ABSTRACT

The thesis consists of seven chapters. In Chapter 1, a brief introduction to fluid mechanics along with non-Newtonian fluids and its classification and applications has been given. The various fluid flow mechanisms like porous media, heat transfer, mass transfer, magnetohydrodynamics, no-slip and slip boundary conditions and chemical reaction are presented. The self-similar solution, homotopy perturbation method and non-dimensional parameters relating to this study are also discussed. A brief review of the relevant areas of this present study, motivation and objectives of this study is integrated in last section.

In Chapter 2, an investigation is initiated to examine the heat transport and slip effects on steady elastico-viscous boundary layer fluid motion past a flat permeable plate. The non-Newtonian fluid model Walters Liquid (Model B′) is taken for elastico-viscous fluid. The special forms of slip factors involving local Reynolds number are considered. Using similarity variables, the governing equations of fluid motion along with boundary conditions are reduced to self-similar form to solve by inbuilt MATLAB solver 'bvp4c'. The computed results of velocity, temperature, temperature gradient at the plate and skin-friction coefficients are plotted for discussion to find the impact of involved flow parameters. The study reveals that elastico-viscosity plays a significant role to enhance the fluid velocity, heat transport rate and friction at the surface.

In chapter 3, the hydromagnetic visco-elastic boundary layer flow characterized by Walters Liquid (Model B') past an exponentially stretching sheet with suction or blowing has been investigated. Slip velocity considered instead of no-slip conditions at the boundary. Similarity transformations are obtained by careful inspection to convert the governing partial differential equations into nonlinear self-similar ordinary differential equations. The velocity profiles and the skin friction coefficient have been computed using MATLAB solver 'bvp4c' for various values of flow parameters involved in the solution. The velocity and the skin-friction coefficient have been plotted to observe the visco-elastic, slip velocity, magnetic and suction or blowing parameters effects in the flow field.

In chapter 4, the study intends to analyze how concentration changes at a flat porous plate affect the diffusion of a solute owing to chemical reaction in an elastico-viscous fluid through a porous media. Walter Liquid (Model B/) is taken for Elastico-viscous fluid and the variable chemical reaction rate is considered for the solute. Using the built-in Matlab

'bvp4c' algorithm, the equations regulate the fluid motion are transformed into a self-similar form by selecting the right similarity variables. The estimated outcomes of velocity and concentration for changes in flow variables are demonstrated by plots. The graphical presentation of skin-friction coefficient for some dominant flow parameters is also plotted. The effects of various flow feature parameters is discussed from graphs to bring out possible physical reasons. The fluid flow and the diffusion process in Elastico-viscous boundary layer flow are significantly influenced due to chemical reaction with the variation of surface concentration.

In Chapter 5, the two-dimensional boundary layer flow through a convergent channel of a non-Newtonian electrically conducting fluid characterized by Walters Liquid (Model $B^{'}$) in presence of transverse magnetic field has been investigated analytically using Homotopy perturbation method. Similarity solutions of the problem are obtained considering a special form of magnetic field. The velocity expression and skin friction coefficient at the wall have been attained and numerically worked out for different values of the flow parameters involved in the solution. The velocity and the skin friction coefficient have been presented graphically to observe the non-Newtonian effects for various values of the magnetic parameter across the boundary layer.

In Chapter 6, a theoretical approach has been made to investigate the hydromagnetic and slip impact on heat transport for elastico-viscous boundary layer fluid flow past a flat moving plate considering non-Newtonian fluid model Walters Liquid (Model $B^{/}$). To transform equations governing fluid motion to solvable form, similarity variables are introduced to obtain the self-similar resulting equations. The specially designed solver 'bvp4c' of MATLAB for solving boundary value problems is used for numerical computation. To study the influence of hydromagnetic and slip parameters on the elastico-viscous fluid together with other flow feature parameters, the computed results are plotted for discussion purpose from physical standpoint.

In Chapter 7, the fluid motion and heat transport across a stretching surface in an unsteady elastico-viscous boundary layer is investigated. The mathematical model Walters Liquid (Model $B^{'}$) is considered for elastico-viscous fluids. The fluid guided equations are converted to self-similar form by employing similarity variables. The Matlab inbuilt code 'bvp4c' is utilised for numerical computations of velocity and temperature, along with involved flow feature parameters. The impact of elastico-viscous, unsteadiness, and slip,

and no-slip conditions on the flow field is examined. The study reveals that elastico-viscous and velocity, and thermal slip parameters have a major impact on the fluid motion and the heat transition rate.