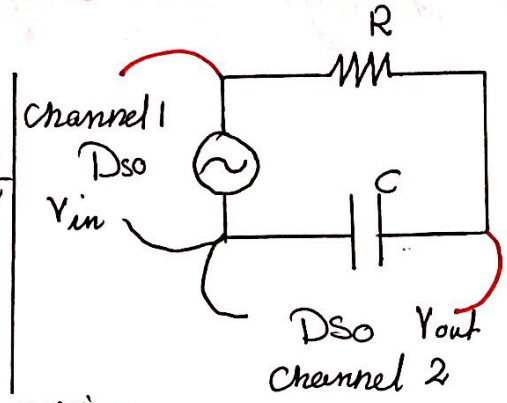
Experiment 10

Filters

R-C filters

Note: f_{-3dB} in both cases should be the same theoretically

Low pass filters integrator



$V_{in} = V_o \sin \omega t$

$V_{in} = I Z$

from the previous Exp $Z = \sqrt{R^2 + X_c^2}$

$$\therefore V_{in} = I \sqrt{R^2 + X_c^2}$$

Remember that $X_c = \frac{1}{\omega C}$

$$V_{out} = I X_c$$

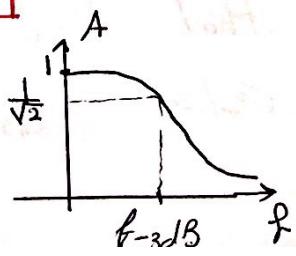
Attenuation factor :-

$$A = \frac{V_{out}}{V_{in}} = \frac{X_c}{\sqrt{R^2 + X_c^2}}$$

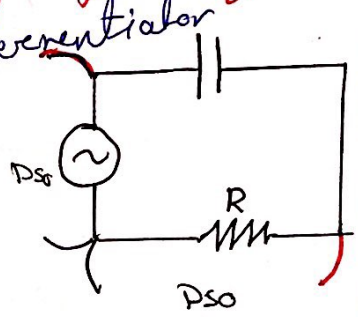
$$A = \frac{1}{\sqrt{R^2 \omega^2 C^2 + 1}}$$

$$\omega_{-3dB} = \frac{1}{RC}$$

$$f_{3dB} = \frac{1}{2\pi RC}$$



High pass filters differentiator

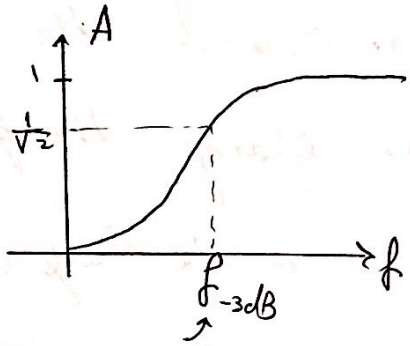


here :-

$$V_{out} = I R$$

$$A = \frac{R}{\sqrt{R^2 + X_c^2}}$$

$$A = \frac{1}{\sqrt{1 + \frac{1}{\omega^2 R^2 C^2}}}$$



Alaa Hatwi

Theoritical explanation :-

- low pass filter only allows low frequency signals to pass
- When the frequency is low the signal travels through the output and when it is high it travels through the Capacitor.

what we use :-

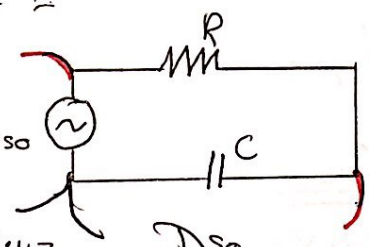
- R, C
- signal Generator & Dso

- قم بوصل هذه الدارة
- غير تردد الى (0.2 -- 20)
وقس فرق الجهد
- احسب A بقسمة Vout على 10v
- ارسم A vs f ، احصل f_{-3dB}

Procedure

- low pass filter :-

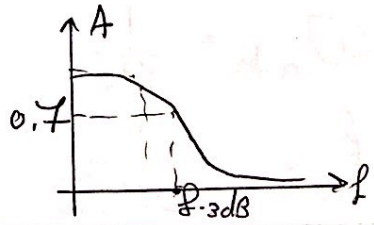
→ • Connect the Circuit :-



→ • Change the frequency in the Range (0.2 -- 20) kHz and measure V

→ • Calculate A by knowing that $V_{in} = 10$

→ • Draw A vs f and obtain f_{-3dB}



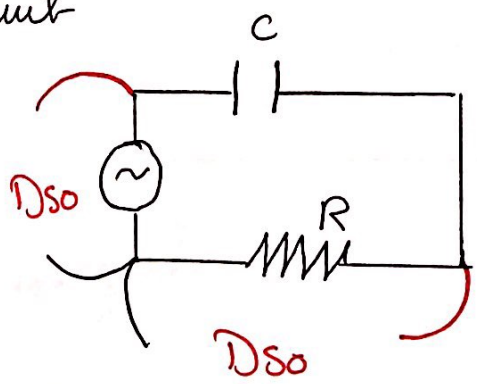
Alaa Etaiwi

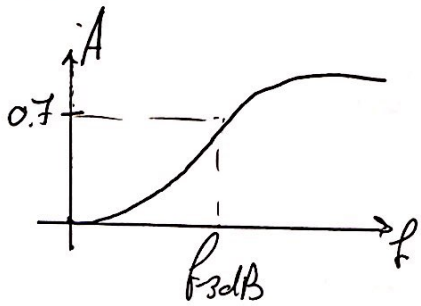
- high pass filter

→ • Connect this Circuit

→ • Same as the previouse

- Obtain f_{-3dB}





- قم بوصل الدارة (المقاومة بدل الوصلة)
- نفس خطوات التركيب السابقة
- احصل على f_{-3dB}

Alaa Etaiwi