CHAPTER 7

7.1. Summary and Conclusions:

A theoretical study has been carried out to examine the effects of main physical parameters on velocity, temperature and concentration. The computations for skin friction, Nusselt number and Sherwood number are also performed and studied. In this study different fluids as well as variety of boundary conditions are considered. Some of the parameters like magnetic parameter, chemical reaction parameter, radiation absorption parameter, heat source/sink parameter and porosity parameter are common in Chapters 3, 4, 5 and 6. To perform the computations, various mathematical methods namely Laplace transform technique, Perturbation method and finite difference method are applied.

In Chapter 1, the basic concepts of MHD heat and mass transfer along with governing equations associated to conservation of mass, momentum, energy and species diffusion, kuvshinski fluid, Casson fluid are discussed. In Chapter 2, the review of the literature consisting of the contributions of several researchers related to the present work is reported.

In Chapter 3 an investigation on analytical study of ramped temperature influence on MHD convective chemical reactive and heat absorbing fluid past an exponentially accelerated vertical plate is carried out. The governing equations related to the problem are solved by using Laplace transform technique. The variations in velocity, temperature and concentration are discussed with the graphical representations. Also the effects of some important parameters on skin friction, Nusselt number and Sherwood number are discussed by using tabular values. Important findings of the problems are cited below.

- Primary and secondary velocities of the fluid flow are increasing for increasing values for thermal Grashof number, solutal Grashof number, radiation absorption parameter, Hall current parameter, porosity parameter whereas in the case of heat absorption parameter, Schmidt number, chemical reaction parameter the primary and secondary velocities are decreased.
Ramped temperature of the fluid is falling down for increasing values of Prandtl number, heat absorption parameter and the temperature is raised for increasing values of heat source parameter, radiation absorption parameter and time factor.

Concentration of the fluid decreases for increasing values of Schmidt number and chemical reaction, but it shows reverse effect for time factor.

Coefficient of skin friction increased due to the increments in solutal Grashof number, heat source parameter and decreases for increments in magnetic field parameter, Hall parameter, radiation absorption parameter, porosity parameter, heat absorption parameter.

The rate of heat transfer increases for increasing values of Prandtl number, heat absorption parameter whereas opposite reaction is noticed for increasing values of the radiation absorption parameter, heat source parameter.

The rate of the mass transfer is increased for increasing values of Schmidt number and chemical reaction parameter.

In Chapter 4 an investigation is performed on Soret and Dufour effects on radiation absorption fluid in the presence of exponentially varying temperature and concentration in conducting field. The non-dimensional governing equations of this problem are solved by using semi implicit finite difference method. The effect of various parameters encountered in the problem on velocity, temperature and concentration is discussed with the help of graphs. Also the effect of few parameters on skin friction, Nusselt number and Sherwood number is discussed thoroughly. The major findings are given below:

The velocity of the fluid increases with the increasing values of thermal Grashof number, solutal Grashof number, porosity parameter, radiation absorption parameter, Soret number and Dufour number but it shows reverse trend in case of magnetic field parameter, chemical reaction parameter and Prandtl number.

The temperature of the fluid reduces for increasing values of Prandtl number, whereas it enhances in the case of Dufour number, radiation absorption parameter, heat absorption parameter and radiation parameter.

Increasing values of Soret number results a rise in the concentration, but it falls down under the influence of Schmidt number and chemical reaction parameter.
Skin friction increases when magnetic field parameter and Prandtl number increases where as it decreases for increasing values of Grashof number, modified Grashof number, radiation absorption parameter, porosity number, heat absorption parameter, Soret and Dufour numbers.

Nusselt number increases with increasing values of Prandtl number, but an opposite behavior is noticed in the case of heat absorption parameter, Schmidt number, radiation absorption parameter and Dufour number.

The rate of mass transfer is enhanced with increasing values of Schmidt number and chemical reaction parameter but it decreases in the presence of Soret effect.

Chapter 5 consists of a numerical study on radiation absorption and chemical reaction effects on MHD heat and mass transfer flow of a Casson fluid past an oscillating vertical porous plate with heat absorption and generation. The equations that govern the flow are solved by applying finite difference method. The results for concentration, temperature and velocity profiles are obtained and plotted graphically. The effects of some important parameters on Sherwood number, Nusselt number and skin-friction are also presented in tables. The following are the conclusions of this manuscript.

Velocity of the Casson fluid decreases with increasing values of magnetic field parameter, chemical reaction parameter, Prandtl number, Casson fluid parameter whereas it increases with increasing values of thermal Grashof number, solutal Grashof number, radiation absorption parameter, porosity parameter and heat absorption parameter.

Temperature of the Casson fluid increases with increasing values of radiation absorption parameter, heat absorption parameter whereas reverse trend is seen in the case of Prandtl number.

Increasing values of chemical reaction parameter and Schmidt number lead to decrease in concentration of the Casson fluid.

Skin-friction decreases with increasing value of Grashof number, and it shows reverse effect when Prandtl number and Schmidt number increases.
Nusselt number decreases for rising values of radiation absorption parameter, heat source parameter and decreasing values of Prandtl number.

Sherwood number enhances with increasing values of Schmidt number and chemical reaction parameter.

In Chapter 6 a theoretical study has been performed on radiation absorption effect on unsteady MHD free convection flow of a Kuvshinski fluid past a vertical porous plate in the presence of chemical reaction and heat source or sink. The obtained partial differential equations are expressed in two dimensional form using non-dimensional parameters. These equations are solved analytically and graphs are obtained to study the effects of various physical parameters on velocity, temperature and concentration profiles. The most interesting points can be noted as follows:

- Velocity decreases for an increase in visco-elastic parameter, heat absorption parameter, chemical reaction parameter, magnetic field parameter, Prandtl number, Schmidt number and increases for increasing values of Grashof number, and radiation absorption parameter.
- The temperature profiles increased for an increase in visco-elastic parameter, radiation absorption parameter and decreased due to an increase in heat absorption parameter, chemical reaction parameter, Prandtl number and Schmidt number.
- Concentration of the fluid decreases due to an increase in Schmidt number, chemical reaction parameter, visco-elastic parameter.
- Skin friction increases due to increase in Schmidt number, visco-elastic parameter, Prandtl number, chemical reaction parameter, heat absorption parameter, magnetic field parameter and decreases with an increase in radiation absorption parameter, thermal Grashof number and solutal Grashof number.
- Rate of heat transfer decreases with an increase in radiation absorption parameter and visco-elastic parameter, but it shows reverse trend for the values of Schmidt number, Prandtl number and heat absorption parameter.
- Sherwood number increases for increasing values of Schmidt number, visco-elastic parameter and chemical reaction parameter.
The findings of the above investigations may be used to study the intermediate molecular weight gases in coupled heat and mass transfer binary systems of the fluid, often encountered in chemical engineering, petroleum engineering and irrigation process.

7.2 Scope for future work:

The present studies may be extended feasibly as explained below

- The present investigation can be extended for three dimensional studies.
- This work can be applied for other non-Newtonian fluids like Jeffrey fluid, Nano fluid, micropolar fluid etc.
- The present analysis can be further extended by considering different parameters on the flow by changing the boundary conditions, such as convective boundary layer or Newtonian heating.
- Enhanced knowledge of this work will be supportive in designing of related equipment.
- This theoretical study can be evaluated experimentally.

Hence developing the knowledge of fluid flow properties pertinent to the present study is an interesting extension in the practical point of view.

7.3 Published work:

The major findings of Chapter 4, Chapter 5 and Chapter 6 are published in Scopus indexed/peer reviewed international journals (Complete list is enclosed). The contents of Chapter 3 are also communicated for a Scopus indexed, peer reviewed internationally reputed journal.