Preface

The present thesis entitled "Bulk rheological behaviour of blood in narrow vessels", is a record of genuine research work carried out by me under the supervision and guidance of Dr. Nand Lal Singh (Supervisor), Reader in the Deptt. of Maths., T.D. Post Graduate College, Jaunpur (U.P.) India.

The purpose of the thesis is to study some problems on steady and micropolar laminar viscus flow of blood in vessels of small diameters.

The effects of peripheral layer, yield stress and other rheological parameters on blood flow have been analysed.

This thesis consists of seven chapters. Chapter I contains the general introduction of the subject and a brief account of the relevant literature on the subject.

In Chapter II, a theoretical study of blood in narrow circular vessels have been done. Two layer blood flow model, the central core layer and peripheral layer, both satisfying Herschel-Bulkley constitutive equation.
has been considered for the analysis. Apparent fluidity of the blood and flow rate have been discussed with respect to peripheral layer thickness, yield stress and parameter $n$.

In Chapter III, "Mathematical study of Steady Blood Flow in narrow vessel with Plasma Layer Near the Wall" have been done. In this paper we have assumed that the fluid in core region satisfy casson's equation and the fluid in marginal layer region satisfy Newtonian equation. Here we have obtained the apparent viscosity of blood as a function of yield stress, vessel diameter and plasma peripheral layer thickness. It is observed that the apparent viscosity increases with increasing yield stress parameter.

In Chapter IV, effect of mild stenosis on blood flow through narrow vessels have been studied. A stenosis causes the narrowing of the blood vessels due to the development of abnormal tissues and it gives way to serious circulatory disorder. In this chapter variation of flow rate $\dot{Q}$ with $\frac{\alpha}{R}$ i.e. variation of $\dot{Q}$ with stenosis height and variation of $\dot{Q}$ with yield stress have been discussed with the help of graphs. Variation of $\phi$ with $\frac{\alpha}{R}$ for different values of $\beta$
have been studied with help of tables.

In Chapter V, we have discussed Micro polar fluid model of steady blood flow in narrow tube with slip at the wall. In the present chapter we have studied the Poiseuille flow of micro polar fluid as a model of blood flow in 40 μm diameter tube and for 40 % RBC concentration.

At the boundary, we have introduced a slip in the axial velocity and a partial rotation depending upon the wall effect parameters and fluid vorticity. From the analysis we have observed that the introduction of slip reduces the apparent viscosity of the suspension and increases its axial velocity whereas it has no effect on particle's rotation. Results have been discussed with the help of tables and graphs.

In Chapter VI, a study of dispersion process in blood flow in narrow vessels have been done. In this paper we have prepared the flow model with casson fluid in the core region surrounded by a Newtonian plasma layer near the wall. Taylor's limiting condition and Fick's law of diffusion are used for finding the solution of problem. The effective dispersion coefficient with which the
solute disperses across a plane moving with mean speed of the medium is found to be decreased with respect to yield stress and molecular diffusion coefficient whereas a reciprocal behaviour is observed with respect to the viscosity of the casson fluid. The results are discussed with the help of tables.

In Chapter VII, Laminar flow model of blood in a tube with an idealized Plasma Layer at the wall, have been studied.

In the analysis, we have used casson's equation for the constitutive relation. We have obtained the flow profile and the flow rate. It is seen that a plug flow region exists. Two layer model with cell rich region in the centre and a cell free region near the wall is assumed. Both the fluids obey casson's equation.

It is observed that the loss in apparent viscosity is caused due to increase in $\xi$ as

$$\frac{f_{n}}{f_{i}} \geq \frac{1 + f_{i}^{2} - r_{i} f_{n}^{2} y_{n}}{1 + f_{i}^{2} - r_{i}^{2} y_{n}}$$

for a constant slip parameter.