PREFACE

The thesis entitled, "A**nalysis of magnetic field effect on nanofluid flow**" is founded on the analysis on theoretical features of the mathematical modeling of various physical phenomena arising in nanofluid flow in presence of magnetic field. The key objective of this investigation is to focus on the fluid flow of electrically conducting nanofluids considering effects of various parameters. The motivation behind studying these flows lies in the cooling processes, nuclear reactors, metal extrusion, blood flow analysis, in which properties of the fluids like heat transfer or mass transfer can be enhanced using nanofluids. Research institutes like THE HELMHOLTZ-ZENTRUM DRESDEN-ROSSENDORF (member of the Helmholtz Association of German Research Centres), MHD RESEARCH INSTITUTE based at the University of Latvia, THE MAX PLANCK INSTITUTE, Göttingen are dedicated to research related to MHD. The thesis is comprised of eight chapters. First chapter describe introductory details as well as theoretical aspects of the research work carried out. Second to eighth chapters deal with different phenomena of one, two and three dimensional MHD nanofluid flow.

Chapter 1 is taken in order to build up a stronger structure in logical manner to provide knowledge of fundamentals of MHD flow, basic concepts of nanofluid, heat and mass transfer effects, radiation effects, heat generation effects and Soret effects. A brief history of the development of the subject is also given. Relevant literature has been surveyed. Further, Laplace transform technique for solving system of linear partial differential equations and Homotopy analysis method for solving system of non-linear equations are discussed.

The gravity-driven convective heat transfer is a vital phenomenon in the cooling mechanism of many engineering systems like solar collectors, cooling systems for nuclear reactors; because of its minimum cost, low noise, smaller size and reliability. There has been increasing interest in studying the problem of MHD with convective boundary layer flow and heat transfer characteristics over a vertical plate. Aim of Chapter 2 is the study of gravity-driven convective boundary layer flow of nanofluids past an oscillating vertical plate in presence of a uniform transverse magnetic field and thermal radiation.

The convective heat transfer phenomena in nature are often attended by mass transfer. Convective mass transfer process creates support of various procedures in chemical engineering. This appears like sufficient purpose to contain mass transfer in heat convection as well. Heat and Mass transfer problems, involving porous media have many engineering applications such as ground water pollution, geothermal energy recovery, crude oil extraction, thermal energy storage and flow through filtering media. Section 1 of chapter 3 deals with the mathematical analysis heat and mass transfer in unsteady natural convective MHD flow of electrically conducting water based nanofluid, past over an oscillating vertical plate. Section 2 of chapter 3 introduces mathematical modelling useful in studying fluid flow of some special fluids like blood, paint, crude oil and in food industries.

The effect of heat generation is very important in industrial processes. A thorough observation of the literature shows that, study of effects of internal heat generation is limited. Thus, Chapter 4 analyzes the effects of thermal diffusion and heat generation on the unsteady natural convective flow of radiating and electrically conducting nanofluid past over an oscillating vertical plate embedded in porous medium.

Two dimensional MHD flow problems are of more importance and realistic compared to one dimensional problems. Due to this reason, Chapter 5 is dedicated to the study of effects of magnetic field on two dimensional nanofluid flow with heat transfer.

In many real problems involving convection of nanofluids, mechanism such as thermophoresis and Brownian motion are evident, the concentration of nanofluids may not be considered as uniform. In Chapter 6, influence of magnetic field on two dimensional squeezing nanofluid flow considering heat and mass transfer between two plates is examined.

Chapter 7 deals with three dimensional nanofluid flow in presence of magnetic field through porous medium. System under consideration is rotating. Effects of thermal interfacial resistance, nanoparticle volume fraction, Brownian motion and nanoparticle size on thermal conductivity are considered. Also micro mixing in suspensions is taken into account while calculating viscosity.

In chapter 8, three dimensional CuO – water nanofluid flow between two horizontal parallel plates through porous medium in a rotating system is scrutinized. Micro mixing in suspensions is taken into account while calculating viscosity.

To sum up, subject matter of this thesis is to provide a research to make the original contribution and to develop an interpretation of known facts thereby extending the scope of mathematical study in study of MHD nanofluid flow. This work can be extended to study blood flow analysis and heat transfer characteristics of nanofluids can be enriched using hybrid nanofluids, but this is our humble attempt to make contribution in this field.