Chapter – 7

Conclusion

Peristalsis is a well known process of a fluid transport which is induced by a progressive wave of area contraction or expansion along the length of distensible tube containing the fluid. It is used by many systems in the living body to propel or to mix the contents of a tube. The peristalsis mechanism usually occur in urine transport from kidney to bladder, swallowing food through the esophagus, chyme motion in the gastrointestinal tract, vasomotion of small blood vessels and movement of spermatozoa in the human reproductive tract. There are many engineering processes as well in which peristaltic pumps are used to handle a wide range of fluids particularly in chemical and pharmaceutical industries. It is also used in sanitary fluid transport, blood pumps in heart lung machine, and transport of corrosive fluids, where the contact of the fluid with the machinery parts is prohibited. Further, it is well known that most physiological fluids including blood behave as non-Newtonian fluids. Hence, the study of peristaltic transport of non-Newtonian fluids may help to get better understanding of the working biological systems.

In view of several physiological applications, we are studying the effects of MHD on peristaltic flow of non-Newtonian fluids in different geometries. This thesis is divided into six chapters and it should be noted that, the nomenclatures of the chapters are independent of each other.

In first chapter a brief general introduction to the peristalsis and their applications in physiological fluid dynamics and non-Newtonian fluids are presented.

In second chapter, we studied the effects of slip and magnetic field on the peristaltic transport of a Williamson fluid through a porous medium in a two-dimensional channel under the assumptions of low Reynolds number and long wavelength. The flow is investigated in a wave frame of reference moving with velocity of the wave. The perturbation series in the Weissenberg number $(We < 1)$ was used to obtain explicit forms for velocity field, pressure gradient per one wavelength. It is found that, the axial pressure gradient $\frac{dp}{dx}$ increases with increasing We, M and ϕ, while it decreases with increasing β and Da. Further, it is observed that in the pumping region the time averaged flow rate $\overline{Q}$ increases with increasing with increasing We, M and ϕ, while it decreases with increasing β and Da. Moreover it is found that the pumping is more for Williamson fluid than that of Newtonian fluid. It is observed that, the pressure gradient $\frac{dp}{dx}$ and time-averaged flux $\overline{Q}$ in the pumping region increases with increasing β, α, M and ϕ, where as they decreases with increasing γ. Further it is observed that, the time-averaged flux $\overline{Q}$ in the pumping region is more for Prandtl fluid than that of Newtonian fluid.

In third chapter, we investigated the effects of magnetic field and wall slip on the peristaltic pumping of a Prandtl fluid in an asymmetric channel under the assumptions of long wavelength and low Reynolds number. Series solutions of axial velocity and pressure gradient are given by using regular perturbation technique when Prandtl number is small. It is observed that, the pressure gradient $\frac{dp}{dx}$ and time-averaged flux $\overline{Q}$ in the pumping region increases with increasing β, α, M and ϕ, where as they decreases with increasing γ. Further it is observed that, the time-averaged flux $\overline{Q}$ in the pumping region is more for Prandtl fluid than that of Newtonian fluid.

In fourth chapter, we studied the effect of magnetic field on the peristaltic transport of a Jeffrey fluid through a porous medium in an annulus. The analysis has been carried out in the wave frame of reference with long wavelength and zero Reynolds number assumptions. The expressions for the velocity field and the heat transfer coefficient are obtained analytically. It is found that, the axial pressure gradient and pumping decrease with increasing λ_1 and Da, whereas they increase with increasing M, ε and ϕ.

In fifth chapter, we investigated the effect of MHD on the peristaltic transport of a hyperbolic tangent fluid through a porous medium in a planar channel under the assumptions of low Reynolds number and long wavelength. The expression for the velocity and axial pressure gradient are obtained by employing perturbation technique. It is observed that, the axial pressure gradient increases with increasing We, M and ϕ, while it decreases with increasing n and Da. Also, it is observed that in the pumping region the time-averaged flow rate $\overline{Q}$ increases with increasing We and ϕ, while it decreases with increasing n and Da. Further, it is observed that the pumping is less for hyperbolic tangent fluid than that of Newtonian fluid.

In sixth chapter, we studied the effects slip on the peristaltic flow of a Carreau fluid in a two dimensional channel under the assumptions of low Reynolds number and long wavelength. The flow is investigated in a wave frame of reference moving with velocity of the wave. The perturbation series in the Weissenberg number ($We < 1$) was used to obtain explicit forms for velocity field, pressure gradient per one wavelength. It is observed that, the axial pressure gradient and time averaged flux in the pumping region increases with increasing n, M and ϕ, whereas they decreases with increasing We and β.