed in Busbridge's work (1960). Chandrashekhar (1960), using the principle of invariance also investigated the nature and properties of these functions and presents some numerical results. However he did not solve the problem of uniqueness of the solution he proposed. This problem was solved completely by Mullikin (1964). Sobolev (1963) also deduced the same functions using probabilistic approach. In a nutshell it can be remarked that this area of transport theory has become saturated. However, this is not the case for non-stationary transport theory. Very few articles are there which are devoted to the study of non-stationary transport problems related to non-stationary version of above mentioned functions. In a series of papers Matsumoto (1967) formulated the X' and Y' functions for inhomogeneous atmosphere via principle of invariance. Later he (1974) formulated time-dependent H-function for anisotropically scattering atmosphere.

The form of H-function differs much from that developed by Minin (1971).

In the present undertaken, our main attempt is to formulate time-dependent X' and Y', functions for various problems in non-stationary transport theory by using the successful approach in stationary transport theory. Not only this, but also a part of sub-chapter IG is devoted to formulate H'-function using Busbridge's approach.

During the recent past a very good semi-analytical approach has been developed and successfully applied to all spheres of transport theory except time-dependent transport processes. A complete and comprehensive review was given by (1985). A vast amount of numerical works with easier effort have been compiled with greater successes. But no such work has been reported for the case of non-stationary transport theory. We have devoted a chapter in this undertaken to formulate the main equations which forms the basis of the method (F_n method). We have not reported any numerical result.

A formulation of functional equations which governs the scattering and transmission of non-stationary radiation field in a planetary atmosphere is done. The stationary formulation of such problem in case of Lambert law reflector or diffuse reflector has been done by Muka (1975). Non-stationary formulation of such problem is done here with the introduction of a time-dependent probability function, the form of which is kept arbitrary.

The stationary part (Chapter-II) of our undertaken consists two sub-chapters. In the first, we have used a technique which consists of a series expansion of functions to solve analytically the transport problem in multiregion media. A generalized problem is chosen so that by only changing the co-efficients in the boundary conditions a variety of problems and its solution can be generalized. The resulting equations contains integrals consisting of known rational functions which can be evaluated. The last sub-chapter is devoted to the solution of a line-transfer problem with complete frequency redistribution using a method of linear singular operators in combination with Laplace transform. The method was developed first by Das (1978) and effectively applied to stationary transport equations other than line-transfer problems. The solution has come out involving X' and Y' functions which were extensively studied by Ivanov (1973) We have omitted details of derivations as they are well known.