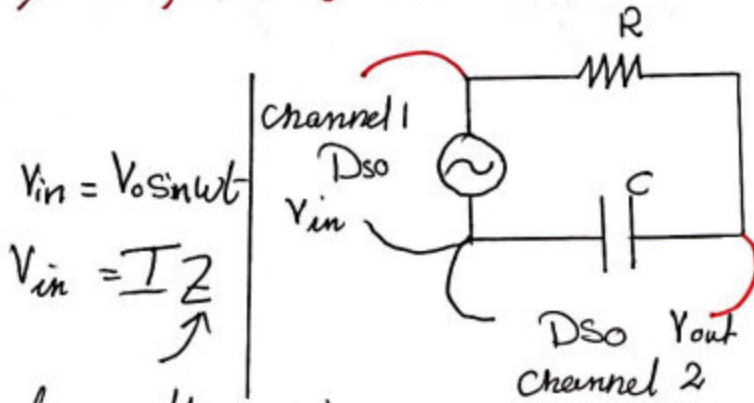


Filters

R-C filters

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

Low pass filters



$$V_{in} = V_0 \sin \omega t$$

$$V_{in} = I Z$$

from the previous

$$Exp \quad Z = \sqrt{R^2 + X_C^2}$$

$$\text{So } V_{in} = I \sqrt{R^2 + X_C^2}$$

$$V_{out} = I X_C$$

Remember that

$$X_C = \frac{1}{\omega C}$$

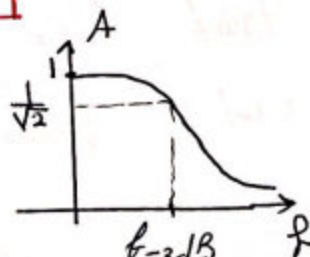
Attenuation factor :-

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

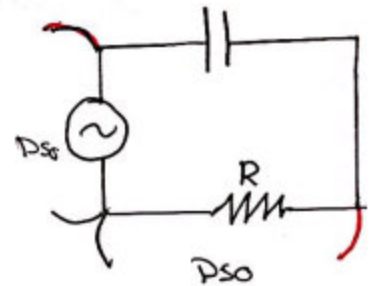
$$A = \frac{1}{\sqrt{R^2 \omega^2 C^2 + 1}}$$

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

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



High pass filters

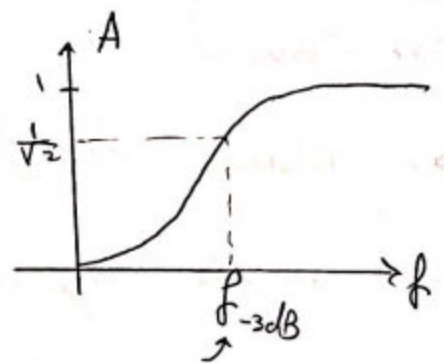


here :-

$$V_{out} = I R$$

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

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



Theoretical explanation :-

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- 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 :-

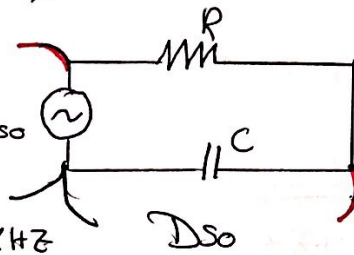
- R, C
- signal Generator & DSO

• قم واصل هذه الدارة
• غير قيم التردد في المدى (0.2...20)
• وقس قوة الخرج

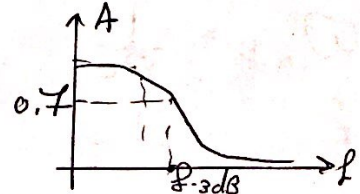
Procedure

- low pass filter :-
- Connect the circuit :-
- Change the frequency of DSO in the Range (0.2...20) kHz and measure V

• اصب A نسبة V_{out} على V_{in}
• ارسم A vs f و اخرج f_{-3dB}



- Calculate A by knowing that $V_{in} = 10$
- Draw A vs f and obtain f_{-3dB}

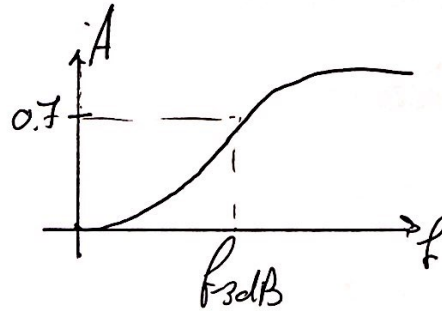
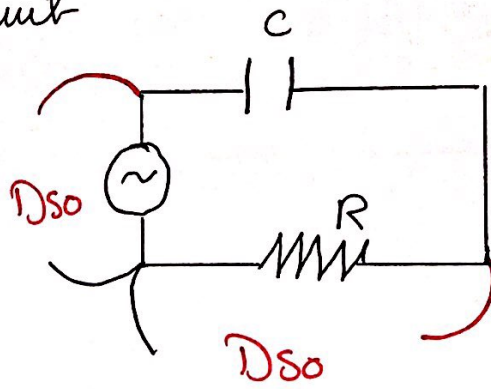


• High pass filter

→ • Connect this Circuit

→ • Same as the previous

• Obtain f_{-3dB}



• قم بوصول الدارة (للقائمة بدل المولج)

• نفس خطوات التركيب السابق

• احصل على f_{-3dB}