CHAPTER - I V

STUDY OF RESPONSE OF
THE CIRCUIT WITH VARIATION IN 'Q'

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4.1 INTRODUCTION AND EXPERIMENTAL STUDY

The new circuit described in the previous chapter is further studied with variation in 'Q'. The transfer functions and design procedure is exactly same as described in Chapter. The frequency response is studied upto 1 MHz. For this study F_o = 10 KHz, R =33 ohms and 'Q' values were 1, 1.5 and 2.5. The various components are calculated. The calculated values and actually used values are given in Table (4.4). The results are graphically shown in Fig.(4.1), (4.2), (4.3) and (4.4). A theoretical curve is also included for comparison in each case.

4.2 RESULTS AND DISCUSSION

The observed responses of the circuit are studied and following conclusions are made about the various outputs.

(1) LOW PASS RESPONSE

The low pass response is shown in Fig.(4.1). It is seen that overall response is quite satisfactory. The frequency response curves for different values of 'Q' with center frequency F_o = 10 KHz are shown. The 3 dB frequen-

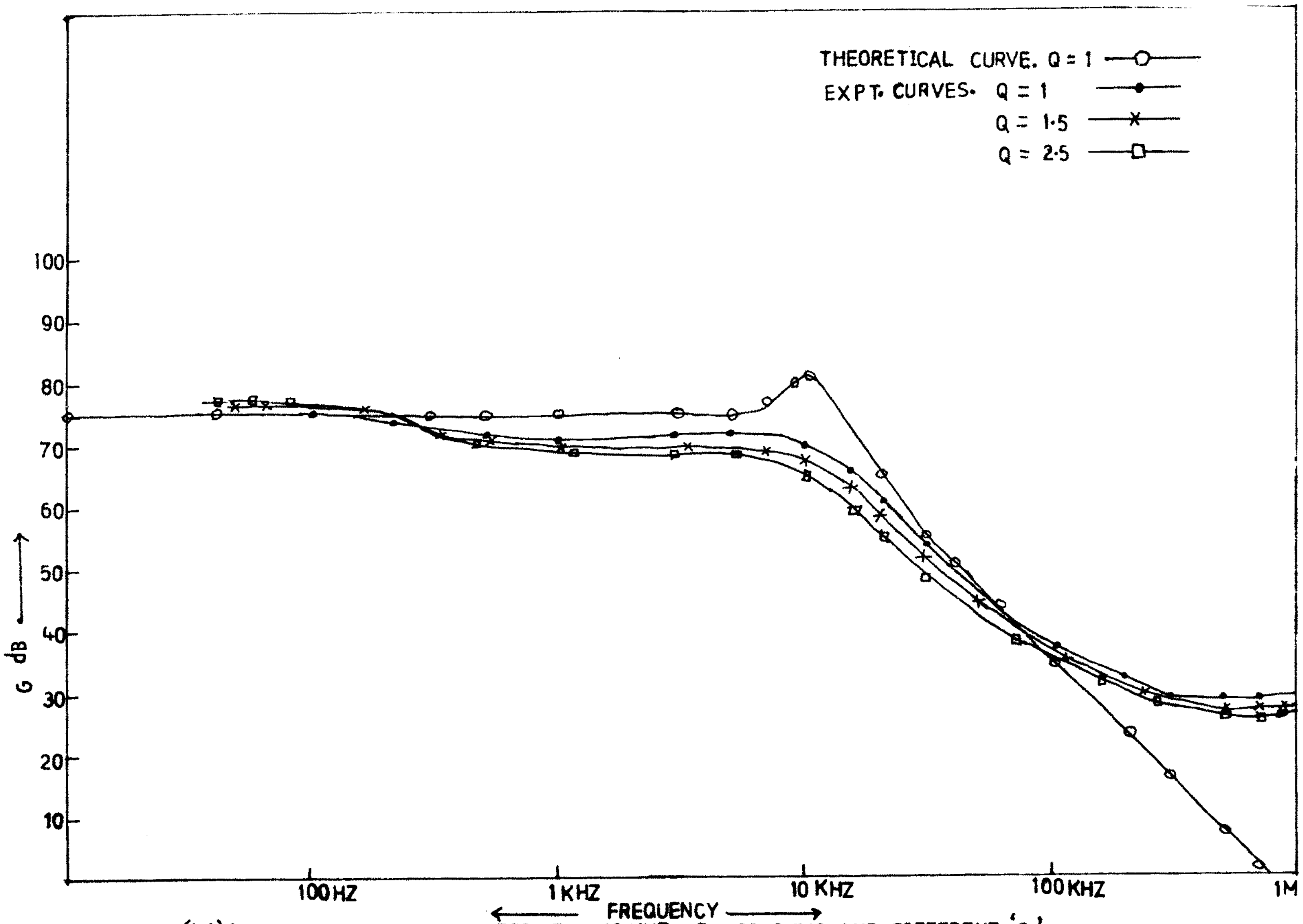


FIG.(4.1): LOW PASS RESPONSE FOR F_0 = 10 KHZ, R= 33 OHMS AND DIFFERENT 'Q'.

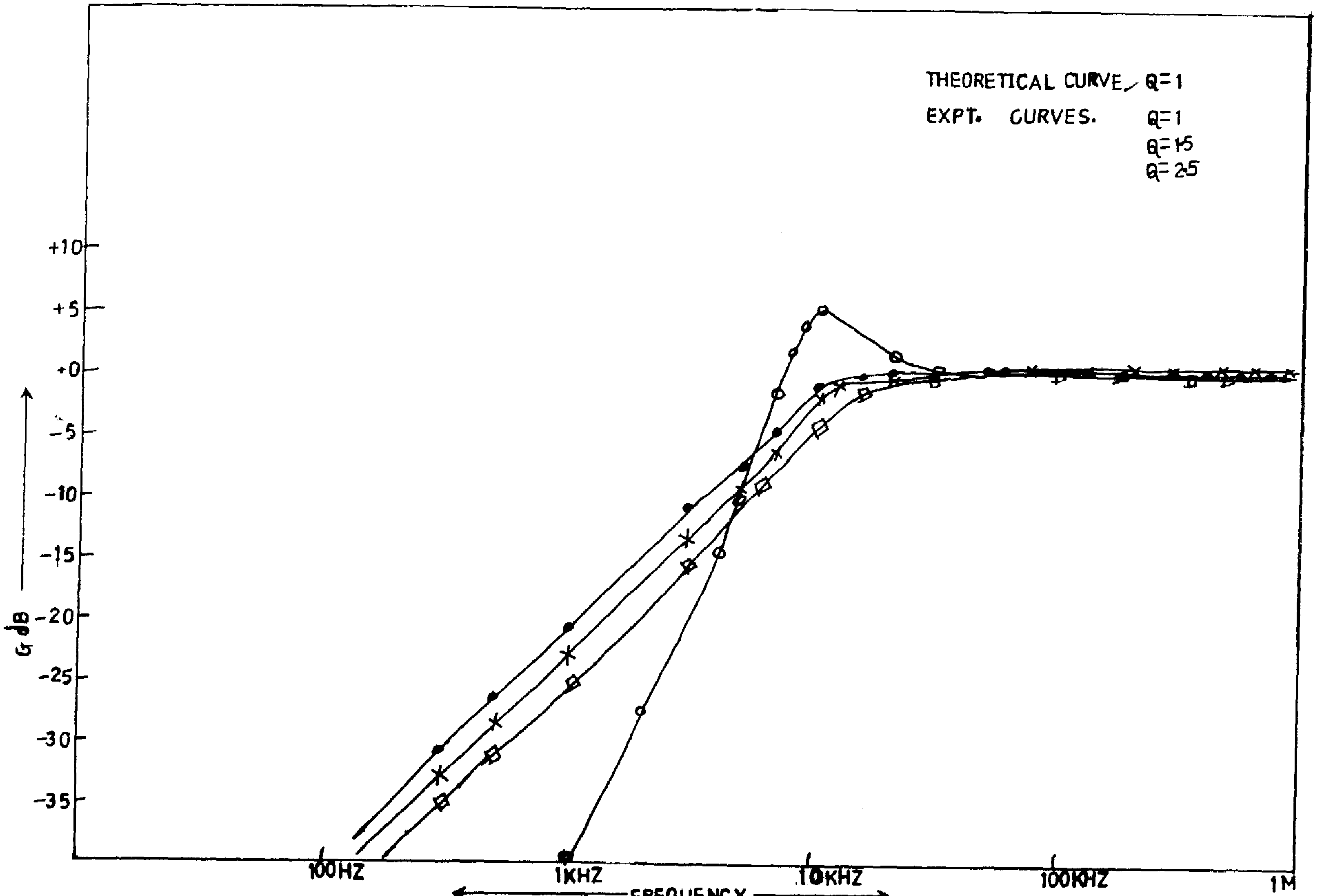


FIG (4.2): HIGH PASS RESPONSE FOR F0=10KHZ, R=33OHMS AND DIFFERENT 'Q'.

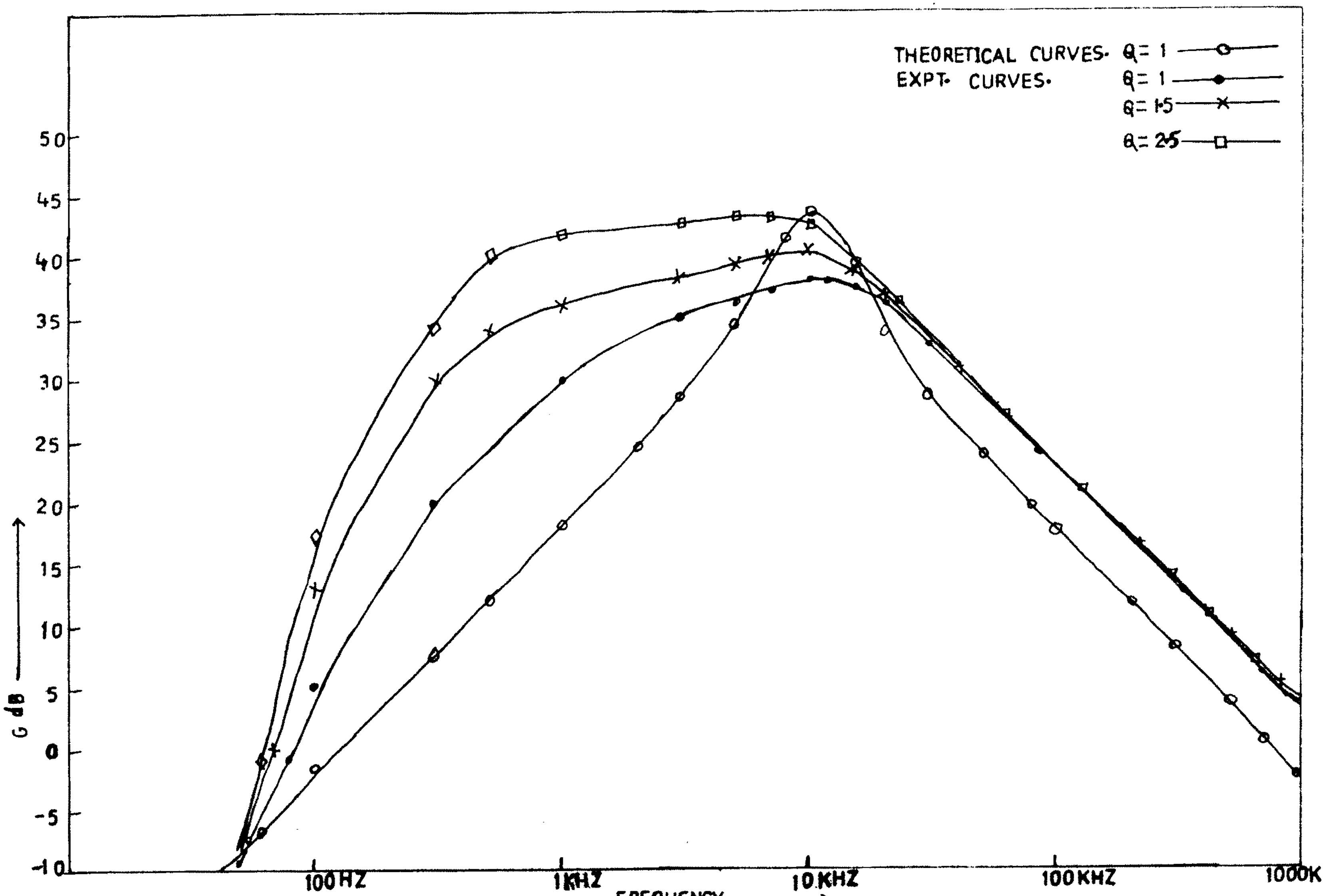
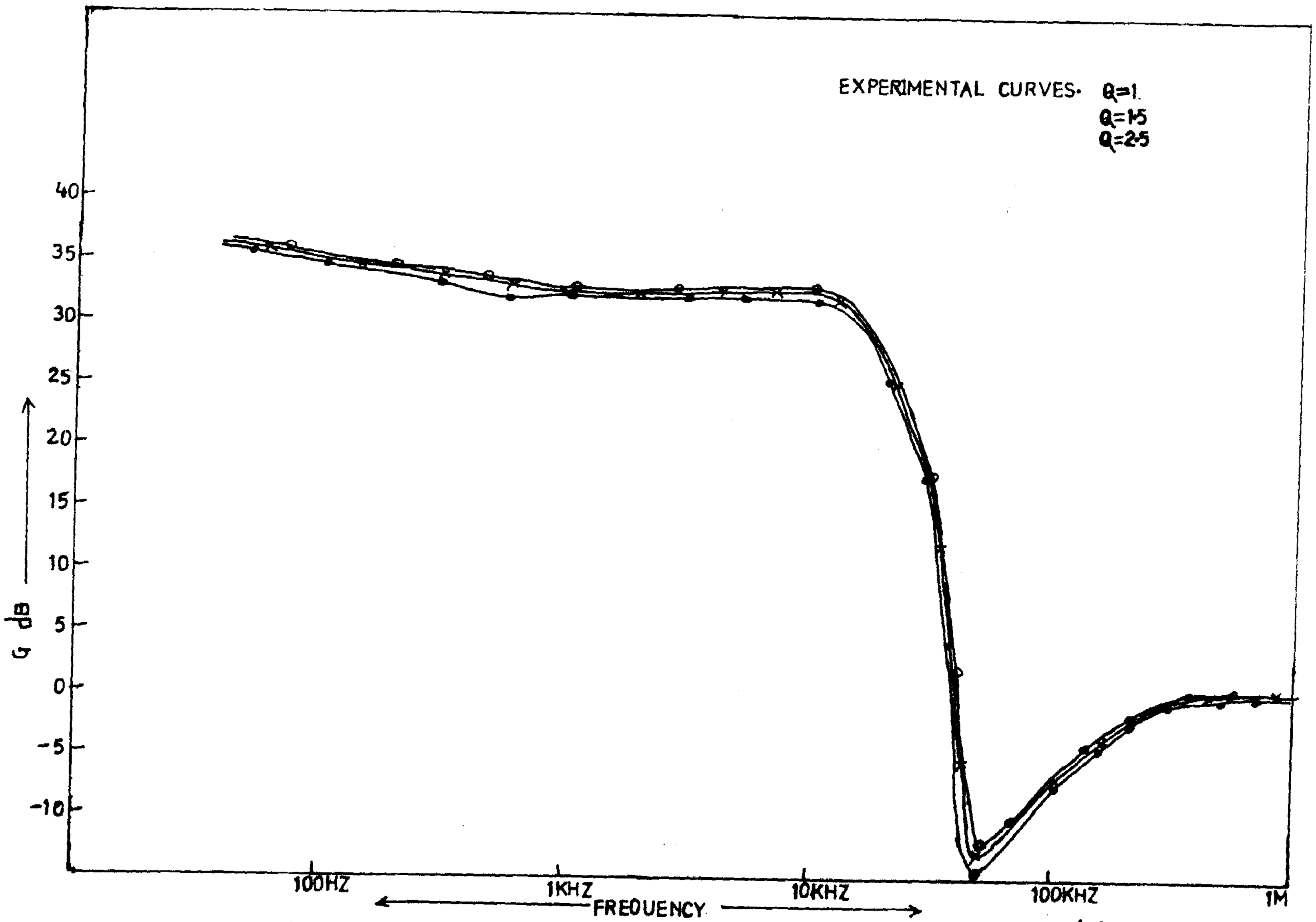


FIG-(4.3) BAND PASS RESPONSE FOR F_0=10KHZ, R=330HMS AND DIFFERENT 'Q'



FIG(4.4) BAND PASS RESPONSE FOR Fo=10KHZ, R=33OHMS AND DIFFERENT 'Q'.

cies closely agree with the design center frequency F_o = 10KHz. The roll-off is also satisfactory for theoretical and experimental curves (32 dB/decade). However, above 100 KHz the output remains constant instead of decreasing rapidly. This may be due to lower gain of the operational amplifier itself at the high frequency end. The variation of 'Q' has very little effect on the response but the circuit has high gain of 74 dB. A theoretical curve, drawn for Q=1 and F_o=10 KHz, shows a small peak at design frequency.

(2) HIGH PASS RESPONSE

The high pass response is shown in Fig.(4.2). In this case also the response is quite satisfactory and there is very good agreement between theoretical and observed values above 20 KHz. The cut-off frequency also agrees well with design value. However, the response below 10 KHz is somewhat degraded as compared to the theoretical curve. The theoretical curve shows a small peak at F_o = 10 KHz in this case also. The circuit shows excellent frequency response from 200 Hz to 1 MHz.

(3) BAND PASS RESPONSE

The band pass response is shown in Fig.(4.3). In this case the curves are identical above 20 KHz but some variation is observed below 10 KHz. It is noticed that as

'Q' value increases, the gain in passband increases. The theoretical curve is just like a resonance curve for low 'Q' values and shows a peak at F_O = 10 KHz. The observed curves, however, show a broad response below 10 KHz. The bandwidth agrees reasonably well. The overall response is satisfactory.

(4) BAND STOP RESPONSE

The band stop response is shown in Fig.(4.4). It is observed that the curves are almost identical showing no variation with respect to 'Q'. This may be due to small values of 'Q' used for the circuit design. There is no agreement between the design value of F_O and observed value. The curves are similar to the curves for low pass filters but show pronounced deep at about 50 KHz. The overall response is not satisfactory.

4.3 CONCLUSIONS

The new Active-R filter circuit is studied with variation in 'Q'. The experimental observations show that the performance of the circuit is quite satisfactory except for the band stop action. Some degradations are observed at the high frequency end of the response. This may be due to lower gain of the operational amplifier which might have affected the overall feedback in the circuit. Similarly, some degradations are also observed below 10 KHz in case of high pass action. It is worthwhile to note that none of the responses show a peak near F_o value while the theoretical curve shows a small peak at F_o. In this study only low values of 'Q' were considered.

Table (4.1) : The designed and experimental values of resistances

F_o (KHz)	Tapping point (A)	Q	Designed Values			Experimental Values		
			R_3	R_2	R_1	R_3	R_2	R_1
10	0.5	1.0	101 Ω	911.20 KΩ	15.50 KΩ	100 Ω	911.20 KΩ	15.30 KΩ
10	0.5	1.5	100 Ω	713.70 KΩ	23.30 KΩ	100 Ω	713.30 KΩ	23.00 KΩ
10	0.5	2.5	100 Ω	642.40 KΩ	38.80 KΩ	100 Ω	643.00 KΩ	40.00 KΩ