CHAPTER - IV

STUDY OF RESPONSE OF THE CIRCUIT WITH VARIATION OF CENTER FREQUENCY Fo

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4.1 CIRCUIT and EXPERIMENTAL STUDEY :-

The new active-R filter circuit discused in previous chapter is further studied with variation of center frequency F_o.

For practical realization,the value of R_1 and R_2 must be positive .Hence there is an upper limit on Q, if F_0 and R are assumed.

From equation (3.12) we have

$$Q < W_0 \frac{R_1(R_1+4R)}{2GB(R_1-2R)}$$

Limits on Q for different center frequencies are given below .

1) F_0 = 1 kHz ; Q < 1.30

2) F_0 = 10 kHz ; Q < 1.34

3) F_0 = 50 kHz ; Q < 1.559

4) F_0 = 100 kHz ; Q < 1.918

This active R filter was constructed by using identical μA 741 as operational amplifiers for Q = 1 and different center frequencies .The performance of the circuit was studied for F_0 = 10 kHz,50 kHz,and 100 kHz. The low pass,high pass ,band pass and band stop response was taken at four different output terminal on A.C. millivoltmetere. The response is as shown in fig.(4.1), (4.2), (4.3) and (4.5) with the theoretical curve is shown by (________.______).

4.2 RESULT AND DISCUSSION :-

A) LOW PASS RESPONCE :- The low pass response is shown in fig. (4.1). A theoreaical response is plotted for Q = 1, F_0 = 10 kHz. Result shows close agreement between designed and experimental value of Q and F_0. The frequency response curves for Q = 1 and different values of central frequencies; F_0 = 10 kHz , 50 kHz and 100 kHz is shown. From response we note that, as center frequency decreases there is decrease in gain in the pass band. The gain roll off at high frequency resion is also satisfactory (35 dB per decade). It is noted that, the response is extended upto 10 Hz, the gain is high (74dB for 10kHz), no overshoot, good agreement of center frequency with designed value as compaired to earlier reported circuits[1-8].

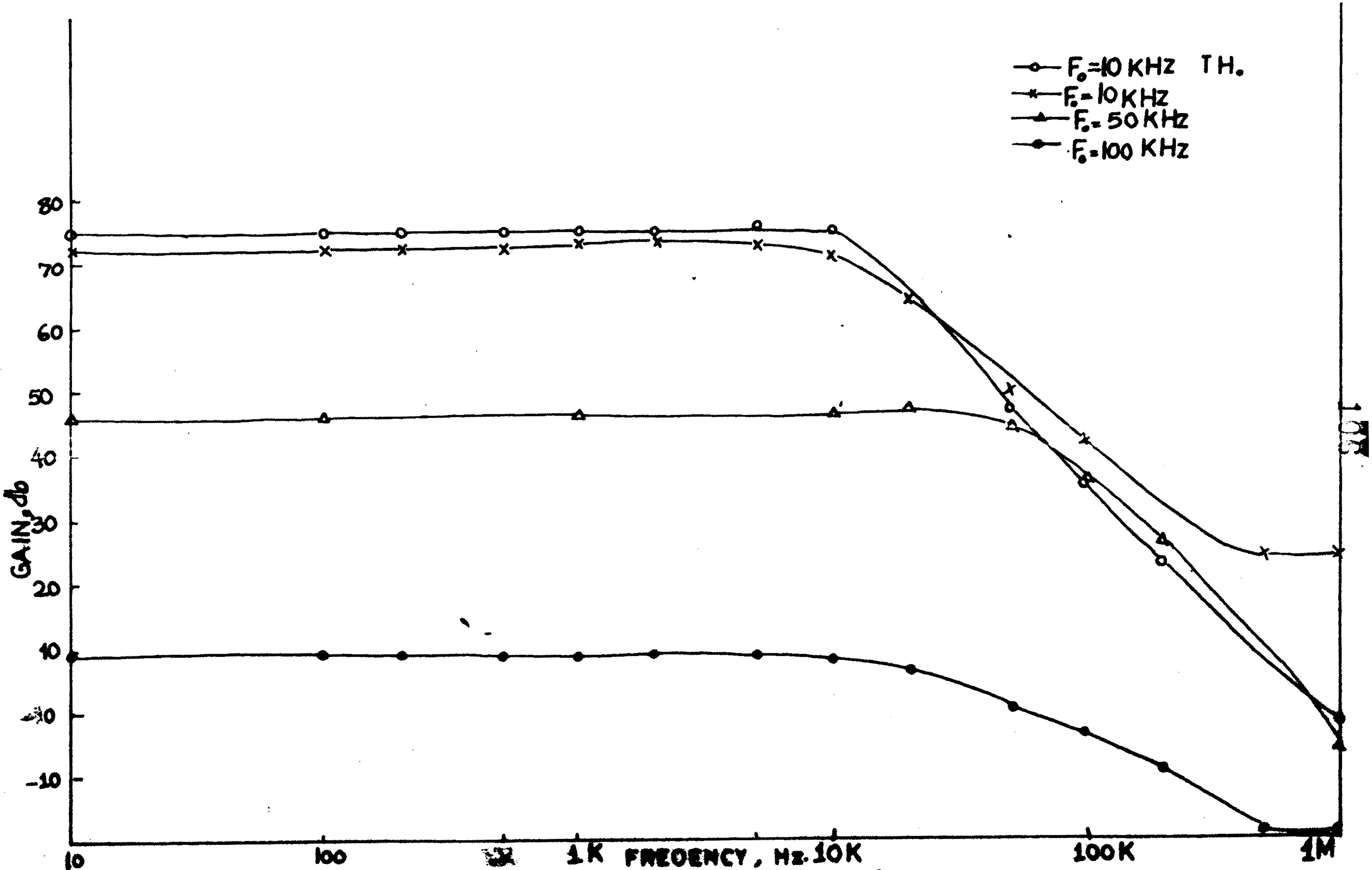

Fig.4.1 Low Pass Response For Q=1 And Different f_o

B) HIGH PASS RESPONSE : -

The high pass response is shown in fig. (4.2). In this case also a good agreement in theoretical and experimental result was observed. However, the theoretical result and practical curve differ greatly up to 2 kHz. Above these frequencies,the theoretical and experimental curves merge together. Satisfactory response was observed from 2 kHz onwards.As the center frequency increases, the gain of the high pass filter decreases and attains - 20 dB, for 100 kHz, also flatness at the pass band decreases.

C) BAND PASS RESPONSE :-

The band stop response is shown in fig.(4.3). In this case also there is a close agreement between theoretical and experimental values . The response of the filter circuit was taken form 1 kHz to 1 MHz. For the lower center frequencies , the response is peaked. However,the center frequency differs greatly for F_o = 100 kHz. For F_0 = 100 kHz.,we get wide band width 596.5 kHz with gain roll off 9 dB / decade in high frequency region.

D) BAND STOP RESPONSE :-

Band stop response is shown in fig.(4.4). It is seen that below 10 kHz,the response is almost flat

and sharply decreases at 100 kHz. It shows sharp rejection

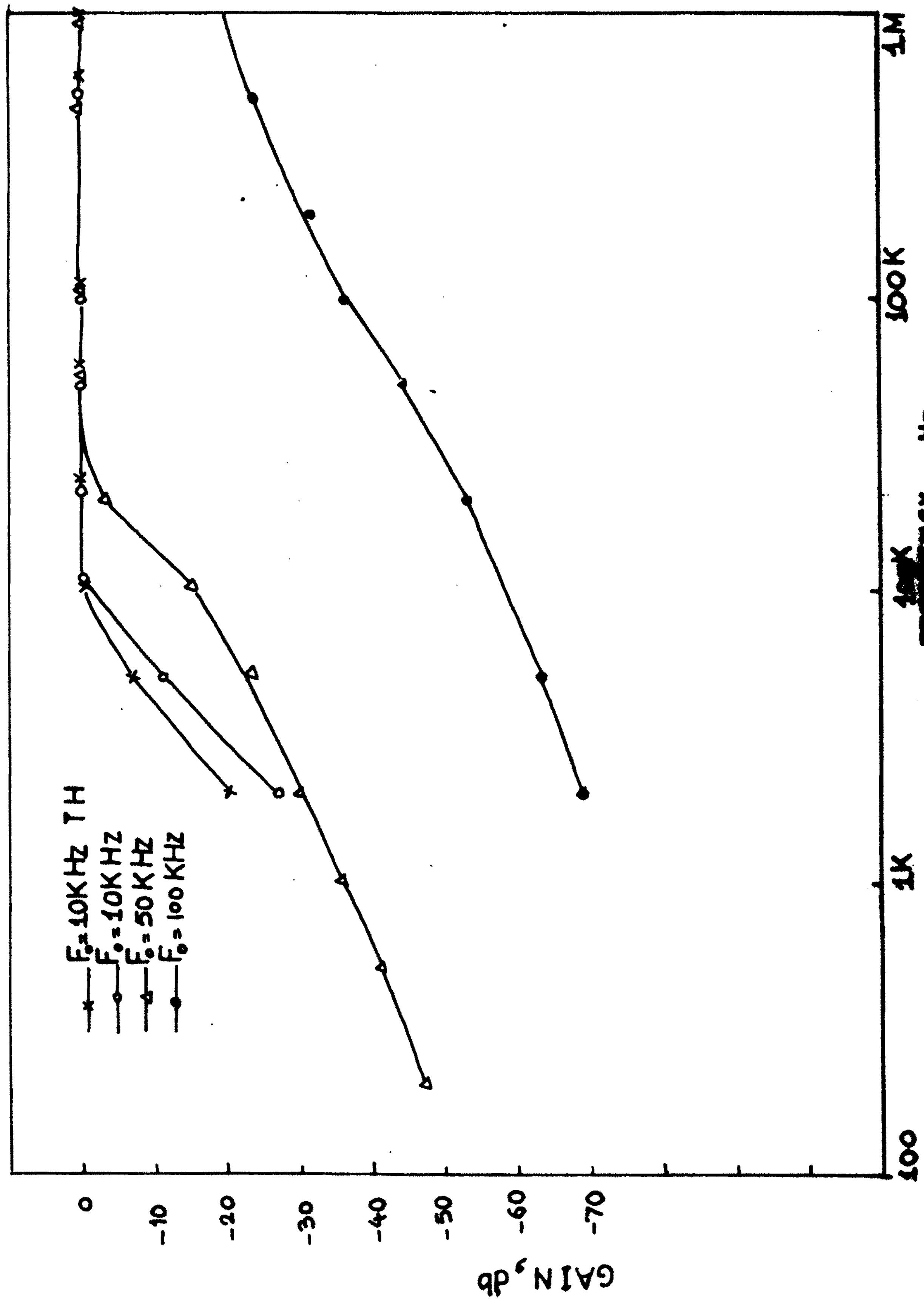

Fig.4.2 High Pass Response For Q=1 And Different f_o

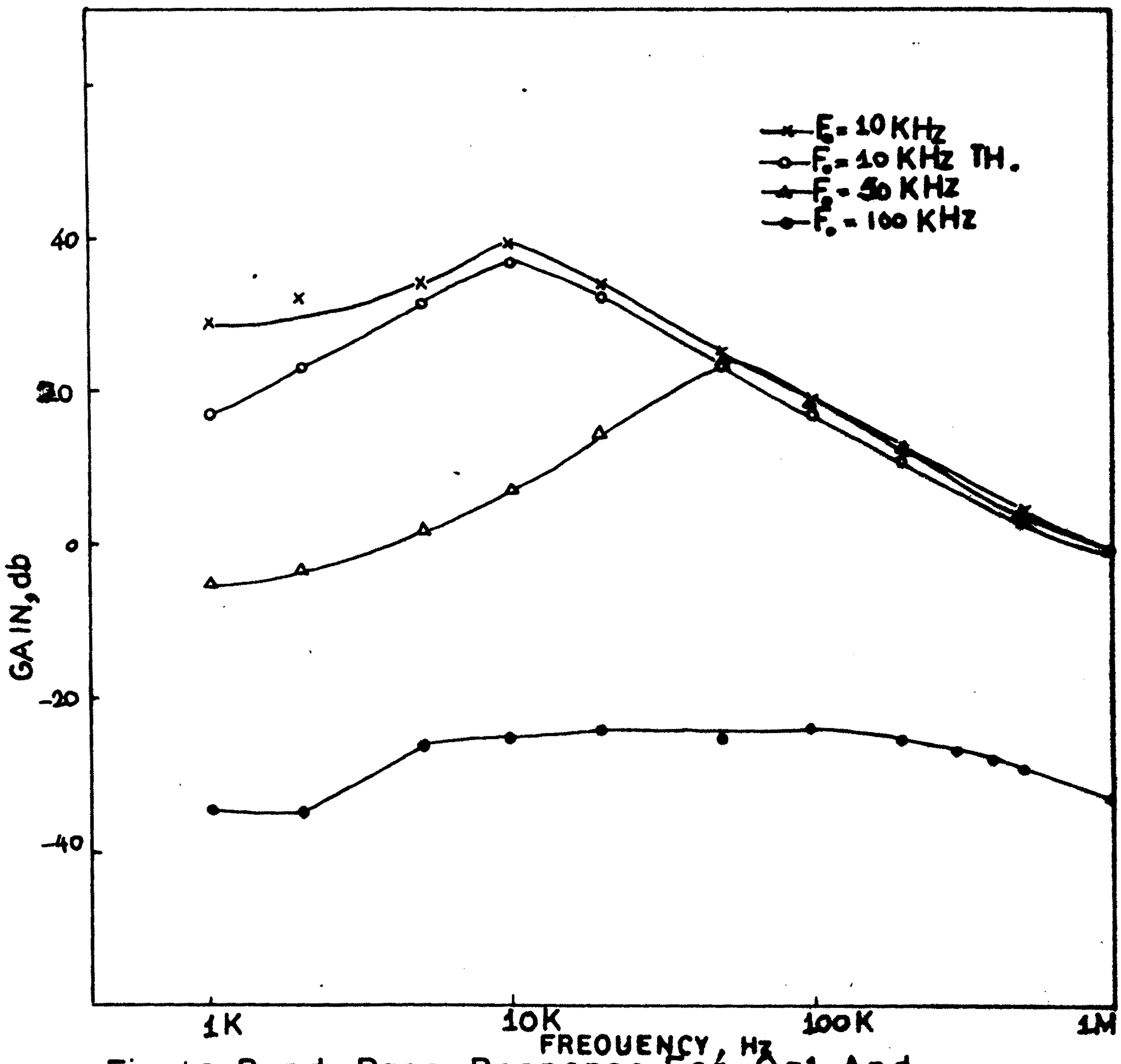

Fig. 43 Band Pass Response For Q=1 And Different f_o

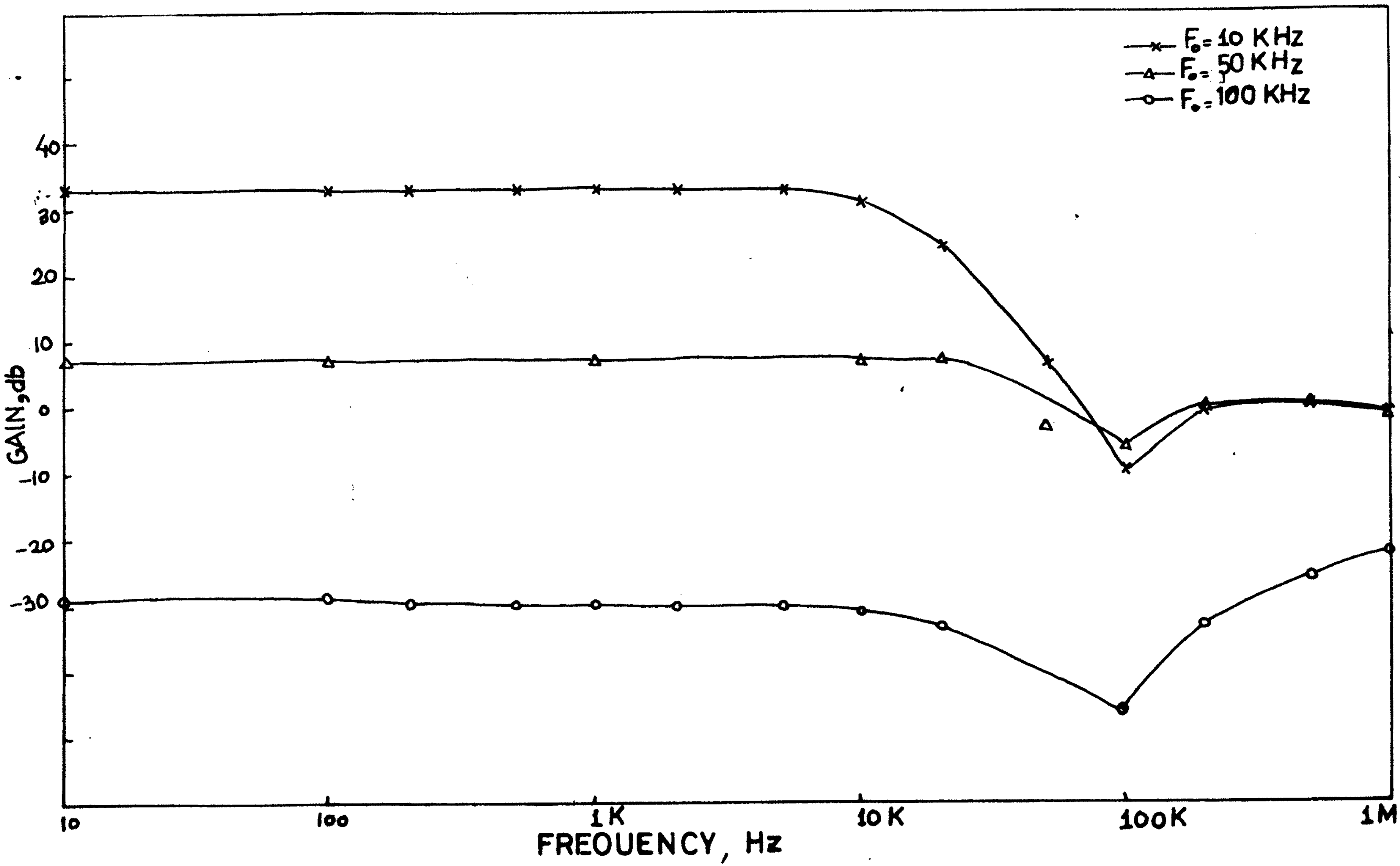

Fig.44 Band Stop Response For Q=1 And Different f_o

point at 100 kHz and above 100 kHz, gain decreases and levels off. However, there is decrease in deep of rejection point as we increase the center frequency. The gain decreases also. The center frequency does not agree with the designed value.

The table (4.1) summarizes the overall behavior of the circuit. In this table the design value of F_o is compared with observed values. Also design values of Q and observed from the graphs are represented.

TABLE (4.1)

EXPERIMENTAL AND DESIGN VALUES COMPARISION

F_0 kHz		Q		Band pass gain dB
DE	Exp	DE	Exp	
10.00	10.00	1.0	1.2	39.32
50.00	50.00	1.0	1.06	24.62
100.00	60.00	1.0	1.02	-24.73

(where DE.= Design value, Exp. = Experimental value)

4.3 CONCLUDING REMARKS :-

The new active -R filter ciurcuit is studied for different center frequecies. It shows close agreement betweeen the design and experimental values. The response is extended from very low frequency to 1 Mhz frequency region. As center frequency decreases, there is decrease in gain in the pass band. The roll-off for the low-pass response is 35 dB/decade and for high pass response the flatness of the curve decreases as center frequency increases. For the lower center frequencies for band pass filter the curves are peaked. However there is sharp rejection point with decrease in deep of rejecion point is observed for bandstop response. The center frquency for 100 Khz does not agree with designed value.

The new active -R filter can be used for different center frequencies with the limiting value of Q.

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