Questions **10marks**

Filters are important components in electronics system as seen in communication devices, speech and signal processing.

A. Discuss the benefits of filters in engineering system.
B. Design a low pass filter of 0.005Ω and 0.01F using **building blocks only**; you are free to determine your amplitude value.
C. Determine the cut-off frequency
D. Simulate the design and show the output using a display unit
E. If two signals of 5 KΩ and 2 KΩ are pass through the filter at different intervals. Discuss your observation(s).

Answers

A.

- ✓ **AUDIO ELECTRONICS**:

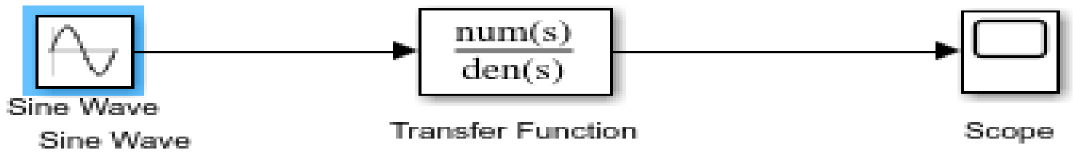
The audio filters are the electronic circuits which are designed to amplify or attenuate certain range of frequency components. This helps in eliminating the unwanted noise from the audio signal and improving the tone of the output audio. Filters play a major role in telecommunication and audio electronics

- ✓ **RADIO COMMUNICATIONS:**
  RF filters are used to remove or accept signals that fall in certain areas of the radio spectrum. There are many different instances where they can be used - the list of applications is almost infinite. ... They are used within transmitters to ensure that unwanted or spurious signals are not transmitted
- ✓ **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.

- ✓ Used in Audio Applications for Equalization purposes.
- ✓ Used in Receivers for efficient reception of the baseband signals.

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(FREQUENCY)= 0.5*pi*0.005*0.01=3189.099 Hz

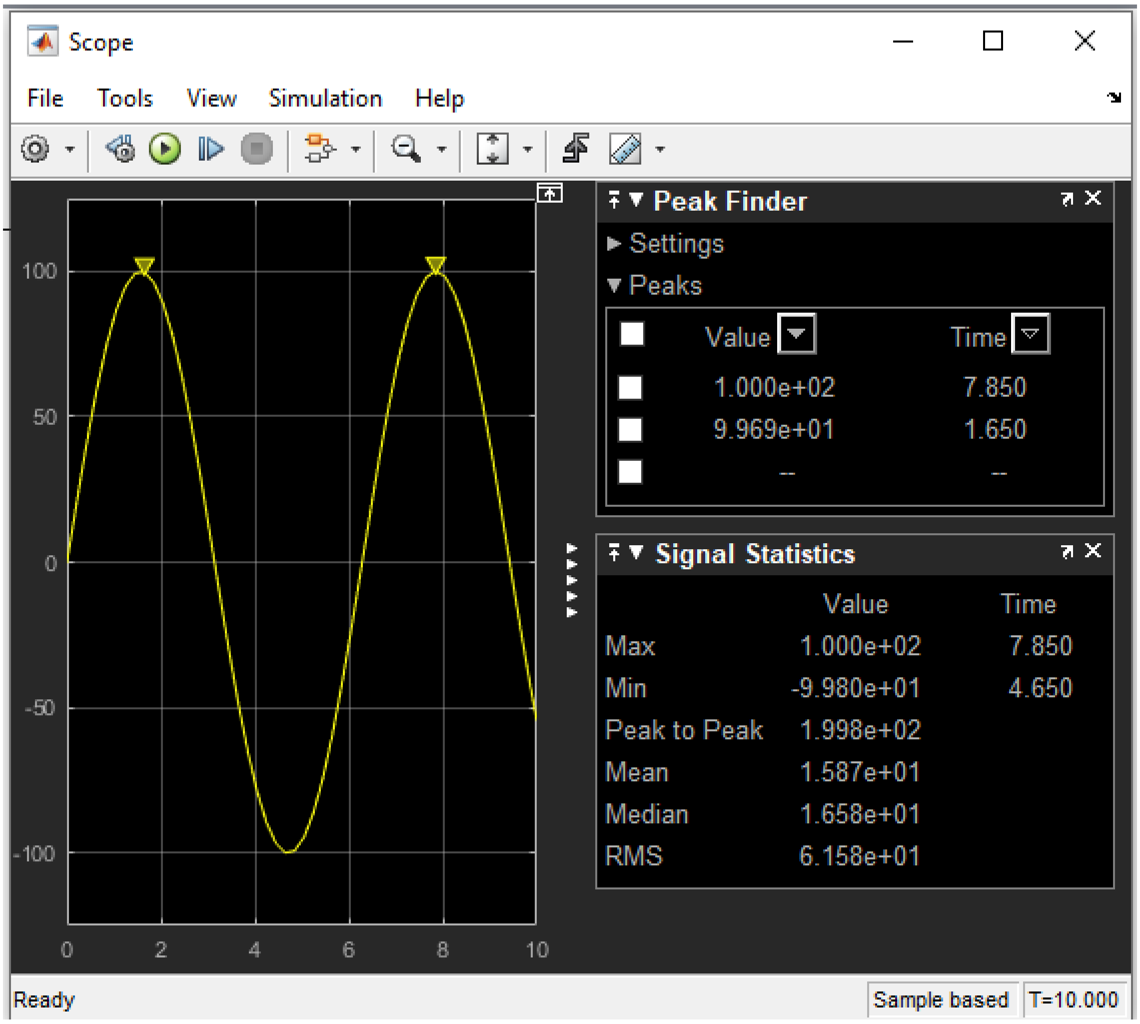
D. DESIGN OUTPUT

The transfer function is:

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

When R= 0.005Ω and C= 0.01F

TRANSFER FUNCTION=(1/0.005*0.01)/(S + (0.005*0.01))= (20000)/(s+ 20000)



A. IF TWO SIGNALS OF 5 KΩ AND 2 KΩ ARE PASS THROUGH THE FILTER AT DIFFERENT INTERVALS. DISCUSS YOUR OBSERVATION

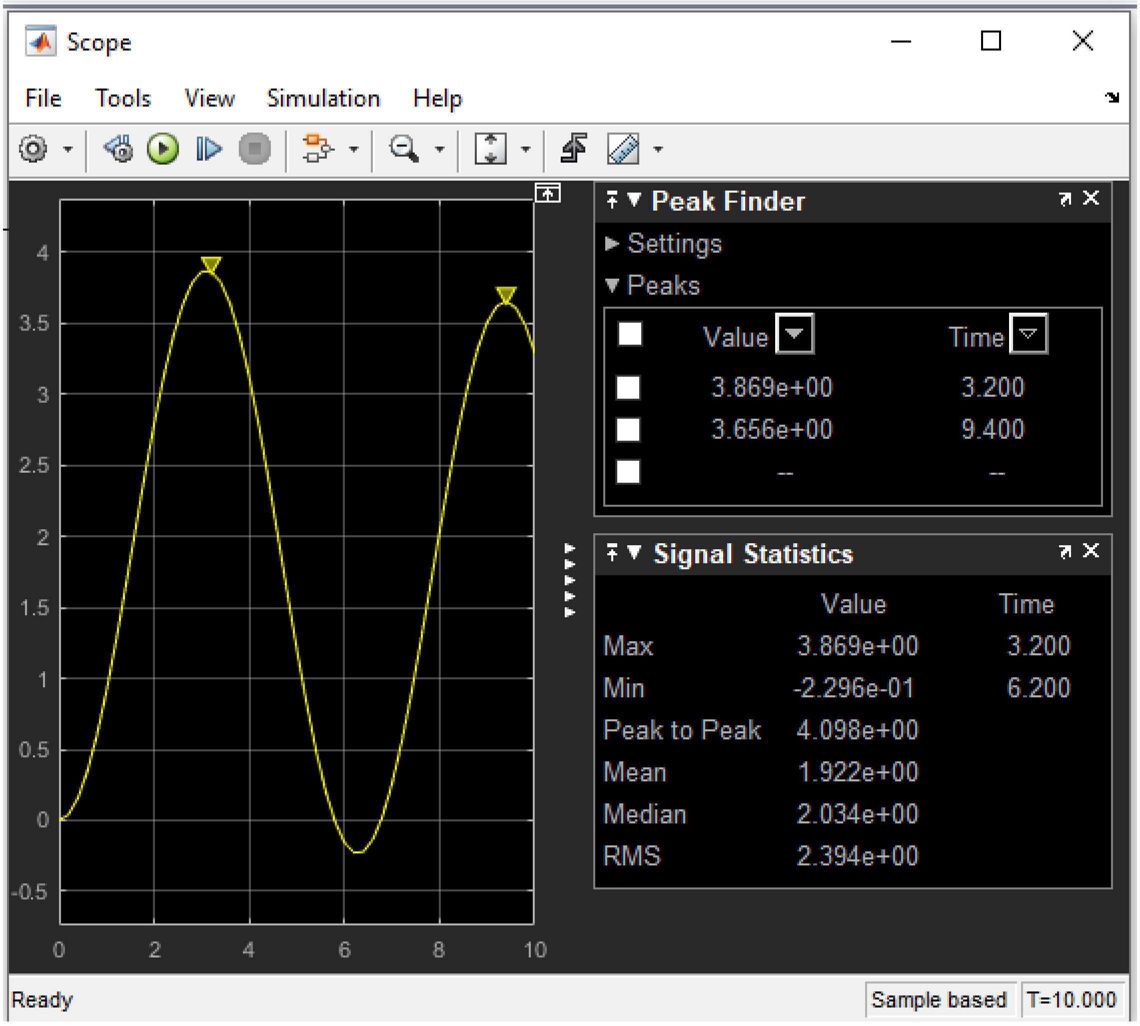
When the signal of 5 KΩ is passed through the filter, the following result is obtained:

The transfer function equation for the circuit is given as

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

When R= 5000Ω and C= 0.01F

TRANSFER FUNCTION=(1/5000*0.01)/(S + (5000*0.01))= (0.02)/(s+ 0.02)



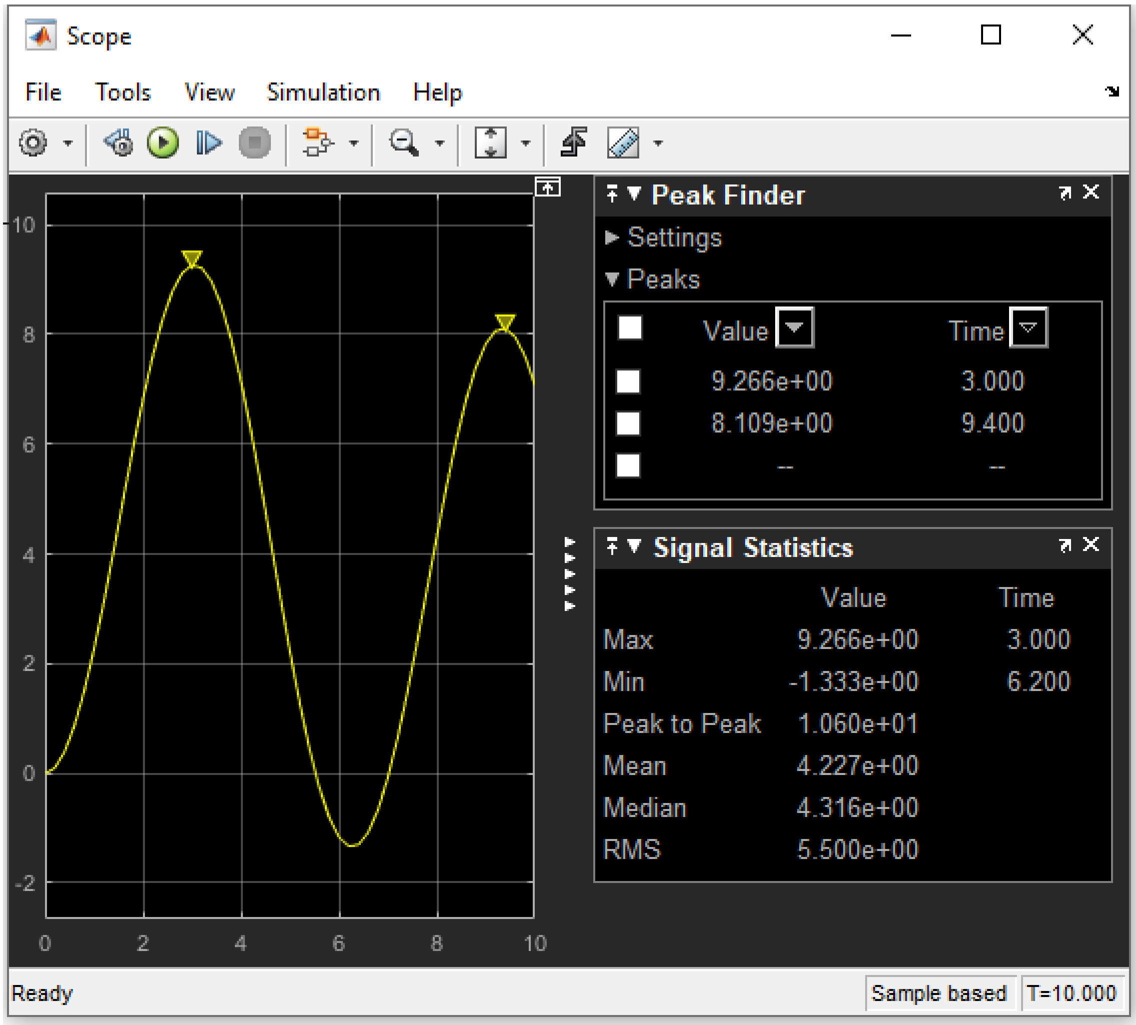
Observations: The signal is attenuated to 3.869 ohms

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



<u>OBSERVATIONS</u>: The signal is attenuated to 9.266 ohms