ABSTRACT

The thesis consists of six chapters. In chapter 1, a brief introduction to fluid mechanics and application of visco-elastic fluids has been included. The outline of various theories and results which are related to the present research work are included in this chapter. Brief descriptions of various fluid flow mechanisms are presented and some of the dimensionless numbers are also defined. A brief review of the relevant areas, motivation and objectives of this present study are integrated in last section.

In Chapter 2, the elastico-viscous boundary layer fluid motion over a flat permeable plate having a slip boundary is considered. The transition of thermal energy and mass transport mechanism has been analyzed. The elastic and viscous characteristic in the fluid is exhibited by Walters Liquid (Model $B^{'}$), a non-Newtonian fluid model. The permeable plate at which suction is applied is placed in the porous medium. The fluid domain receives thermal energy from the permeable plate. The governing equations of fluid motion with satisfying imposed boundary conditions are reduced to self-similar type by similarity transformation. The finite difference method-based solver 'bvp4c' of MATLAB code is employed to perform numerical computation. The impact of different involved flow parameters is illustrated from obtained graphs for discussions from a physical point of view.

In Chapter 3, the heat transport with combined interaction of pressure and buoyancy forces for visco-elastic fluid past a vertical plate along with slip condition is investigated. Visco-elastic nature of the fluid is explored by the Walters Liquid (Model $B^{'}$), a fluid model for non-Newtonian fluid. The fluid motion is guided by highly non-linear coupled differential equations. The governing differential equations are reduced to solvable self-similar form by employing relevant similarity transformation. The self-similar resultant governing equations are evaluated by inbuilt MATLAB solver 'bvp4c'. The numerically evaluated results of velocity component, temperature, and temperature gradient are represented graphically. The impacts of involved flow feature parameters on the fluid domain are illustrated from graphs for discussions to bring out physical insight. The fluid motion and the heat transition are substantially affected by the involved flow parameters.

In chapter 4, the analytical study using Homotopy perturbation technique has been initiated for two-dimensional steady elastico-viscous hydromagnetic fluid flow past a stretching permeable sheet. The elastico-viscous property in the fluid exhibited by Walters Liquid (Model $B^{'}$). The stretching permeable sheet is exposed to suction or blowing.

Similarity solutions are obtained by careful inspection to convert the governing equations of fluid motion into self-similar solvable ordinary differential equations. The velocity expression and shear stress at the stretching permeable sheet have been retrieved and numerically evaluated for different values of elastico-viscous, magnetic and suction or blowing parameters. The velocity distribution and skin friction expression are plotted to study the effects of involved flow feature parameters.

In Chapter 5, an investigation is initiated to study the solute diffusion with chemical reaction of the first order in non-Newtonian viscoelastic fluid through boundary layer over a stretchable exponential sheet due to variation in wall concentration. Walter Liquid (Model B/), a model of non-Newtonian fluid, exhibits the fluid's viscoelastic nature. The chemical reaction rate and distribution of wall concentration for the species are taken in exponential form. Utilizing suitable similarity variables, the equations guiding fluid motion and relevant satisfying boundary conditions are simplified to self-similar forms. The MATLAB solver ‘bvp4c' is used to evaluate the resultant equations. The concentration profiles computed numerically for different involved flow parameters are plotted. The impact of flow feature factors on the concentration profiles is analyzed from graphs from a physical point of view. The mass diffusion process due to chemical reaction in viscoelastic flow through boundary layer past a stretchable exponential sheet affected noticeably with the variation of wall concentration.

In Chapter 6, the steady hydromagnetic visco-elastic boundary layer laminar electrically conducting fluid with slip effects past a flat plate characterized by Walters Liquid (Model $B^{'}$) has been investigated. The heat transfer mechanism is also studied. Special forms of velocity and thermal slips are taken into account involving the local Reynolds number. The governing partial differential equations of fluid motion are transformed to ordinary differential equations by making use of suitable similarity variables. The transformed differential equations along with boundary conditions are solved with the help of bvp4c inbuilt MATLAB software. The computed numerical results of velocity, temperature and temperature gradient have been depicted graphically and discussed for different values of flow parameters involved in the solution. The skin friction coefficient is also evaluated and presented in tabular form for various values of magnetic parameter for discussion.