SUMMARY

Theoretical modeling of blood flow in a stenosed artery is significant from physiological, clinical and sub-clinical points of view. The body fluid blood, due to the pumping mechanism of heart, flows through the different channels of circulatory system and supplies nutrients to tissues, cells and organs. The complex constitution and various functions of physiological fluid blood, non-uniformity of carrier vessels, formation of symmetric and non-symmetric stenosis at vessel wall, catheterization of arteries for clinical and sub-clinical activities, inclined and non-inclined geometries etc., have resulted the theoretical modeling more complicated, interesting and challenging. However, in order to get some insight in such physiological, pathological situations, many investigators have suggested mathematical models under different conditions and flow geometries. Bugliarello and Sevilla, Cokelet and others have reported experimentally that for blood flow through small arteries, there exists a cell poor peripheral layer of plasma and a core region of red cells. The present investigation includes (i) the theoretical modeling of blood flow, (ii) steady behaviour of blood flow in different kinds of flow geometries, (iii) two-layered flow of blood, (iv) an inclined tapering stenosed artery, (v) asymmetric stenosis growth at vessel wall, (vi) the marvellous body fluid blood, exhibiting both Newtonian and non-Newtonian characters, (vii) the successive kinds of stenosis formation at vessel wall, (viii) with the presence and absence of body force, (ix) subject to velocity slip condition at the interface of two layers and (x) blood flow in annular and non-annular regions.

The aim of the present investigation is

a. To study the Newtonian and non-Newtonian behaviour of blood and its flow inside an inclined, non-inclined, catheterized or, non-catheterized tapering artery.

b. To study the two-layered behaviour of blood flow.

c. To study the effect of inclination and tapering angle for flow inside a constricted non-uniform artery.

d. To explore the behaviour of symmetric and non-symmetric stenosis on blood flow in a tapered vessel.
e. To study the combined influence of several parameters like, velocity slip at interface, artery inclination, two-layered modeling, stenosis size and its non-symmetry on blood flow in a constricted artery.

- **Chapter 1** accommodates a general introduction that includes the basic information about circulatory system in general and cardio vascular system (CVS) in particular, its main divisions, their composition and role in blood flow, basic information about an arterial stenosis or atherosclerosis, together with its formation, gradual growths, effects and treatment measures, along with two-layered behaviour of blood flow, some kinds of relevant mathematical models and also a brief account of present work.

- **Chapter 2** deals with a brief review of literature, which addresses the relevant theoretical models and experimental observations on blood flow through different geometries and flow situations. The Newtonian and non-Newtonian models and, two-layered blood flow situations, are also included here.

- **Chapter 3** considers two-layered steady blood flow inside a tapered artery with the formation of a non-symmetric stenosis, subject to the employment of a velocity slip condition at interface of Newtonian fluids with different viscosities. Basic equations of the fluid flow are presented and governing equations of unidirectional blood flow have been integrated, using the boundary conditions employed. Analytical expressions for different flow variables are obtained and their variations with different flow parameters are graphically presented, discussed and concluded thereof.

- **Chapter 4** deals with two-layered blood flow through an inclined tapering artery with the development of a non-symmetric stenosis and velocity slip condition at interface of Newtonian fluids with two separate viscosities. Blood is assumed to behave as an incompressible Newtonian fluid and, flow is steady and one-dimensional. Analytic expressions of flow variables in two forms are obtained and variations with flow parameters are presented in figures.
• **Chapter 5** accounts for the annular blood flow in two-layered model of a tapering constricted artery with velocity slip condition at interface of Newtonian fluids with different viscosities. The annular region is confined between a catheter and vessel wall or, fluids interface. Analytical expressions of flow variables are obtained and also graphically presented their variations with several flow parameters.

• **Chapter 6** represents two-layered Casson fluid model for a tapering constricted artery. Blood is assumed to behave as Casson fluid in the core region and peripheral layer plasma is represented by a Newtonian fluid. Analytical expressions of flow variables are obtained and their variations with flow parameters are graphically presented.

• **Chapter 7** accounts for two-layered Bingham plastic model for a tapering constricted artery. Blood is assumed to act as Bingham plastic fluid in the core region and Newtonian fluid in the peripheral layer. A velocity slip condition is introduced at the interface of fluids. Analytical expressions for flow variables have been obtained and their variations with flow parameters are presented graphically.

• In the present investigation, unidirectional steady flow of blood, inside a tapering constricted artery with the employment of velocity slip condition at interface of a two-layered model at five flow situations, has been dealt with. It is aimed at throwing some light in such complicated blood flow situations. The famous biomechanists Caro, Chien, Dintenfass, Haynes, Goldsmith, Skalak, Young, Fung, Puniyani and Nimi, Biswas and others, have clearly reported that the rheologic and fluid dynamics studies of blood and blood flow, could play an important role in the fundamental understanding, diagnosis, prognosis, treatment etc., of various diseases such as cardiovascular (cvs), renal, arterial, hematological etc. It is already indicated that hydrodynamic factors, could play a significant role in the formation, development and progression of arterial stenosis which may be localized at one or several locations at the lumen of an artery. Stenosis or atherosclerosis is a kind of cvs diseases which takes an increasing number of
human lives in the world. The development and progression of atherosclerosis is strongly correlated with wall shear stress and blood cell interactions. The region of low wall shear stress has been identified as the probable sites of initiation of a stenosis. The proper investigation for wall shear stress at stenotic location, is thus very important.

- The proposed models can be improved further by considering
  (i) two slips along radial and axial directions in two-dimensional blood flow models, (ii) parameters like body acceleration, magnetic and electric effects etc.,
  (iii) the external influence like, magnetic effects, variable radial and axial slips, porosity, heat and mass effects, (iv) inertia terms, pulsatile flow of blood etc.

  We intend to propose such kind of blood flow models in future.