ABSTRACTS

Developing laminar convection in a vertical double passage channel has been investigated in this thesis. The channel is divided into two passages by means of a thin baffle. The problems considered are flow of a viscous, porous and micropolar fluids with first order chemical reaction. These problems find applications in different areas, such as transpiration, cooling of vehicles and rocket boosters, drying and dehydration operations in chemical and food processing plants, evaporation at the surface of water body.

Keeping in view of wide area of practical importance of laminar convection in a vertical double passage channel, we investigated in this thesis the following problems and the brief summary of each problem is as follows.

1. **Effect of first order chemical reaction in a vertical double passage channel**

Fully developed laminar mixed convection flow in a vertical channel in the presence of first order chemical reaction has been investigated. The channel is divided into two passages by means of a thin perfectly conducting plane baffle and hence the velocity, temperature and concentration will be individual in each stream. The coupled, nonlinear ordinary differential equations are solved analytically using regular perturbation method. The effects of thermal Grashof number, mass Grashof number, Brinkman number and chemical reaction parameter on the velocity, temperature and concentration field at different positions of the baffle are presented and discussed in detail. The increase in thermal Grashof number, mass Grashof number and Brinkman...
number enhances the flow, whereas the chemical reaction parameter suppresses the flow at all baffle positions.

2. **Heat and mass transfer for a chemically reacting permeable fluid in a vertical double passage channel**

   The heat and mass transfer characteristics of mixed convection in a vertical double passage channel filled with saturated porous medium is studied. The governing equations of continuity, momentum, energy and concentration, which are coupled and nonlinear ordinary differential equations, are solved analytically using perturbation method. The effects of the various dimensionless parameters such as porous parameter, thermal Grashof number, mass Grashof number, Brinkman number and chemical reaction parameter on the velocity, temperature and concentration fields are discussed in detail at all the baffle positions.

3. **Effect of first order chemical reaction in a vertical double passage channel filled with porous matrix**

   An analytical solution of dispersion of solute with first order chemical reaction in a vertical double passage channel with porous medium has been investigated. The channel is divided into two passages by means of a thin perfectly conducting baffle. Approximate analytical solutions are found for the coupled nonlinear ordinary differential equations using perturbation method. The solutions are evaluated and shown graphically for thermal Grashof number, mass Grashof number, Brinkman number, porous parameter and chemical reaction parameter at all the baffle positions. It is found that thermal Grashof number, mass Grashof number and Brinkman number enhances the flow, where
as porous parameter and chemical reaction parameter reduces the flow at all baffle position.

4. **Natural convection heat and mass transfer of a chemically reacting micropolar fluid in a vertical double passage channel.**

   The fully developed mixed convection for a laminar flow of a micropolar fluid in a vertical double passage channel has been studied. The channel is divided into two passages by means of a thin perfectly conductive plane baffle and the velocity, temperature and concentration will be individual in each streams. After inserting the baffle, the fluid is concentrated in stream-I. The governing equations of the fluid have been solved analytically subject to the relevant boundary conditions. The closed form solutions are presented graphically. The effect of governing parameters namely, buoyancy ratio, vortex viscosity parameter and chemical reaction parameter on the velocity, microrotation velocity, temperature and concentration has been discussed. It is seen that increasing the vortex viscosity parameter tends to increase the magnitude of microrotation and thus decreases the fluid velocity in the vertical channel. Moreover, the volume flow rate, the total heat rate added to the fluid and the total species rate added to the fluid for micropolar fluids are lower than those of Newtonian fluids.

5. **Effect of first order chemical reaction in a vertical double passage channel filled with micropolar fluid.**

   The fully developed natural convection of heat and mass transfer of a micropolar fluid in a vertical double passage with asymmetric wall temperature and concentration has been investigated. The closed form analytic solutions for the important characteristics of
the fluid flow, heat and mass transfer are obtained. Analytical expressions for velocity, microrotation velocity and temperature have been obtained. The results are presented graphically for varying physical parameters such as vortex viscosity parameter, buoyancy ratio and chemical reaction parameter. It is found that an increase in the vortex viscosity parameter enhances the microrotation velocity and decreases the fluid velocity. The buoyancy ratio enhances the microrotation velocity and accelerates the velocity for heat source and sink. The volumetric flow rate, the total heat rate and the total species rate added to the micropolar fluids are lower than those of Newtonian fluid.