BARISAL ENGINEERING COLLEGE

DURGAPUR, BARISAL

LAB REPORT

DEPARTMENT OF ELECTRICAL & ELECTRONIC ENGINEERING

Course Title : ELECTRICAL CIRCUIT (II) SESSIONAL

Course Code : EEE-1202

Name of Experiment : To analyze the frequency response of a RC Lowpass filter

Date of Experiment :

Experiment No. :

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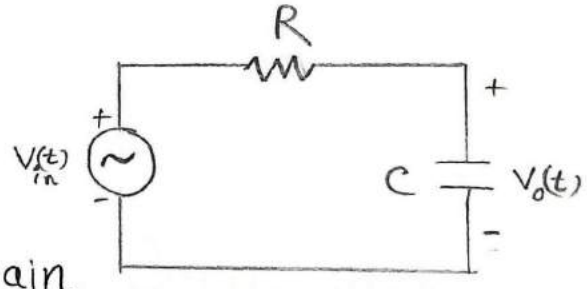
Name of the experiment: To analyze the frequency response of a RC low pass filter for a specific cutoff frequency.

Objective: After completing this experiment we will know the effect of input frequency to the output of a L.P.F. We will also know how to draw semi-log graph of frequency vs transfer function H(ω) / Gain.

Theory: An L.P.F is formed when the output of an RC circuit is taken of the capacitor. shown in fig.(1).

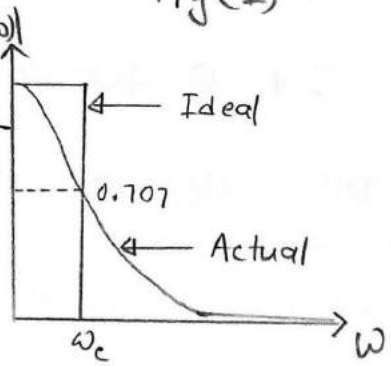


Fig(1)

The transfer function or gain of a L.P.F is,

$$H(\omega) = \frac{1}{1+j\omega RC}$$

In the fig-(2), the frequency



vs gain graph showing the ideal and actual frequency response of an L.P.F.

We know the cutoff frequency of an L.P.F is -

$$\omega_c = \frac{1}{RC} \Rightarrow f_c = \frac{1}{2\pi RC}$$

Now, for our given cutoff frequency,

$$f_c = 1300\ Hz$$

Taking the resistance $R = 12.2\ \Omega$, the capacitance,

$$C = \frac{1}{2\pi \times 12.2 \times 1300} = 10\ \mu F$$

Taking 5V as input voltage, the required circuit will be same as fig-(3)

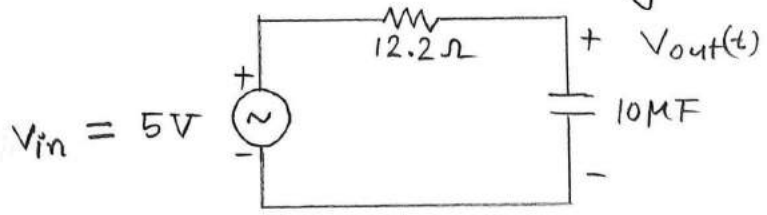


Fig-(3)

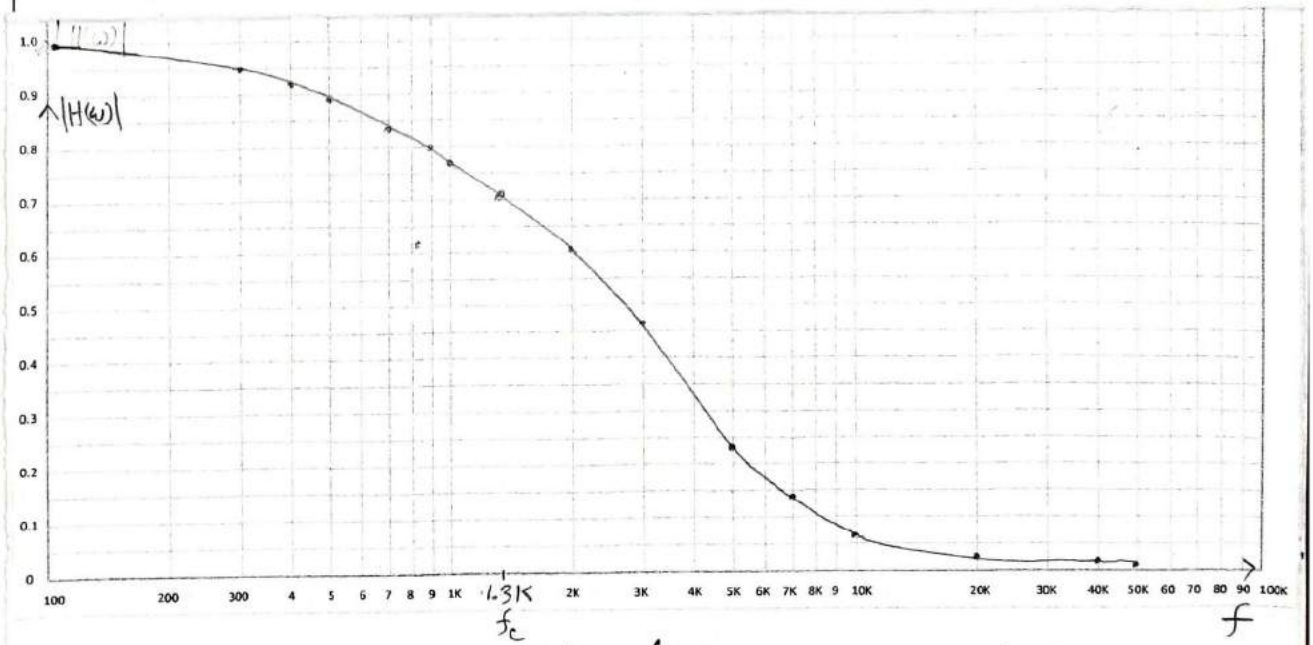
Apparatus: (1). Frequency generator (2). Oscilloscope (3). Resistor (4). Capacitor (5). Breadboard (6). Connectors

Procedure:

1) Make the circuit and connect frequency generator to the input.
2) To measure the frequency responses, connect CH-1 and CH-2 of oscilloscope to input and output respectively.
3) Go to the 'measure' function of oscilloscope and set the peak-to-peak voltages of CH-1 and CH-2 to display.
4) For a wide range of frequency, in both side of cutoff frequency, note the peak-to-peak voltages (VPP) of CH-1 and CH-2 and make a data table of fregency, $V_{PP(in)}$, $V_{PP(out)}$ and gain.
5) From the experimental value, draw a ~~graph~~ semi-log graph of frequency vs gain.

Data table:

	Frequency(Hz)	Vin (Pk - Pk)	Vout (Pk - Pk)	Gain $H(\omega) = \frac{Vout}{Vin}$
01	100	5	4.9	0.98
02	300	4.79	4.55	0.95
03	400	4.55	4.18	0.92
04	500	4.24	3.73	0.88
05	700	3.98	3.34	0.84
06	900	3.77	3.01	0.8
07	1K	3.62	2.72	0.753
08	1.3K	3.58	2.50	0.70
09	2K	3.50	2.13	0.61
10	3K	3.33	1.53	0.46
11	5K	3.14	0.72	0.23
12	7K	3.04	0.43	0.14
13	10K	2.78	0.17	0.06
14	20K	2.39	0.047	0.02
15	40K	2.27	0.023	0.01
16	50K	2.11	0.0105	0.005



The semi-log graph of frequency vs gain

Calculation:

We know, at cutoff frequency, the output gain is $\frac{1}{\sqrt{2}} = 0.707$

From our data table,

At frequency 1300Hz, the gain is 0.70

or, at f_c, " " " 0.70

which is very closer to 0.707

Hence, the cutoff frequency of this filter is 13K.

Result: Before cutoff frequency, the voltage gain decrease highly. But after the cutoff f, votage gain decrease slowly as the frequency goes up. At cutoff fre. the gain dropped about 30%.

Precautions:

(i) Make sure the sine wave is selected from frequency generator.

(ii) Set both the coaxial cable of oscilloscope either 1x or 10x.

(iii) Make sure, bothe channels of oscilloseope is on.