ABSTRACT

This research is dedicated to the study of the MHD (magneto hydrodynamic) convection of heat and mass transfer through channels/ducts such as vertical channel, cylindrical annulus, a stretching sheet with chemical reaction under various conditions. It also deals with the study of emerging problems on heat and mass transfer in a flow of viscous fluid over several enclosures in a porous medium. In our research, we divide the thesis into seven chapters including the general introduction, literature survey and our research work with four problems. In these problems, the governing equations means equation of continuity, equation of energy, equation of momentum, equation of diffusion, equation of state, these equations by considering various effects of physical parameters like Chemical reaction parameter, Heat source parameter, Grashof number, Prandtl number, Schmidt number, Soret and Dufour parameters, Forchheimer parameter, Hall parameter on velocity, temperature and concentration fields. Thus the equations are solved by utilizing perturbation technique (PT) and Galerkin finite element method (FEM). The numerical results are analyzed by using mathematica and mat lab software’s. The present numerical results are compared with previously published articles and are found to be in good agreements. Briefly, this thesis is arranged in the below order.

Chapter 1 shows the introductory part of this thesis. In this chapter we discussed about the historical perspective of the subject, means fundamental equations and basic definitions.

Chapter 2 contains the related literature survey of all the four problems and then bringing out the motivation for this thesis work.

Chapter 3 titled “Transient convective heat and mass transfer flow in a vertical constricted channel with oscillatory flux with chemical reaction, thermal radiation and radiation absorption” research, on unsteady free convective heat and mass transfer flow due to oscillatory flux in vertical constricted channel with chemical reaction effect in the porous medium. The non linear governing equations have been evaluated by means of the use of perturbation method with the slope $\delta$ as the perturbation parameter. The rate of
heat and mass transfers, concentration, temperature, and velocity are calculated for varied values of $G$, $R$, $D^1$, $Q_1$, $N$, $N_1$, $k$, $\alpha$, $\beta$, $\gamma$, $x$ and $t$. Numerical evaluations had been achieved and graphical results were gained to illustrate the info of the flow and heat and mass transfer characteristics and their dependence on a few physical parameters inclusive of chemical reaction parameter, heat source parameter, radiation absorption parameter, radiation parameter, inverse darcy parameter. Part of this work published in International Journal of Mathematical Achieves, 5(7), 2014.

Chapter 4 titled “Effect of thermo-diffusion, thermal radiation, and radiation absorption on convective flow of past stretching sheet in a rotating fluid” investigates the combined influence of chemical reaction, hall current, thermo-diffusion and radiation absorption of a viscous electrically conducting fluid in a past stretching sheet. The governing equations governing have been analyzed through Galerkin finite element technique with three nodded line segments. The rate of heat and mass transfer, temperature, velocity, and concentration on the plate has been evaluated numerically for one of kind various parameters $G$, $M$, $m$, $N$, $N_1$, $Sc$, $\alpha$, $\gamma$, $So$, $Q_1$, $R$. The numerical results had been received and compared with previously published articles and are observed to be in good agreement. Graphical results for various parametric conditions were offered and discussed for different values. Part of this work published in Procedia Engineering of Elsevier, 127, 2015.

Chapter 5 titled “Combined influence of thermal radiation, soret, dufour effects on non-darcy mixed convective heat and mass transfer flow with dissipative in a vertical channel” deals with the influence of dissipation, thermal radiation, Soret and Dufour effects on non-darcy mixed convective flow in a vertical channel with Galerkin finite element technique. The governing equations have been evaluated to attain velocity, temperature and concentration and rate of heat and mass transfer with varied parameters. The numerical consequences obtained within the present chapter are established through favorable comparisons with previous published results. For various parametric conditions we provided graphical results and discussion for distinctive values. In this work, we
analyzed an increasing Sr (or decreasing Du) enhances the velocity u, temperature θ and Sherwood number Sh, while the concentration C, Skin friction τ and Nusselt number Nu reduces on the walls. Part of this work published as an article in International journal of mathematical archive, 2016.

Chapter 6 titled “Convective heat and mass transfer flow in a cylindrical annulus with Chemical reaction, Soret and Dufour effects” discussed in a cylindrical annulus, the effect of thermo-diffusion, diffusion-thermo, chemical reaction on non-darcy mixed convective flow of a viscous electrically conducting fluid through a porous medium, where the boundaries are maintained at temperature T_w and concentration C_w. The behavior of velocity, temperature, concentration, the rate of heat and mass transfer and shear stress are evaluated at distinct axial positions by utilizing Galerkin finite element technique with governing parameters. The numerical results obtained in the present chapter are validated by favorable comparisons with previous published results. For various parametric conditions graphical consequences were offered and discussed for different values.

Chapter 7 is devoted to the overall conclusions of the research work, followed by bibliography and publications of our research work.