Preface

Magnetohydrodynamics 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. Some of the MHD fluid flow problem arising non-linear system of partial differential equations whose solutions are difficult to find analytically. Homotopy analysis Method is one of the semi-analytical methods which can be used for said problems.

In this thesis, eight chapters are included. Chapter 1 deals with basic fundamental of the fluids and flows. Chapter 2 and 3 deals with entropy optimized MHD fluid flow with heat and mass transfer. Chapter 4 deals with MHD Williamson fluid flow with varying viscosity, Soret and Dufour effects. Chapter 5 deals with MHD Carreau fluid flow with varying viscosity and non-linear radiation. Chapter 6 deals with unsteady MHD Micropolar fluid flow over stretching sheet. Chapter 7 deals with entropy optimized unsteady Williamson fluid flow with viscous dissipation. Chapter 8 deals with EMHD fluid flow with slip effects.

Chapter 1 is taken in order to build up a stronger structure in logical manner to provide knowledge of fundamentals and applications of MHD fluid flow, mathematical models of Williamson fluid, Carreau fluid, and Micropolar fluids effects of heat and mass transfer, radiation, heat generation and absorption, Joule heating, viscous dissipation, Soret and Dufour effects, boundary conditions like slip condition and convective boundary conditions, linear and nonlinear stretching sheets are all covered in this Chapter. A brief history of the development of the subject is also obtain in review of relevant literature.

Chapter 2 deals with the importance of study about entropy optimization of MHD fluid flow due to its wide range of applications. Entropy optimization is used to enhance the system performance. MHD fluid flow research is important because it has numerous engineering applications. For example, slurry flows, industrial oils, diluted polymer solutions. This motivates this chapter to include the study of En-

tropy optimized MHD fluid flow.

In Chapter 3, nonlinear radiation effects on MHD fluid flow considering mass transfer are considered. Mass transfer finds application in industrial and chemical engineering processes. In processes comprising high temperature like polymer processes, nuclear power plants, glass production, gas turbines etc. radiation contributes an important role. So, mass transfer and nonlinear radiation effects are taken into account.

Chapter 4 deals with two dimensional modelling of Williamson fluid flow considering variable viscosity. Williamson fluid is characterized as a non-Newtonian fluid with shear thinning property. The viscosity of the fluid mainly depends upon temperature of the fluid along with fluid nature. The assumption of constant viscosity leads to measurable inaccuracies while calculating the surface calculating factors. Which is a motivation in this area, thus many investigators are doing research intensively.

In Chapter 5, several physical and practical situations that are directly related to fluid flow, heat and mass transfer produced by stretching sheet. The uses of such types of mechanisms are involved in industrial and engineering simulations of fluid transport due to stretching sheet. This investigation embraces the study two dimensional Carreau fluid flow over a stretching sheet. The analysis is performed considering Soret and Dufour effects into account.

Chapter 6 deals with effects of magnetic field and thermal radiation on two dimensional unsteady Micropolar fluid flow. Important phenomena like chemical reaction and viscous dissipation effects are taken into account.

Chapter 7 deals with two dimensional modelling of the fluid flow problems are more realistic compared to steady flow. This chapter deals with two dimensional unsteady flow of MHD Williamson fluid flow over stretching sheet. Also, in this chapter, viscous dissipation, Joule heating effects, chemical reaction effects and convective boundary conditions are taken into account.

In Chapter 8, Electromagnetohydrodynamic (EMHD) fluid flow is considered. EMHD is the area that concerns the study of dynamics of electrically conducting fluids under the influence of magnetic and electric fields. EMHD has raised quite an interest over the years due to its versatile application in geophysics, engineering and biomedical engineering, and many others. So, this chapter deals with EMHD Micropolar fluid flow considering velocity slip in the presence of viscous dissipation.