ABSTRACT

The thesis constituting of seven chapters, presents some theoretical investigations on peristaltic transport of Newtonian/non-Newtonian nanofluids in a tapered asymmetric channel (generalized channel). A model of wall-induced fluid flow within an infinite tapered channel has been developed to simulate the transport phenomena due to asymmetric wall displacements. This problem has plentiful applications. Moreover, it may serve as a model for the intrauterine fluid motion in a sagittal cross-section of the uterus under cancer therapy and drug analysis. An attempt has been made to study the effects such as heat source/sink parameter, porous medium, thermal radiation, chemical reaction and magnetic field on flow characteristics in some of the flow geometries proposed in the biomedical applications. Exact expressions for temperature field, nanoparticle fraction field, axial velocity, pressure gradient and stream function are derived under the assumptions of long wavelength and low Reynolds number. This dissertation work builds upon the above scenarios and aims to address the following issues.

The opening Chapter of the thesis is introductory in nature which explains briefly about the fluid flow investigations undertaken along with the necessary mathematical techniques used in the present study.

The combined influence of radiation and magnetic field on peristaltic transport of nanofluids through a porous space in a tapered asymmetric channel is discussed in the second chapter. The assumption of long-wavelength and low Reynolds numbers approximations is applied to reduce the governing equations into relatively simple. This study reveals that the axial velocity for a divergent channel ($m > 0$) is higher compared to its value for a uniform channel ($m = 0$), whereas it is lower for a convergent channel ($m < 0$).
Chapter three is the extension of the second chapter when both chemical reactions and inclined magnetic field effects are taken into consideration. Homotopy perturbation method is successfully employed to find the analytical solutions of temperature of the fluid and nanopartical concentrations. The validation of HPM is made with a numerical solution which is obtained with the help of MATLAB package.

The effect of thermal radiation parameter and magnetic field on the peristaltic motion of Williamson nanofluids in a tapered asymmetric channel is invesitgated in the fourth chapter. Analytical expressions for velocity an pressure gradient are derived by using Regular perturbation method. The trapping boluses are also discussed through streamlines. It is indicated that the tapped bolus increases as the fluid character changes from Newtonian \((We = 0)\) to Williamson nanofluids \((We > 0)\).

Chapter five provides the influence of heat source, thermal radiation and inclined magnetic field on peristaltic flow of a Hyperbolic tangent nanofluid in a tapered asymmetric channel. The numerical computation shows that the velocity profile increases with an increasing \(We\) in the right part of the channel. However, the converse behaviour is noticed in the case of left part of the tapered asymmetric channel.

Sixth chapter discloses the analysis for MHD Peristaltic transport of Carreau nanofluids in a tapered asymmetric channel. It is observed that for Carreau nanofluids the peristalsis works as a pump against a greater pressure rise compared with a Newtonian nanofluid, while there exists no significant difference in free pumping flux for Newtonian and Carreau nanofluids in the tapered asymmetric channel. Moreover, the flow variables are also strongly depend on the geometric parameters like, non-uniform parameter, amplitudes and phase difference of the walls. Chapter seven contains the results and discussion of the whole study and future scope of works.