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18/ENG04/079

DEPARTMENT : ELECTRICAL ELECTRONICS

A.

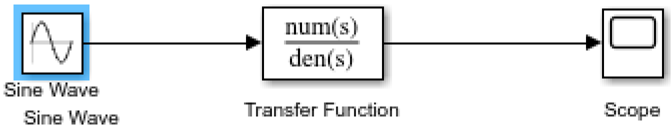
A filter is a circuit capable of passing (or amplifying) certain frequencies while attenuating other frequencies. Thus, a filter can extract important frequencies from signals that also contain undesirable or irrelevant frequencies.

In the field of electronics, there are many practical applications for filters. Examples include:

- *Radio communications*: Filters enable radio receivers to only "see" the desired signal while rejecting all other signals (assuming that the other signals have different frequency content).
- *DC power supplies*: Filters are used to eliminate undesired high frequencies (i.e., noise) that are present on AC input lines. Additionally, filters are used on a power supply's output to reduce ripple.
- *Audio electronics*: A crossover network is a network of filters used to channel low-frequency audio to woofers, mid-range frequencies to midrange speakers, and high-frequency sounds to tweeters.
- *Analog-to-digital conversion*: Filters are placed in front of an ADC input to minimize aliasing.

B. Designing a Low-Pass Filter with 0.005Ω resistor and 0.01F capacitor

A 100V Amplitude was selected with a frequency of 1Hz for the Sine Wave Source.



C. Determining the Cut-off frequency

The cut-off frequency is calculated by F= ½*(pi*R*C)

When R= 0.005Ω and C= 0.01F

F= 0.5*pi*0.005*0.01=3189.099 Hz

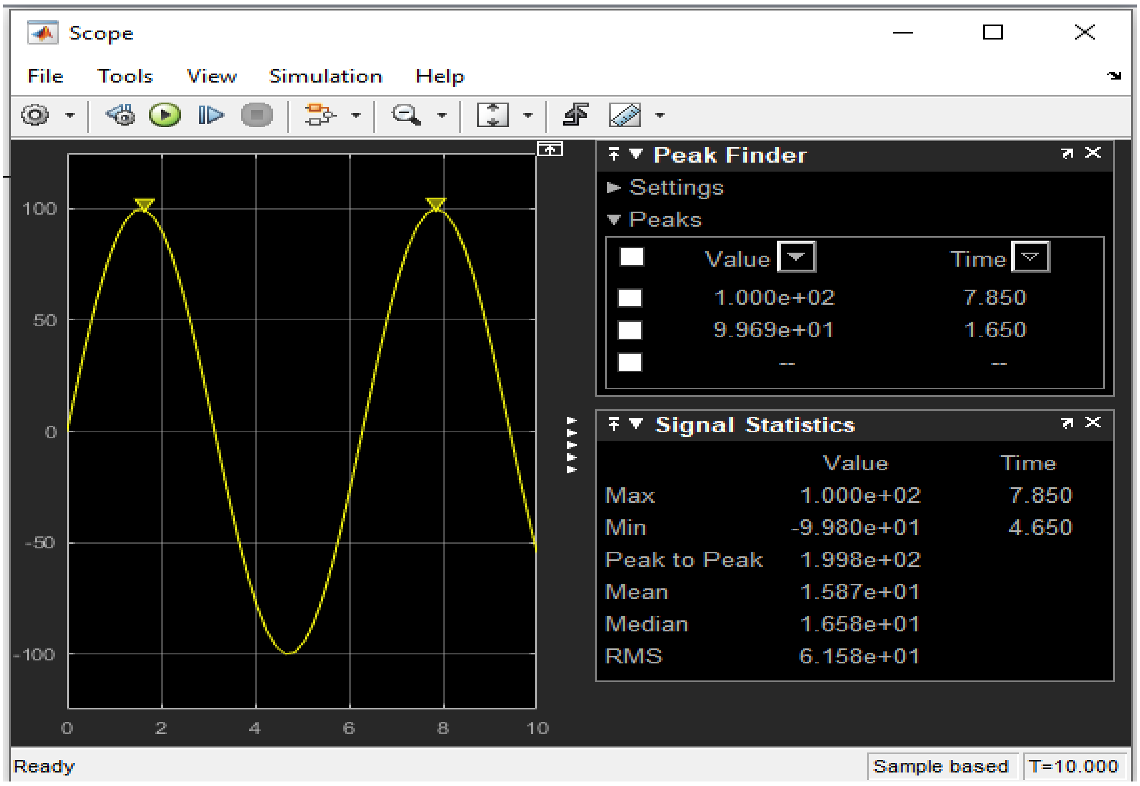
D. Design Output

The transfer function equation for the circuit is given as

(1/RC)/(S + 1/RC)

When R= 0.005Ω and C= 0.01F

Transfer Fcn=(1/0.005*0.01)/(S + (0.005*0.01))= (20000)/(s+ 20000)



Peak Finder

☐	Value	Time
☐	1.000e+02	7.850
☐	9.969e+01	1.650
☐	--	--

Signal Statistics

	Value	Time
Max	1.000e+02	7.850
Min	-9.980e+01	4.650
Peak to Peak	1.998e+02	
Mean	1.587e+01	
Median	1.658e+01	
RMS	6.158e+01	

A. If two signals of 5 KΩ and 2 KΩ are pass through the filter at different intervals. Discuss your observation

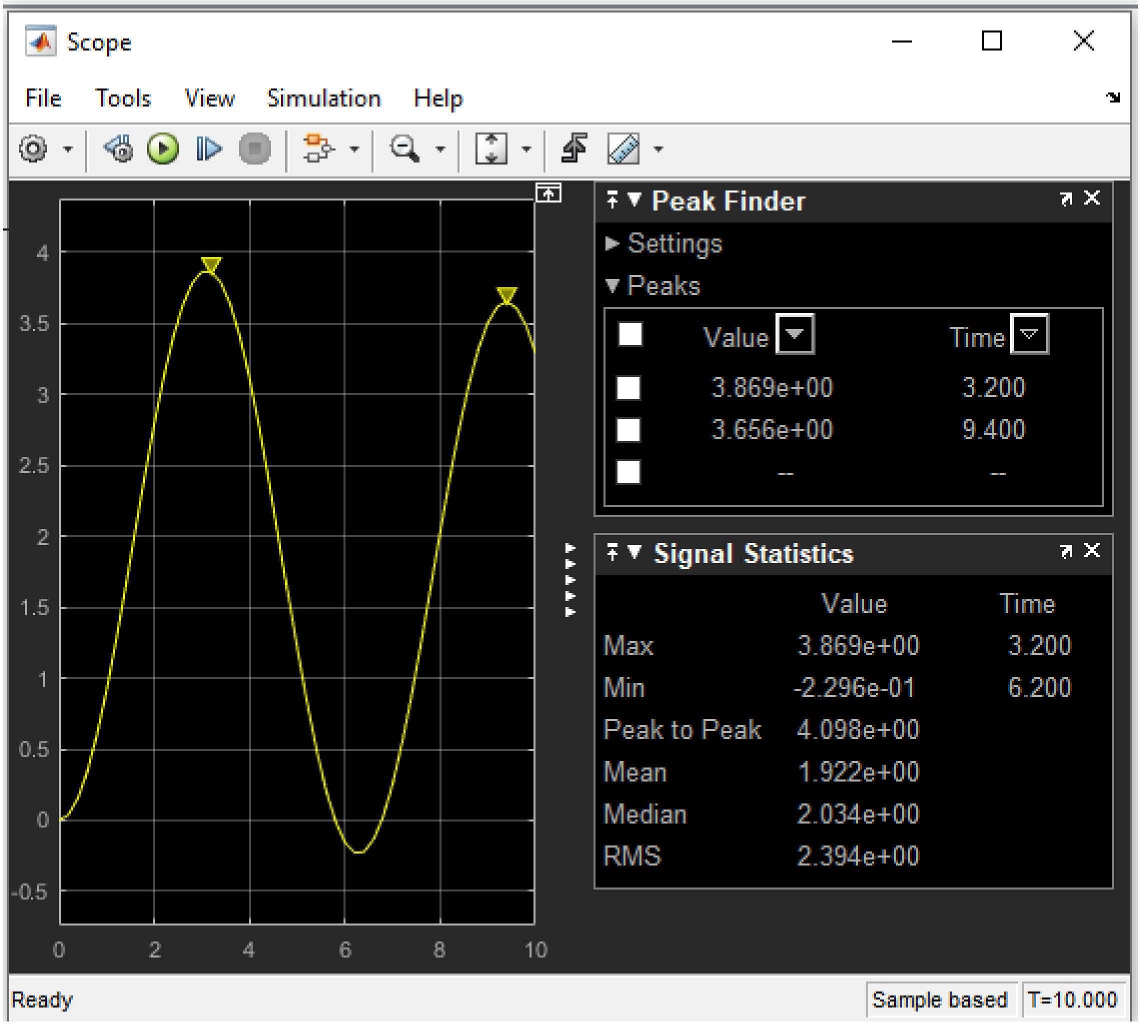
When the signal of 5 KΩ is passed through the filter, the following result is obtained:

The transfer function equation for the circuit is given as

(1/RC)/(S + 1/RC)

When R= 5000Ω and C= 0.01F

Transfer Fcn=(1/5000*0.01)/(S + (5000*0.01))= (0.02)/(s+ 0.02)



Peak Finder

☐	Value	Time
☐	3.869e+00	3.200
☐	3.656e+00	9.400
☐	--	--

Signal Statistics

	Value	Time
Max	3.869e+00	3.200
Min	-2.296e-01	6.200
Peak to Peak	4.098e+00	
Mean	1.922e+00	
Median	2.034e+00	
RMS	2.394e+00	

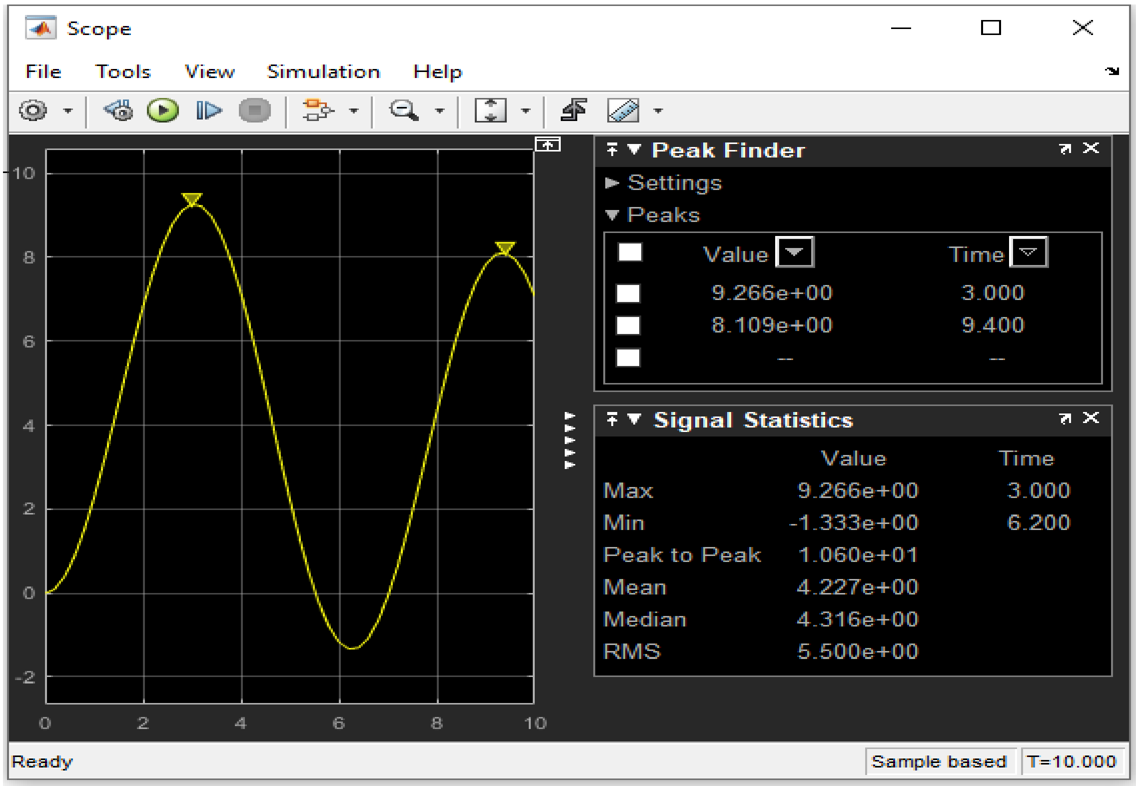
Observations: The signal is attenuated to 3.869 ohms

When the signal of 2K ohms is passed through the filter the following results are obtained: The transfer function equation for the circuit is given as

(1/RC)/(S + 1/RC)

When R= 2000Ω and C= 0.01F

Transfer Fcn=(1/2000*0.01)/(S + (2000*0.01))= (0.05)/(s+ 0.05)



Peak Finder

► Settings

▼ Peaks

	Value	Time
☐	9.266e+00	3.000
☐	8.109e+00	9.400
☐	--	--

Signal Statistics

	Value	Time
Max	9.266e+00	3.000
Min	-1.333e+00	6.200
Peak to Peak	1.060e+01	
Mean	4.227e+00	
Median	4.316e+00	
RMS	5.500e+00	

Observations: The signal is attenuated to 9.266 ohms