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**DEPARTMENT : ELECTRICAL ELECTRONICS**

**MAT NO: 17/ENG04/051**

**A.**

Filters are devices(circuits)/process capable of passing (or amplifying) certain frequencies while cutting off other frequencies. Thus, a filter can extract important frequencies from signals that also contain undesirable or irrelevant frequencies. In other words, filters are devices that remove some unwanted components or features from a signal. Sometimes it is desirable to have circuits capable of selectively filtering one frequency or range of frequencies out of a mix of different frequencies in a circuit.

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

* Analog-to-digital conversion: Filters are placed in front of an ADC input to minimize aliasing.
* *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.
* 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).
* *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.
* 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(F) 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)



1. **If two signals of 5 KΩ and 2 KΩ are passed through the filter at different intervals. Discuss your observation**

**When the 5 KΩ signal is passed through the filter, the following result(s) 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)

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**Observations:** The signal is attenuated to 3.869 ohms

**When the 2K ohms signal 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)

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**Observations:** The signal is attenuated to 9.266 ohms