3. DISCUSSION

The flow problems may be categorized into two kinds as follows. In the first kind, the flow is created due to imposed pressure gradient or movement of the boundaries and the corresponding disturbance is discussed analytically and computationally to investigate the velocity field, flux rate, shear stresses etc. In the second kind, the main interest is to establish the required pressure gradient for maintaining a certain amount of fluid discharge. Here it is possible to adopt a method by which we calculate directly the pressure gradient and the stresses interms of the prescribed discharge function. The discharge may be time independent or dependent and different time dependent forms of

TABLE - 1

VARIATION OF PRESSURE GRADIENT Vs. TIME (CONSTANT DISCHARGE)

t	F(t)			
	I	II	III	IV
1×10^{-5}	3.4149	2.4943	8.4939	7.2692
5×10^{-5}	3.2838	2.3744	8.4408	7.2389
1×10^{-4}	3.1372	2.2467	8.3757	7.2016
5×10^{-4}	2.4094	1.7130	7.9020	6.9238
1×10^{-3}	1.9993	1.4563	7.4091	6.6200
5×10^{-3}	1.8963	0.6382	5.3253	5.0515
1×10^{-2}	0.5122	0.3531	4.1183	3.9157
5×10^{-2}	0.3862	0.2644	2.0525	1.9121
1×10^{-1}	0.3862	0.2644	1.9839	1.8474
5×10^{-1}	0.3862	0.2644	1.9829	1.8465
β	-0.0001	-0.0002	-0.0001	-0.0002
C	0.1	0.1	0.2	0.2

TABLE - 2

VARIATION OF PRESSURE GRADIENT Vs. TIME
(CONSTANT DISCHARGE)

t	F(t) V	F(t) VI	F(t) VII	F(t) VIII
1×10^{-5}	36.1710	43.8429	61.0462	75.9297
5×10^{-5}	36.2147	43.9073	61.1123	76.0067
1×10^{-4}	36.2691	43.9873	61.1946	76.1025
5×10^{-4}	36.6918	44.6142	61.8407	76.8569
1×10^{-3}	37.1899	45.3643	62.6187	77.7700
5×10^{-3}	40.1138	50.1605	67.7516	83.9647
1×10^{-2}	41.7222	53.6978	71.8623	89.3076
5×10^{-2}	31.1105	45.3777	64.6023	85.4459
1×10^{-1}	21.9265	31.1116	45.0500	61.1913
5×10^{-1}	18.8004	24.6467	32.9551	41.4517
β	-0.0002	-0.0005	-0.00005	-0.00005
c	0.6	0.7	0.8	0.9

physical interest may be choosen. We investigate the flow of a second order Rivlin-Ericksen fluid through a rectangular duct under a prescribed discharge. we have analytically evaluated the required pressure gradient to each mode of discharge and computationally discussed its behaviour w.r.t. variations in the governing viscoelastic parameter as well as the ratio of the sides of the rectangular. Tables 1-2, represent the variation of pressure gradient w.r.t. β in a narrow or wide rectangular ducts when the discharge is constant. Tables 3-4, corresponds to the case when the discharge is time dependent. From table 1 we find that in a narrow gap duct for a fixed c(ratio of the sides) an increase in the viscoelastic parameter decreases the pressure gradient at all times. We also notice that for a given c and β the pressure gradient f(t) gradually reduces in course of time and for $t \geq 0.1$ it remains invariant. It is also interesting to note that the variation of f(t) w.r.t. β gradually reduces for $t \geq 0.1$. Also for a given β the pressure gradient increases rapidly as c increases. Thus

TABLE - 3

VARIATION OF PRESSURE GRADIENT Vs. TIME
(TIME DEPENDENT DISCHARGE)

t	$F(t)$ I	II	III	IV
1×10^{-5}	6.3997×10^{-3}	4.0026×10^{-3}	6.6461×10^{-2}	6.0979×10^{-2}
5×10^{-5}	6.5793×10^{-3}	4.1973×10^{-3}	6.6843×10^{-2}	6.1350×10^{-2}
1×10^{-4}	6.7877×10^{-3}	4.4101×10^{-3}	6.7314×10^{-2}	6.1816×10^{-2}
5×10^{-4}	8.0427×10^{-3}	5.4434×10^{-3}	7.0865×10^{-2}	6.5301×10^{-2}
1×10^{-3}	9.1641×10^{-3}	6.1948×10^{-3}	7.4850×10^{-2}	6.9155×10^{-2}
5×10^{-3}	1.6846×10^{-2}	1.1412×10^{-2}	9.8816×10^{-2}	9.1615×10^{-2}
1×10^{-2}	2.6392×10^{-2}	1.7939×10^{-2}	1.2438×10^{-1}	1.1538×10^{-1}
5×10^{-2}	1.0278×10^{-1}	7.0231×10^{-2}	3.2522×10^{-1}	3.0239×10^{-1}
1×10^{-1}	1.9827×10^{-1}	1.3560×10^{-1}	5.7591×10^{-1}	5.3582×10^{-1}
5×10^{-1}	9.6215×10^{-1}	6.5855×10^{-1}	2.5813	2.4033
β	-0.0001	-0.0002	-0.0001	-0.0002
C	0.1	0.1	0.2	0.2

TABLE - 4

VARIATION OF PRESSURE GRADIENT Vs. TIME

(TIME DEPENDENT DISCHARGE)

t	F(t)			
	V	VI	VII	VIII
1×10^{-5}	1.8998	2.9461	4.5906	6.5394
5×10^{-5}	1.9014	2.9480	4.5931	6.5425
1×10^{-4}	1.9032	2.9504	4.5961	6.5463
5×10^{-4}	1.9183	2.9694	4.6206	6.5767
1×10^{-3}	1.9369	2.9931	4.6510	6.6145
5×10^{-3}	2.0789	3.1743	4.8878	6.9102
1×10^{-2}	2.2419	3.3884	5.1688	7.2641
5×10^{-2}	3.2848	4.7741	7.0465	9.6675
1×10^{-1}	4.4161	6.2312	9.0009	12.1588
5×10^{-1}	13.1832	17.2808	23.4656	30.1865
β	-0.0002	-0.0005	-0.00005	-0.00005
C	0.6	0.7	0.8	0.9

the pressure gradient required for maintaining the prescribed discharge in a rectangular channel increases with increase in the channel gap. We also observe that wider the gap larger the magnitude of f(t) (Table 2). Table 2, indicate the values of f(t) for wide gap ducts. We find that in contrast to narrow gap ducts, f(t) continues to reduce even at times of order 0.5. Thus we may infer that the time required for the pressure gradient to become invariant is much higher in wider gap ducts. However, as in the case of narrow gap the magnitude of the pressure gradient increases rapidly with an increase in c. In case of time dependent discharge, Table 3 & 4 give f(t) with discharge varying linearly with time t. We find for a given β and c, f(t) increases rapidly with t. As in the previous case of constant discharge, f(t) reduces with increase in β and enhances rapidly with c. It is also interesting to note that the magnitude of f(t) for any β and c in this time dependent discharge case (Tables 3 and 4) is much less compared to the constant discharge case.