# Abstract


The present thesis is concerned with mathematical modeling and solution of some problems related to Newtonian/non-Newtonian flow of blood. The problems have been analysed/solved by employing some analytical as well as numerical techniques. The problems considered in the thesis have potential applications in the study of physiological fluid dynamics.

The thesis consists of seven chapters. The 1st chapter is introductory. This chapter includes brief discussion on certain relevant topics, like basic equations governing the flow of Newtonian and non-Newtonian fluids, electrically conducting fluids under the influence of a magnetic field and the importance of studies of mechanics of circulatory systems. It also includes a survey of relevant previous investigations.

In Chapter 2, a mathematical model has been developed with an aim to study the flow of blood through a multi-stenosed artery. Blood is considered here to consist of a peripheral plasma layer which is free from red cells and a core region containing the erythrocytes, which is represented by a Casson fluid. The 3rd Chapter is motivated towards studying blood flow through a porous vessel having a pair of stenoses under the action of an externally applied magnetic field. Blood flowing through the artery is considered to be Newtonian. This model is consistent with the principles of ferrohydrodynamics and magnetohydrodynamics (MHD). The aim of the 4th Chapter is to investigate the influence of slip velocity on flow of blood through an artery having its wall permeable. The problem has been solved by the use of a perturbation technique. Of concern in the Chapter 5 is a problem of heat and mass transfer in the unsteady MHD flow of blood through a porous artery in a pathological state, where the lumen of the artery has turned into a porous structure. Consideration of time-dependent permeability and oscillatory suction velocity has been made. The 6th Chapter deals with a fundamental problem of biomagnetic fluid flow through a porous medium in the presence of a magnetic field generated by a magnetic diole. The study pertains to a situation where magnetisation of the fluid varies with temperature. The flow of fluid is considered to be governed by the equation of a second-grade viscoelastic fluid model. Chapter 7 presents the contributions of thesis and possibilities for further research.



**Keywords**: Boundary layer flow, MHD, Biomagnetic fluid, Plug flow, Heat transfer, Mass transfer, Permeable artery, Double stenoses, Multiple stenoses, Viscoelasticity, Porous medium, Hematocrit, Slip velocity and Thermal radiation.