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Assignment

a.) Benefits of filters in the engineering system

i They are used in pre-amplification, equalization, tone control in audio systems: This is the adjusting of the balance between frequency components within an electronic signal.

ii They are used in radio tuning to a specific frequency: An example of filter used is the radio frequency filter. They are used so that only the right kind of frequencies can be entertained while filtering out other unwanted bands of frequencies. It is most frequently used in equipment's such as radio, wireless communications, and televisions etc.

iii They are used in signal processing circuits and data processing: Filters are used to seperate signals that have been combined and also restoration of signals that have been distorted in some way and it helps to analyze data better.

iv Filter circuits are used to eliminate background noise

v Filter circuits are extensively used in medical electronic system

b i. Firstly, I launched the MATLAB program and accessed the Simulink

ii. I then created a new file and I opened the Model libraries

iii. I selected the sources and sinks, then I dragged the scope block into the model.

iv. I accessed the Libraries Browser tab again, I searched AC voltage source in the search bar then I dragged the AC voltage source block into the model

v. I opened the Libraries Browser tab again, I searched Series RLC Branch then I dragged the series RLC Branch block into the model

vi. I then duplicated the Series RLC branch in the model

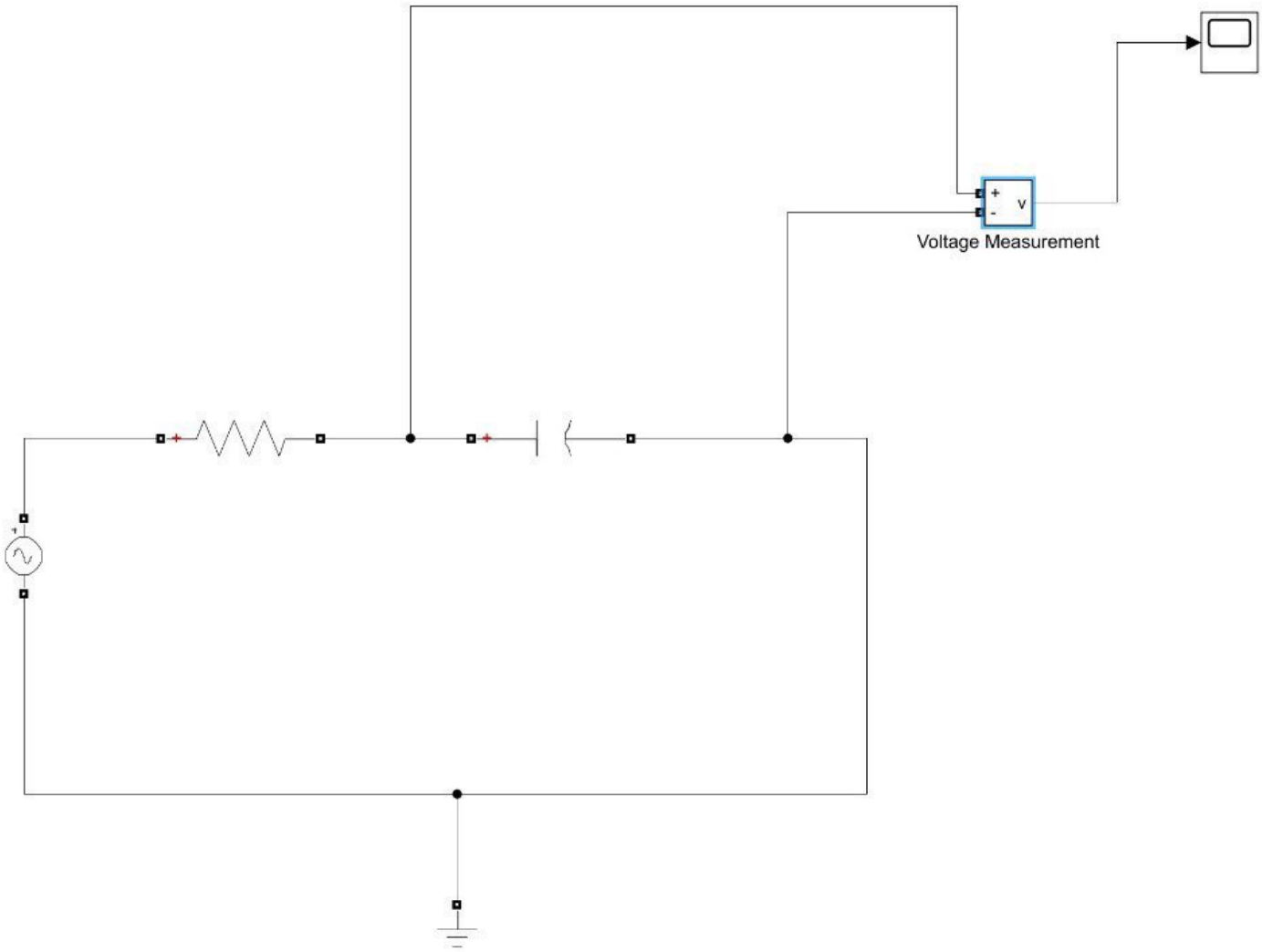
vii. I opened the Model Libraries tab again, I searched Power GUI in the search bar then I dragged the Power GUI block into the model.

viii. I accessed the Model Libraries tab again, I searched voltage measurement in the search bar then I dragged the voltage measurement block into the model.

ix. I opened the Model Libraries Tab again, I searched Ground in the search bar then I dragged the Ground block into the model.

ix All the electronics related blocks used were found under Simscape / Simpower systems / specialized technology / fundamental blocks

x Immediately after adding all the blocks to my model: I connected them to form a simple Low Pass filter circuit as shown below.



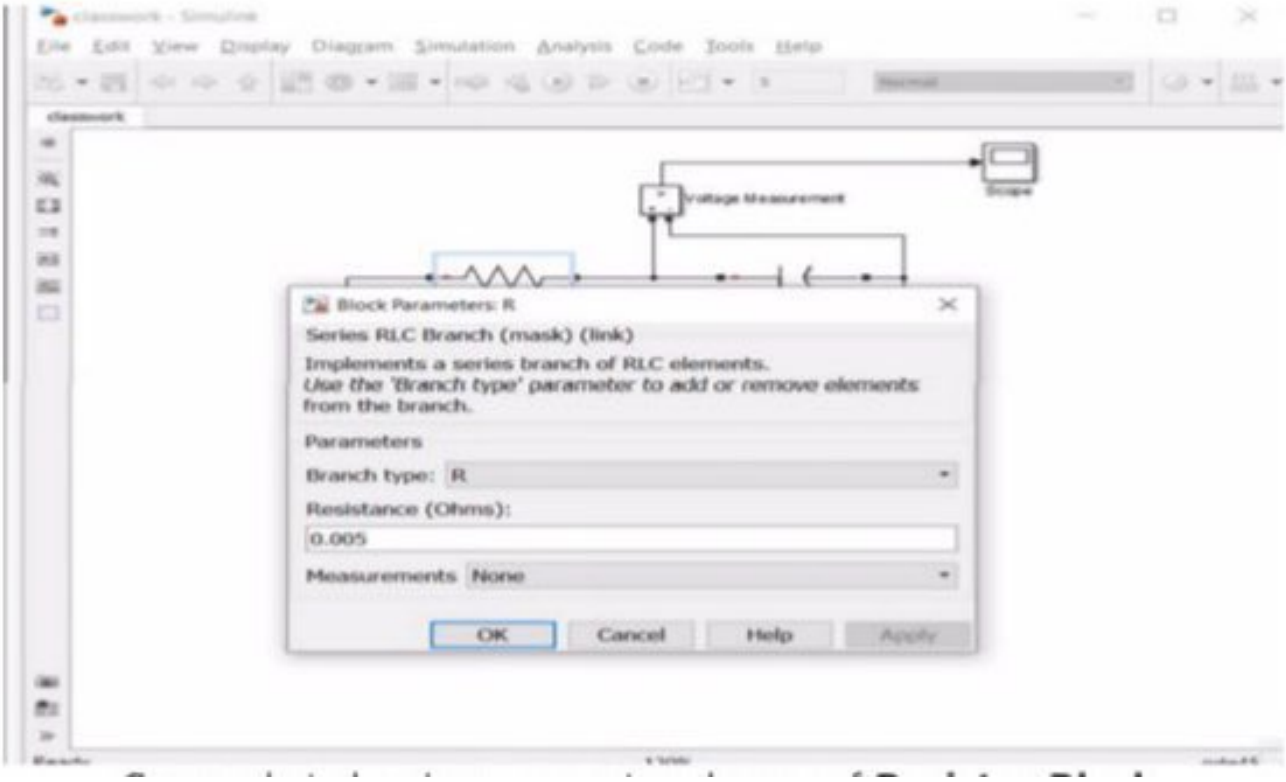
ix All the electronics related blocks used were found under simscape / simpower systems / specialized technology / fundamental blocks

x Immediately after adding all the blocks to my model: I connected them to form a simple Low Pass filter circuit as shown below.

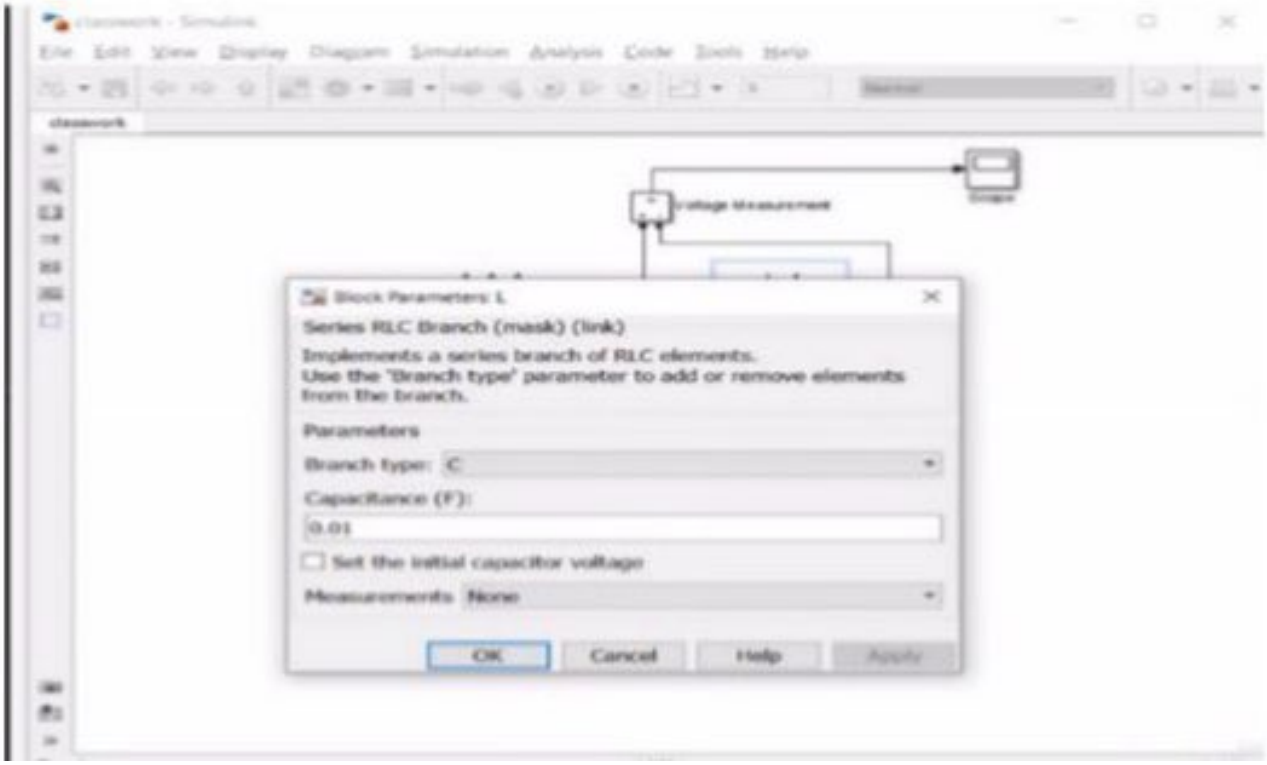
xi I edited each block, I changed the branch type of the first series RLC Branch to Resistance then I changed the branch type of the second series RLC Branch to capacitor. I then double-clicked on them. I then named them R and C to represent resistor and capacitor.

xii. I then edited the amplitude to 10 and frequency to 10

xiii Diagram below shows when the Resistor block was changed



xiv Diagram below shows when the capacitor block was charged
xv I then finally saved my model, then selected start
from the simulation menu to run the simulation. Then
double-clicked on the scope block to view its output

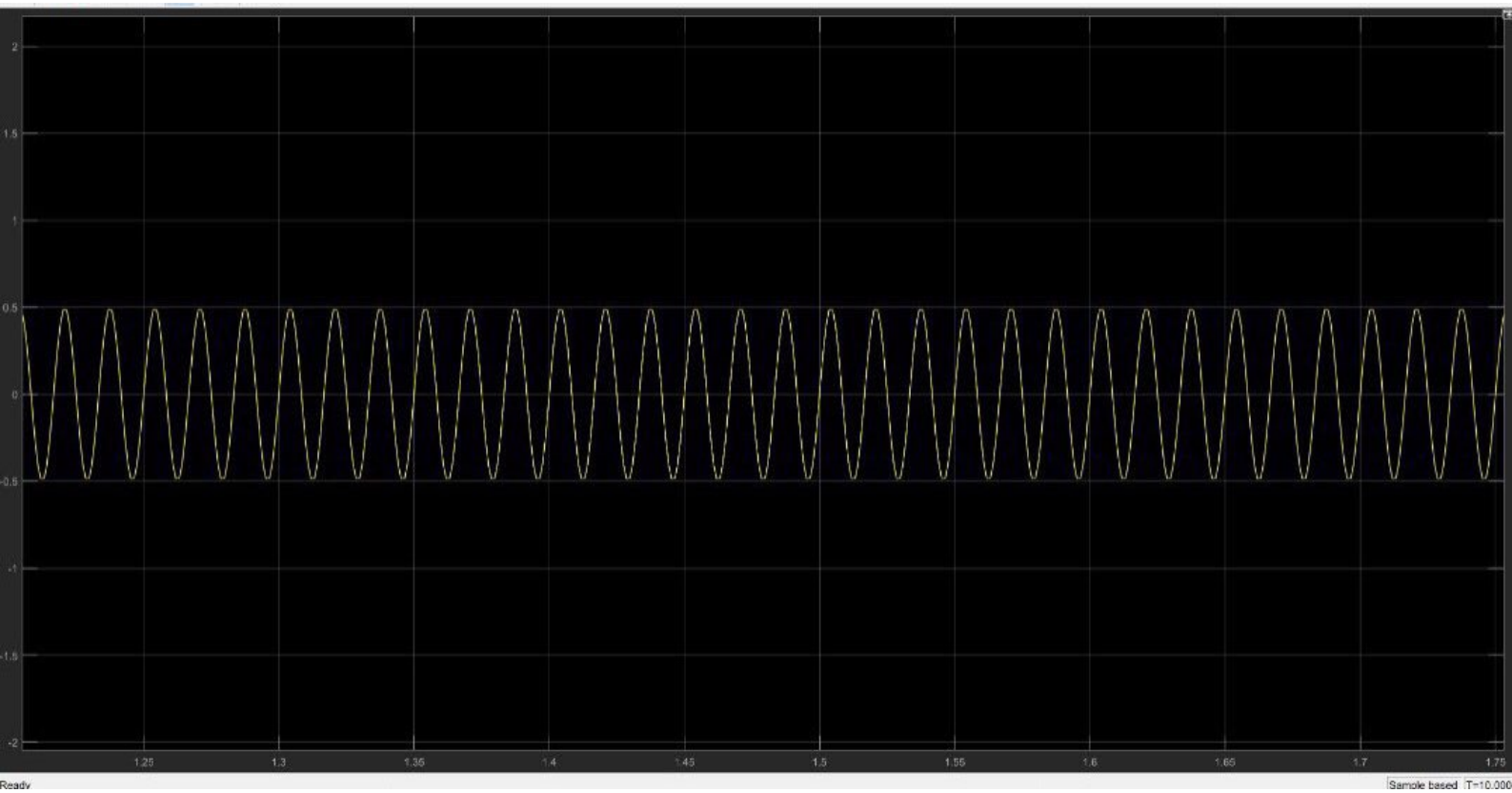


C. Cut off frequency

Cut off frequency = $\frac{1}{2\pi RC}$

$= \frac{1}{213.142 \times 0.005 \times 0.010}$

$= 3183.009\ Hz$



e; When the signal of 5kΩ is passed through the filter, the following result is obtained

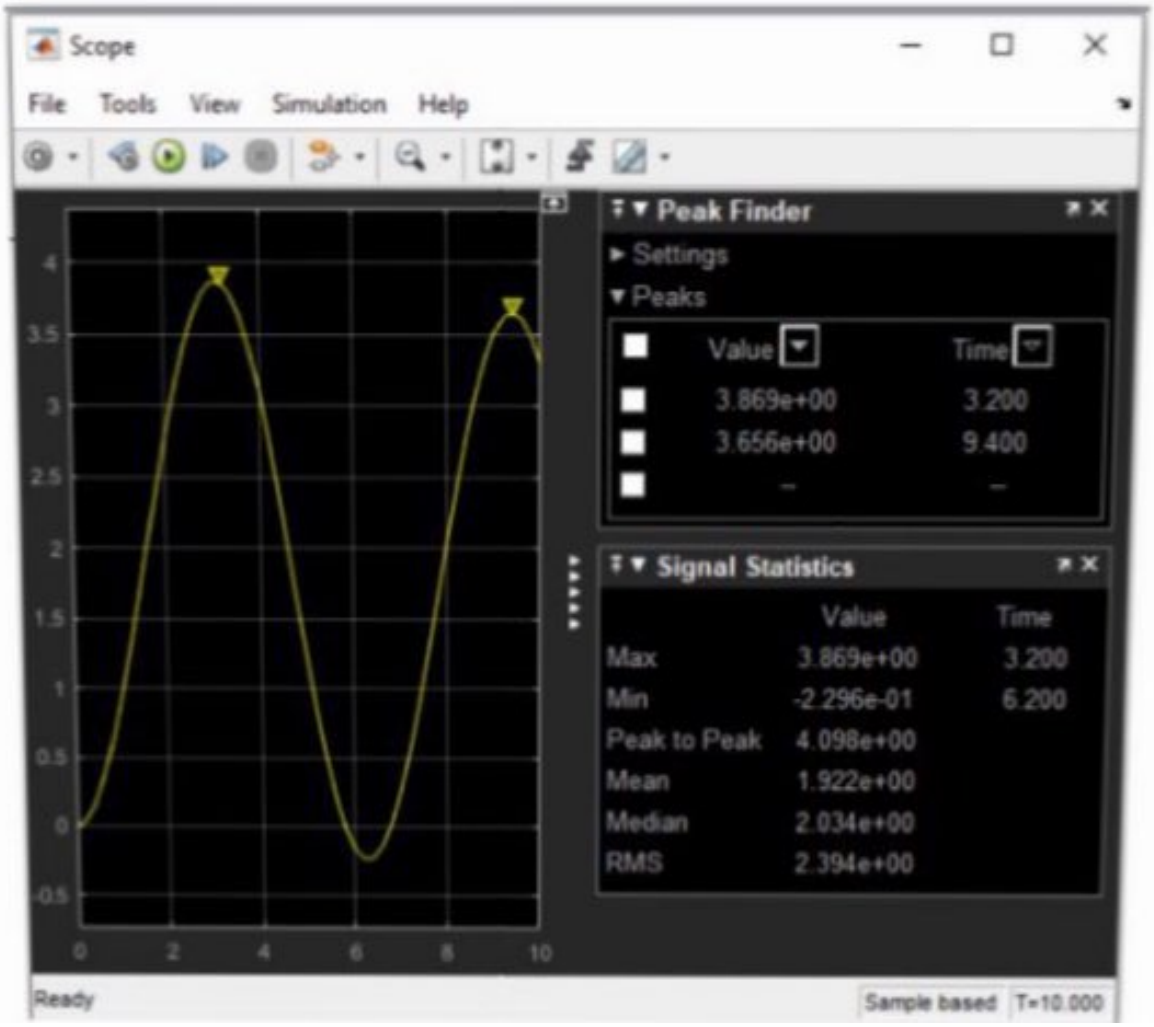
The transfer function equation for the circuit is given as

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

when R = 5000Ω and C = 0.01F

Transfer function = $(1/5000*0.01)/(S+(5000*0.01)) = (002)/(S+0$

Observation: The signal is attenuated to 3.869 ohms.



ii When the signal of 2 kΩ ohms 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 = 2000 Ω and C = 0.01 F

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