Preface

MHD is the branch of science which deals with the study of the interaction between the fluid motion and electromagnetic phenomena. The set of equations which describe MHD are a combination of the Navier –Stokes equations of fluid dynamics and Maxwell's equations of electromagnetism. These differential equations can be solved simultaneously, either analytically or numerically. Laplace transformation is one of the analytical techniques, which can solve many problems arising in the study of fluid mechanics. Moreover, Laplace transform techniques can be used for solving the governing system of partial differential equations are linear. Some of the MHD flow problem arising non-Linear system of partial differential equations whose solutions are difficult to finding analytically. HAM is one of the semi-analytical methods which can be used for said problems.

In this thesis, seven chapter are include. Chapter 1 deals with basic fundamental of the fluids and flows. Chapter 2 and Chapter 3 deals with unsteady free convective one dimensional MHD flow with heat and mass transfer. Chapter 4 and Chapter 5 deals with free convective two dimensional MHD flow with different physical conditions. The Remaining Chapter 6 to 7 deals with free convective three dimensional MHD flow with different types of the non-Newtonian fluids.

Chapter I is taken in order to build up a stronger structure in logical manner to provide knowledge of fundamentals of MHD flow, basic concept of non-Newtonian fluid specially discussed about Second grade fluid, Viscoelastic fluid, Casson fluid and nanofluid in details, heat and mass transfer effects, radiation effects, reaction effects, Heat generation effects and Soret effects, which is an essential part of the study to have a better understanding to study of MHD flow with heat and mass transfer through porous media. This chapter also includes an overview of the Laplace transform and inverse Laplace transform technique, Semi-analytical Homotopy analysis method for finding system of linear/non-linear partial differential equations with initial and boundary conditions. A brief history of the development of the subject is also obtained in review of relevant literature.

Chapter-II deals with the importance of heat transfer problem comprising non-Newtonian fluid has developed noticeably due to vide range of applications of non-Newtonian fluids. The indulgent of physics in such fluid flows have instant effects on polymer treating, varnish, ink-jet painting, micro fluids, geological flows, colloidal suspensions, liquid crystals, animal blood, turbulent shear

flow etc. Non-Newtonian flow embrace shear-thinning, shear thickness, viscoelasticity etc. This motivates this chapter to include the study of non-Newtonian flows

Chapter-III deals with the various substances like such as penetrating muds, clay coatings, oils, grease, molten polymers and emulsions are regarded as non-Newtonian fluids. A single model cannot be employed to justify properties of non-Newtonian fluids completely, they are more complicated compared to Newtonian fluids and this makes classification of non-Newtonian fluids tough. The present chapter is concerned with the study of heat generation/absorption effect on unsteady natural convective MHD Second grade fluid flow past an oscillating vertical plate in presence of thermal radiation and chemical reaction.

In fluid mechanics, fluid flow can be described either by one, two or three-dimensional space coordinates. Generally two or three dimensional fluid flow give better description of physical flow compared to that of one dimensional fluid flow problems. Though, this frequently lead to highly non-linear coupled governing equations and consequently seems to be more difficult to solve. **Chapter IV** deals with effects of magnetic field and thermal radiation on two dimensional Casson fluid flow. Important phenomena like chemical reaction, heat generation, heat absorption, Soret effect and Dufour effect are also taken in account.

In Chapter-V, several physical and practical situations that are directly related to fluid flow and heat transfer produced by stretching/shrinking sheet. The uses of such types of mechanisms are involved in industrial and engineering simulations of fluid transport due to stretching/shrinking. This investigation embraces the study two-dimensional viscoelastic fluid flow over a stretchable surface. The analysis is performed considering Brownian motion, chemical reaction, and thermophoresis into account.

Chapter-VI deals with three dimensional modelling of the fluid flow problems are more realistic compared to lower dimensional studies. Thus this chapter is dedicated to extend work discussed in previous chapters to higher dimensions. In this chapter deals with three dimensional MHD flow of Casson fluid past between horizontal plates. Here the considered fluid is conducting which passes through medium which has porosity.

In Chapter-VII, water based single phase nanofluids containing nanoparticles such as CuO or Al2O3 are discussed. Enhancement of heat transfer is beneficial in engineering and actual world problems. To achieve this, experiments considering composite nanoparticles in place of single

nanoparticle based nanofluids are performed. Consequently, investigators are fascinated towards heat transfer properties of composite nanofluids. Thermal conductivity of nanofluids is high, which is a motivation in this area, thus many investigators are doing research intensively.