ABSTRACT

This study presents the hydromagnetic flow behaviour and heat transfer characteristic under different geometric model. The thesis consists of eight chapters. Chapter 1 presents the definition of key terms, basic equations and a review on earlier works. Except Chapter 2 and 5, all problems are based on time dependent unsteady problems. The induced magnetic field is taken into consideration in Chapter 2 only. Chapter 3 and 4 are designed in rotating frame of reference. The Cogley-Vincent-Gilles heat flux model is adopted in Chapter 2 and 6 while the Rosseland approximation has been considered in Chapter 5. The slip effects on couple-stress fluid over a stretching sheet has been observed in Chapter 5. The impact of Hall current has been explained in Chapter 6 and 7. Impact of convective heating under Arrhenius kinetics on reactive flow has been analyzed in Chapter 4 and 7 where the viscous and Joule dissipations are considered in energy equation. The main findings and some directions for future research work have been summarized in Chapter 8.

The momentum equations are solved analytically using the Laplace transform technique(whenever required). The nonlinear partial differential equations are solved numerically using MATLAB software package or by employing the fourth order Runge-Kutta integration scheme with shooting technique. Velocity field is greatly influenced by magnetic field, rotation, Hall current, radiative heat transfer as well as buoyancy forces. The fluid velocity profile decreases with strengthening of slip parameter while it boosts with increase in Darcy number. The combined effects of suction/injection and convective heating have significant impact in controlling the flow characteristics in the channel. The fluid temperature is increased by Biot number and Eckert number whereas it is decreased by Prandtl number and radiation parameter. The temperature of the reactive fluid reduces with increase in Hall parameter while it increases with suction parameter. The obtained results are validated with previous study and found to be highly satisfactory.

Keywords: *MHD, Heat transfer, Porous medium, Grashof number, Radiation parameter, Prandtl number, Eckert number, Biot number, Hall currents, Reactive fluid, Viscous and Joule dissipations, Couple-stress fluid, Stretching sheet, Slip condition, Arrhenius kinetics.*