```
% Andrew Branicki 100973961
% Elec 4700 Assignment 4

clear
clc

MNPA
Question2
Question3
Question4
```

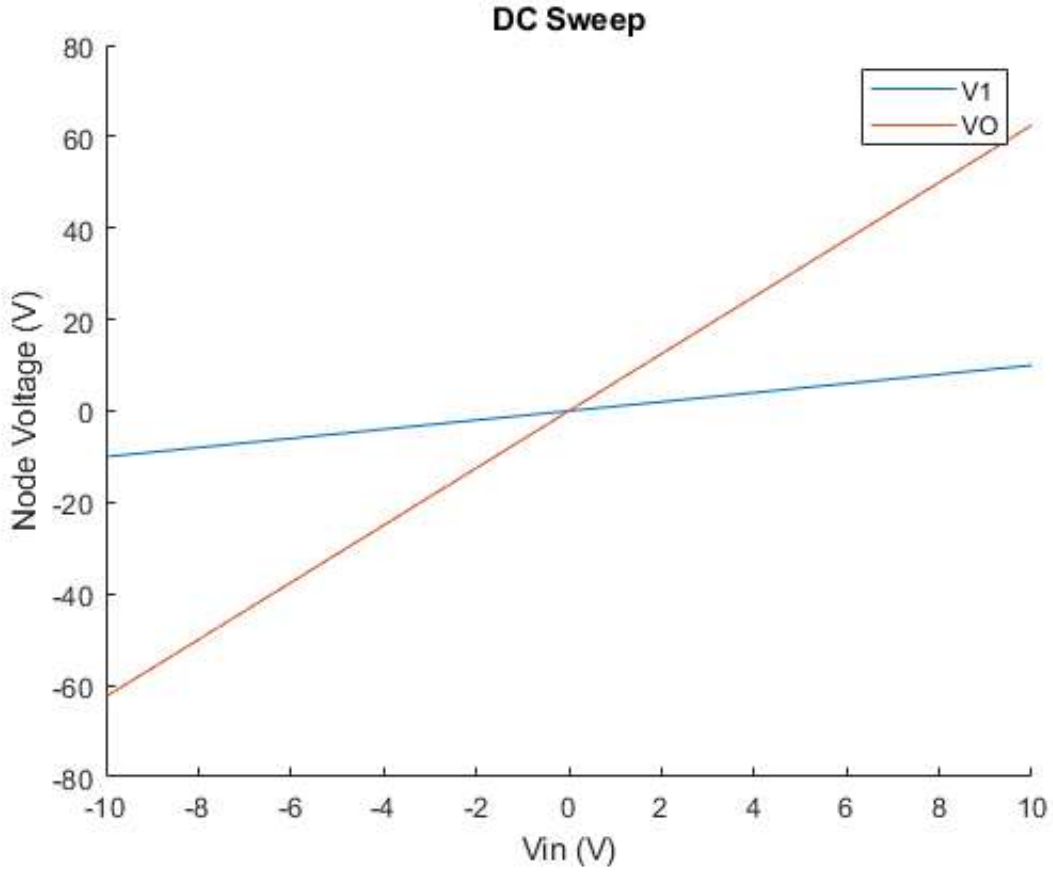
```
Question 2 a) We can see from the frequency response plot in the MNPA that this is a low pass
 filter circuit.
As the frequency increases, the inductor will resist the change in current (it will start to
block current) and the capacitor will create a parallel resistance with the resistor.
Question 2 b) The expected frequency response would be a constant gain at low frequencies, an
d then a -3 dB cutoff at the specific cutoff frequency (fc = 1/(2piRC)) with a drop in gain a
fter that.
QUESTION 2 G and C matrices:
  Columns 1 through 7

    1.0000   -1.0000         0         0         0         0         0
   -1.0000    1.5000         0         0         0    1.0000         0
         0         0    0.1000         0         0   -1.0000         0
         0         0         0   10.0000  -10.0000         0    1.0000
         0         0         0  -10.0000   10.0010         0         0
         0    1.0000   -1.0000         0         0         0         0
         0         0  -10.0000    1.0000         0         0         0
    1.0000         0         0         0         0         0         0

  Column 8

    1.0000
         0
         0
         0
         0
         0
         0
         0

  Columns 1 through 7

    0.2500   -0.2500         0         0         0         0         0
   -0.2500    0.2500         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0   -0.2000         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0

  Column 8
```

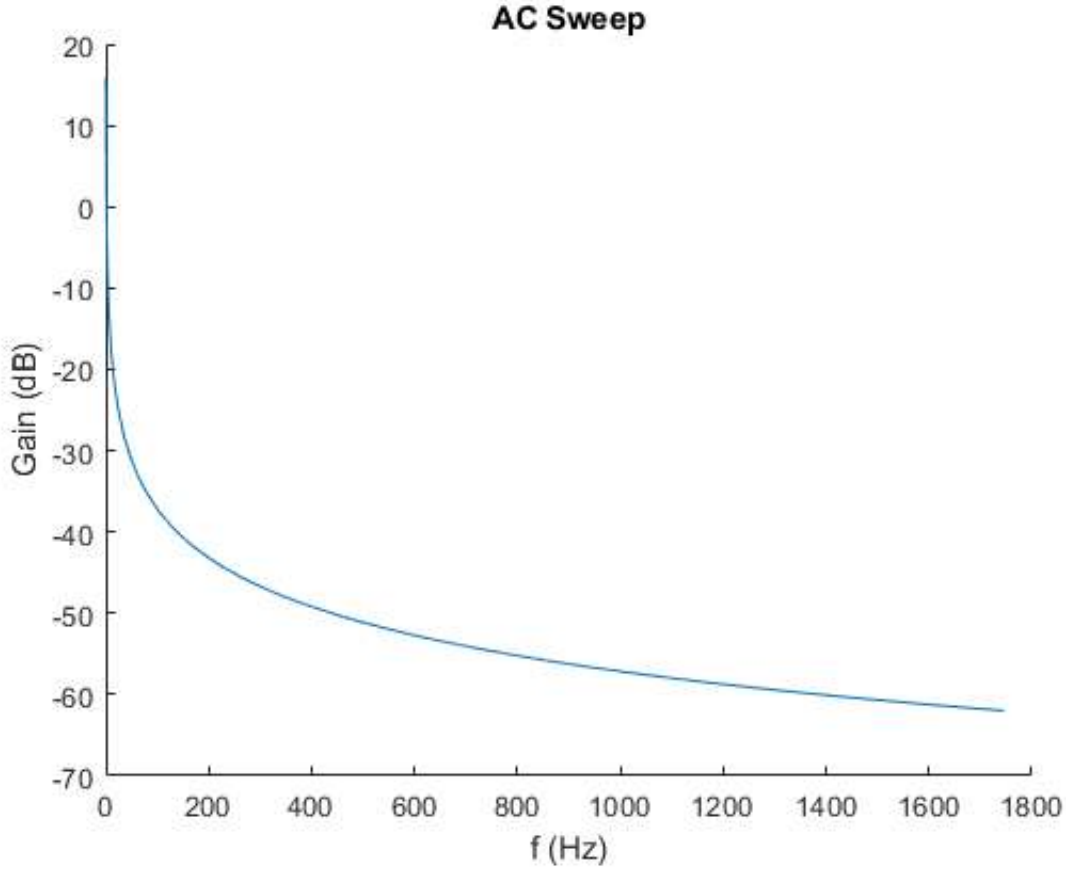
```
         0
         0
         0
         0
         0
         0
         0
         0
```

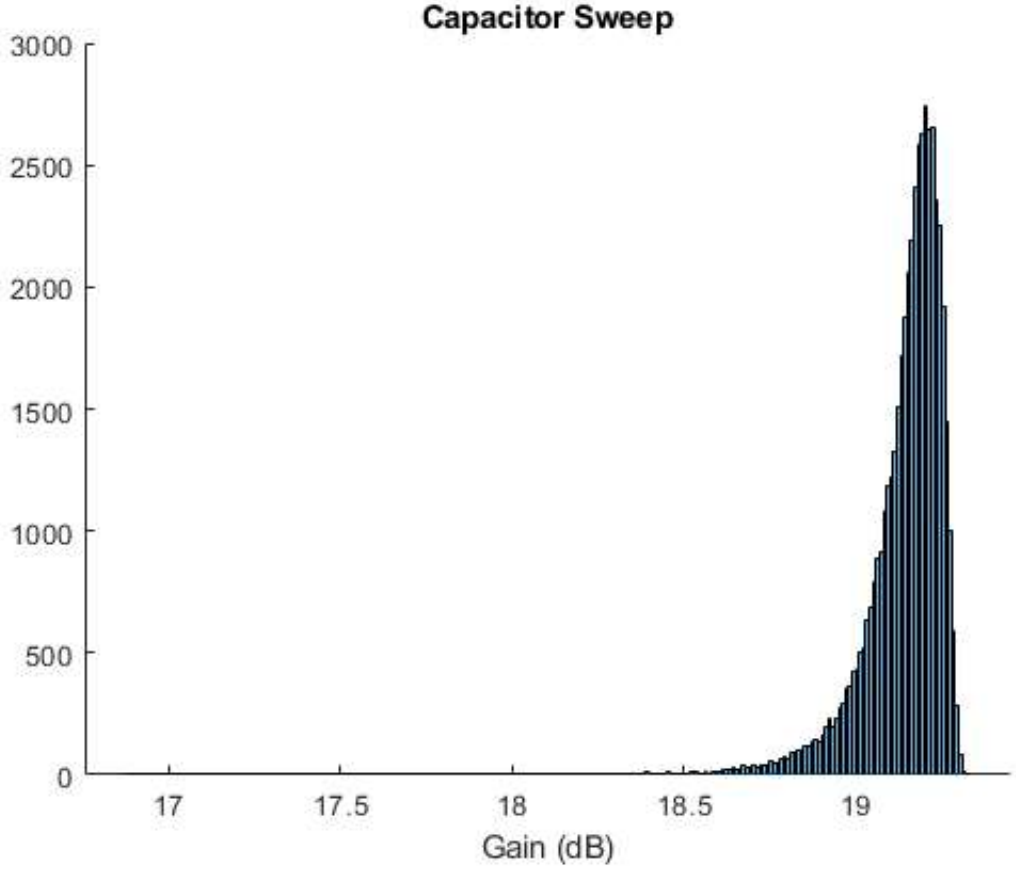
Question 2: SINE WAVE INPUT: We can see that at slower frequencies the gain of the circuit in creases. We are able to get a larger voltage output.
Question 2: Changing the time step changes how accurate the simulation is. With a larger time step we have less accurate simulations since we are getting less detail overall.
QUESTION 3 G and C matrices:

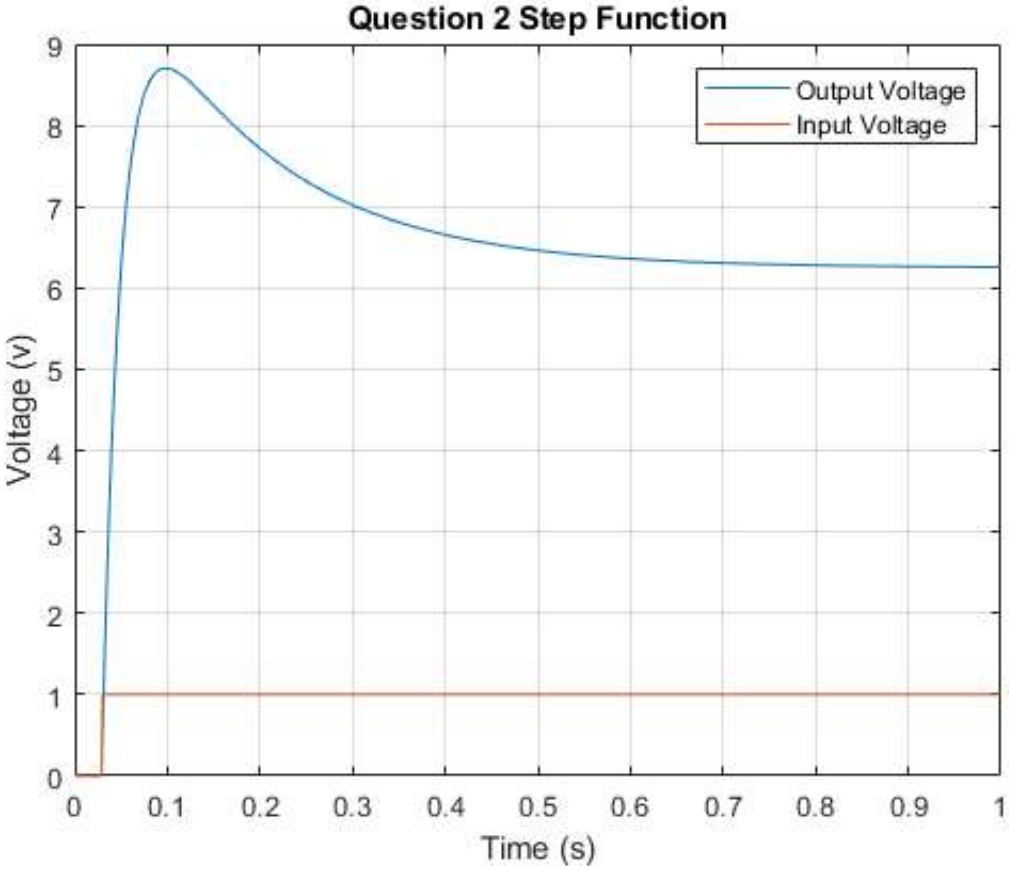
```
  Columns 1 through 7

    1.0000   -1.0000         0         0         0         0         0
   -1.0000    1.5000         0         0         0    1.0000         0
         0         0    0.1000         0         0   -1.0000         0
         0         0         0   10.0000  -10.0000         0    1.0000
         0         0         0  -10.0000   10.0010         0         0
         0    1.0000   -1.0000         0         0         0         0
         0         0  -10.0000    1.0000         0         0         0
    1.0000         0         0         0         0         0         0

  Column 8

    1.0000
         0
         0
         0
         0
         0
         0
         0

  Columns 1 through 7

    0.2500   -0.2500         0         0         0         0         0
   -0.2500    0.2500         0         0         0         0         0
         0         0    0.0000         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0   -0.2000         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0

  Column 8

         0
         0
         0
         0
         0
         0
         0
         0
```

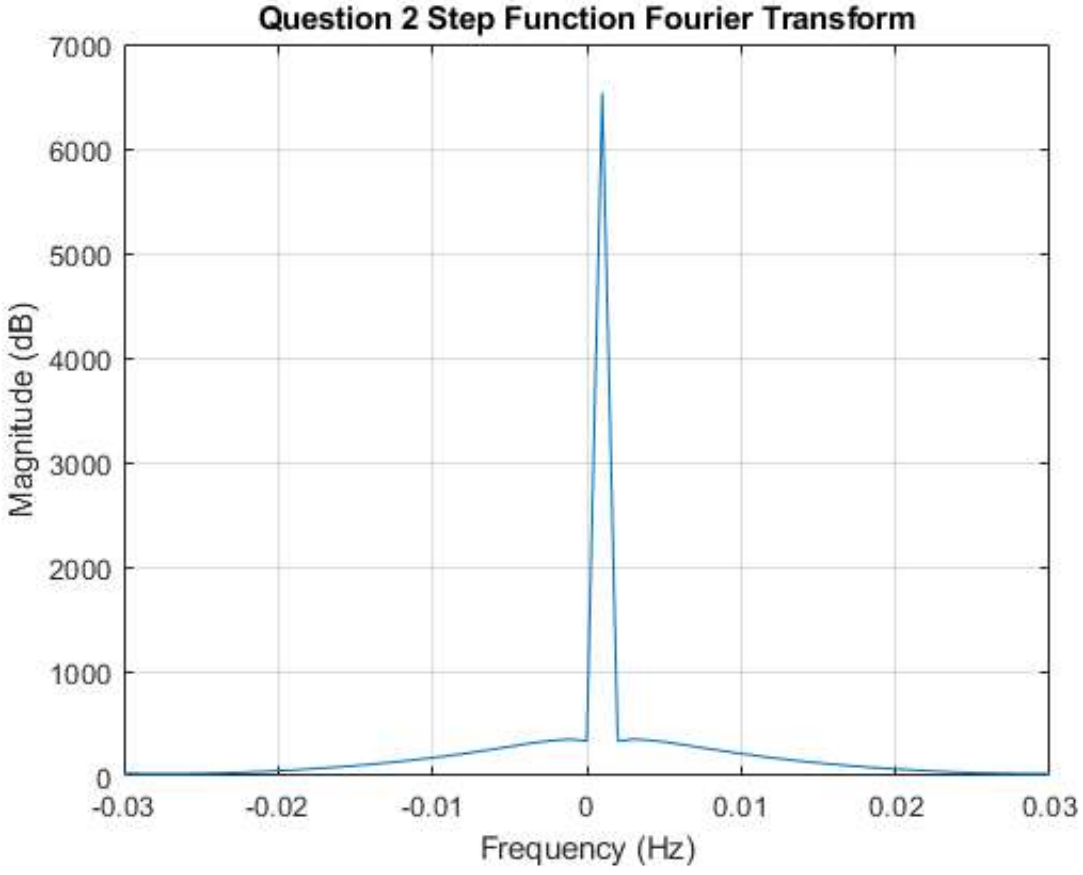
QUESTION 3: We can see how increasing the value of Cn reduces the overall output of the circu it. With C3 = 0.01, the output is actually lower than the input.
QUESTION 3: As before, changing the timestep will have an effect on the accuracy of the simul ation.
QUESTION 4: In this case we can see that V is modelled by a cubic equation. We would need the values for beta and gamma, and then we can take the roots of this function and then use the values of the roots in our MNA matrices.

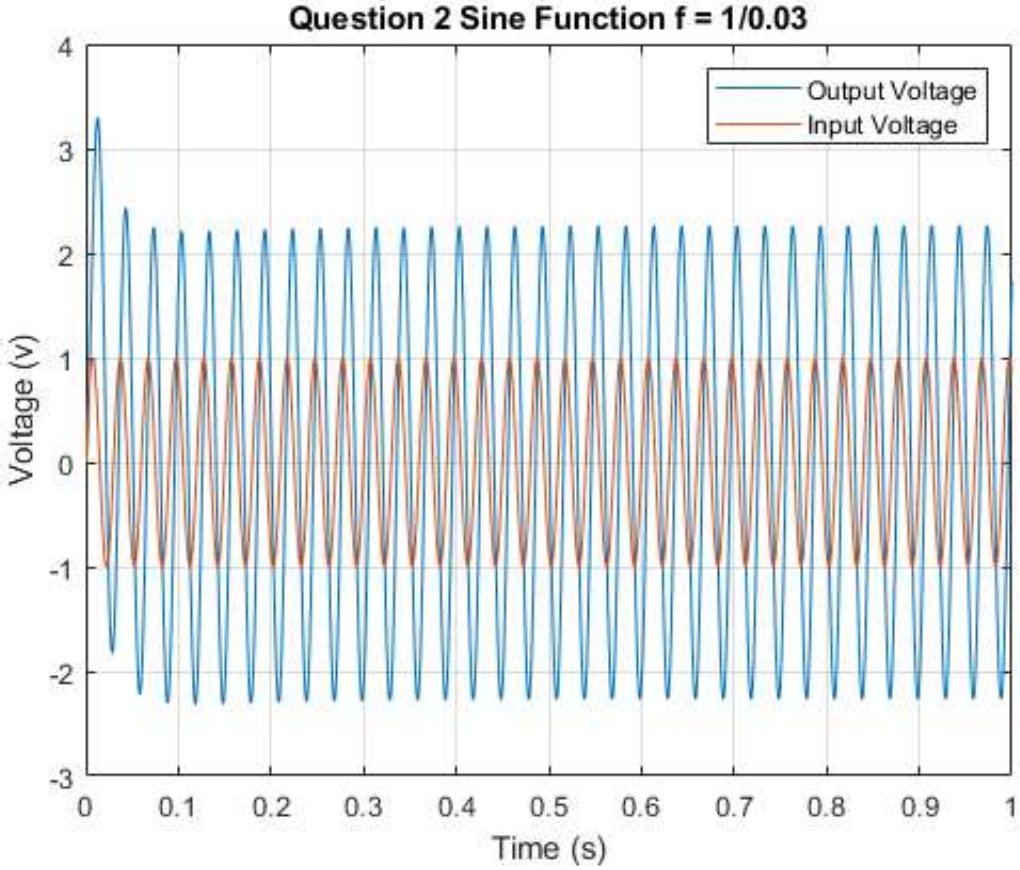


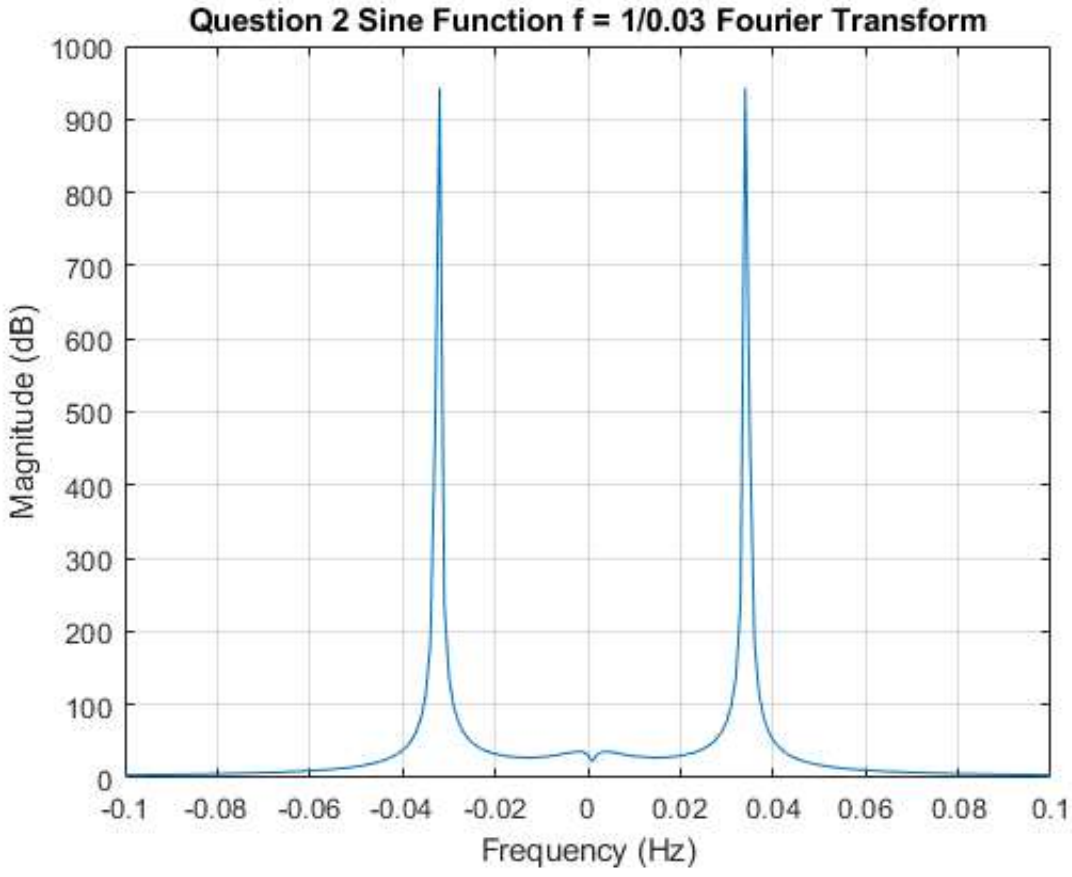

AC Sweep
20
10
0
-10
-20
-30
-40
-50
-60
-70
Gain (dB)
0
200
400
600
800
1000
1200
1400
1600
1800
f (Hz)

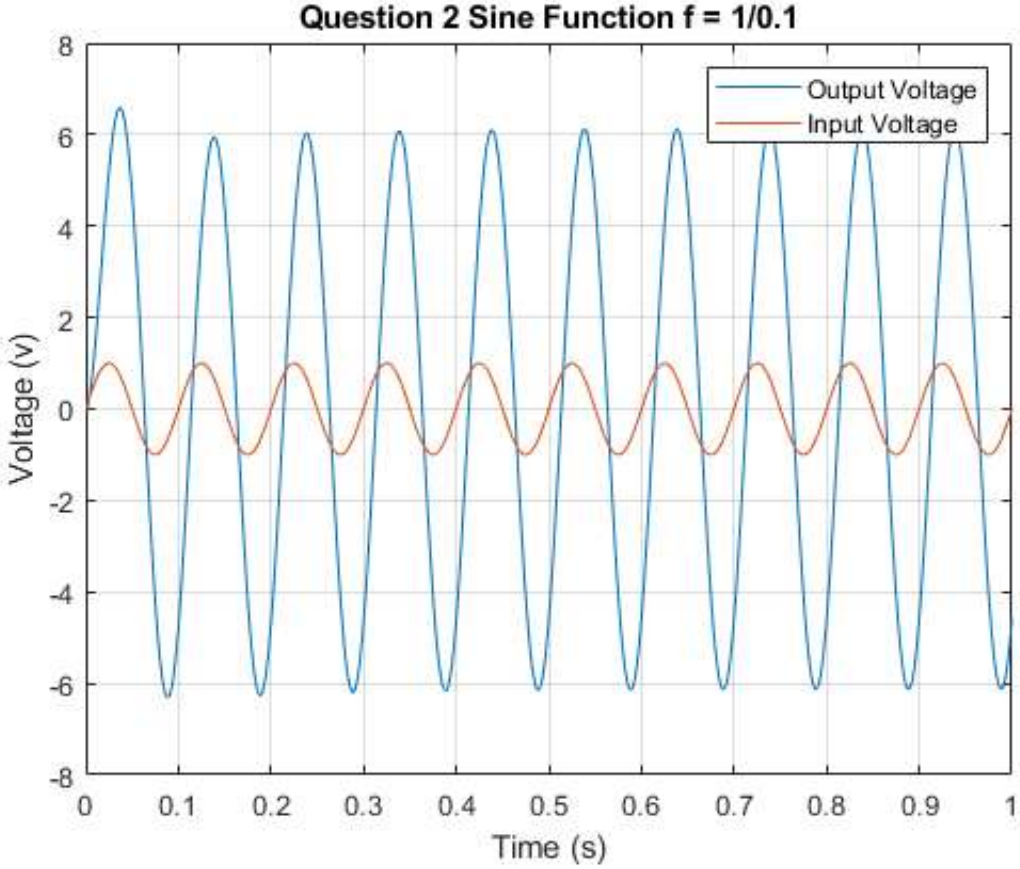

Capacitor Sweep
3000
2500
2000
1500
1000
500
0
17
17.5
18
18.5
19
Gain (dB)

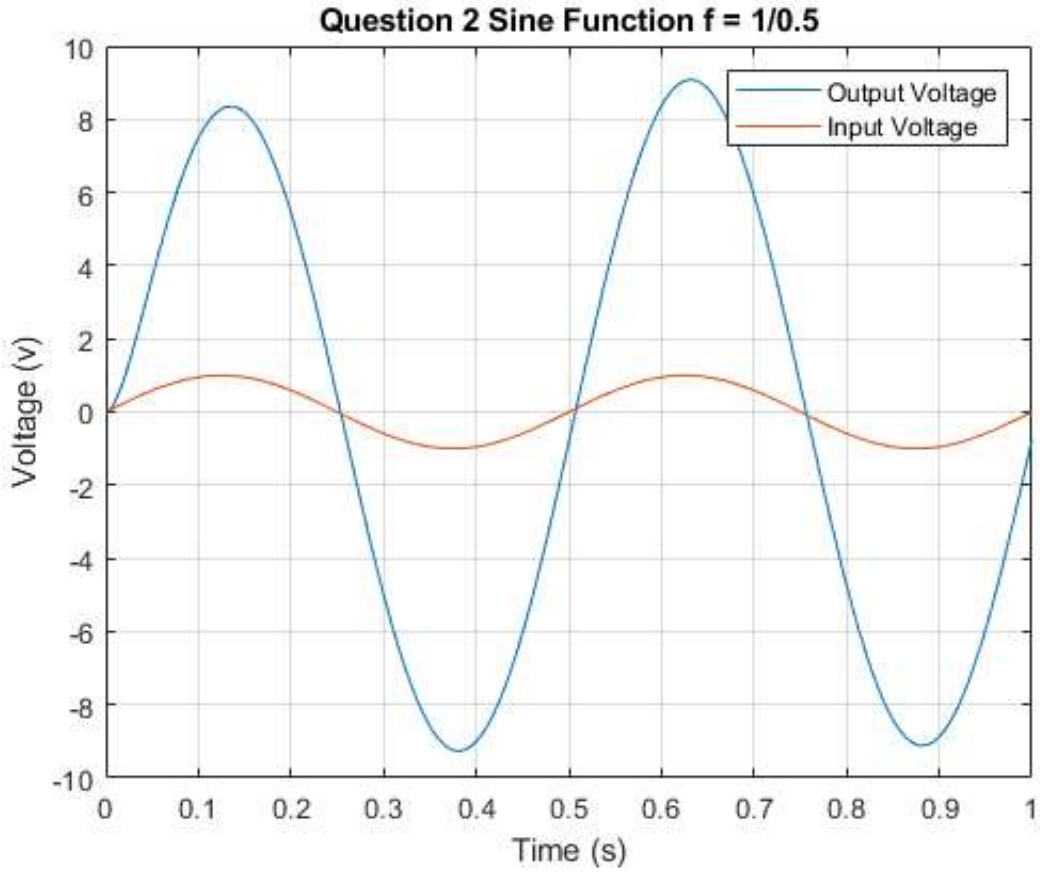

Question 2 Step Function
Output Voltage
Input Voltage
Voltage (v)
Time (s)
0
1
2
3
4
5
6
7
8
9
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

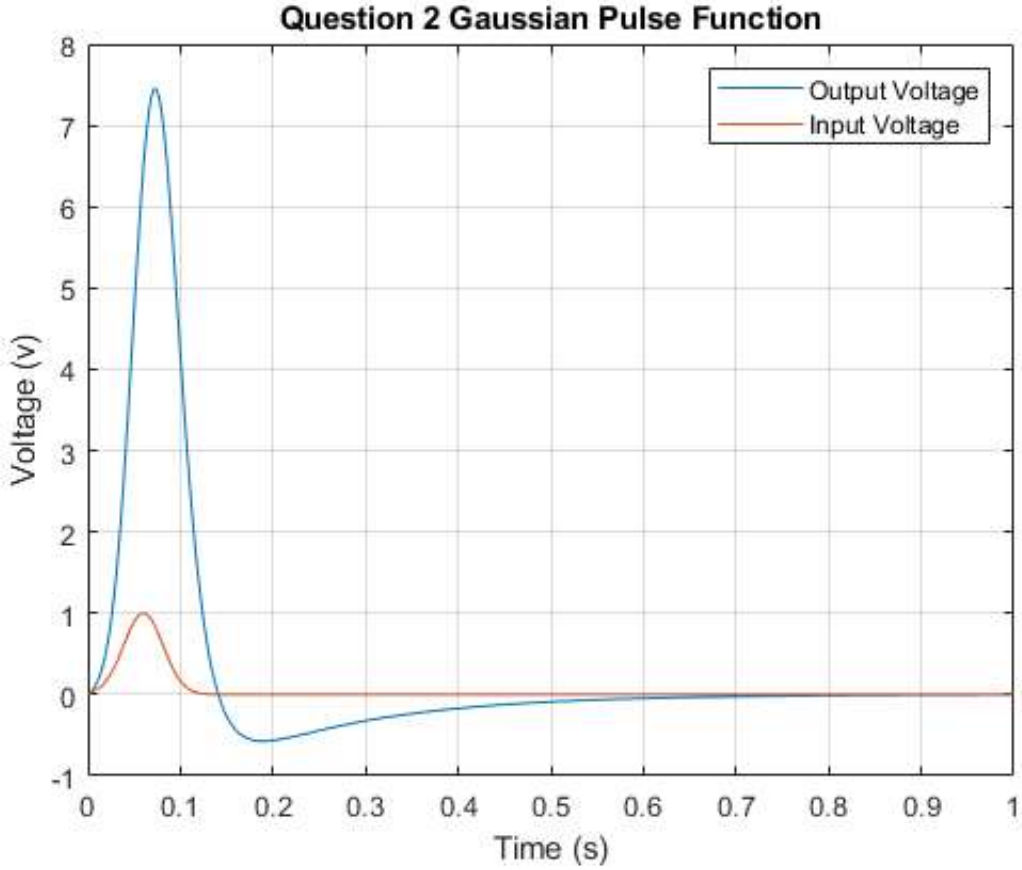

Question 2 Step Function Fourier Transform
Magnitude (dB)
Frequency (Hz)
0
1000
2000
3000
4000
5000
6000
7000
-0.03
-0.02
-0.01
0
0.01
0.02
0.03

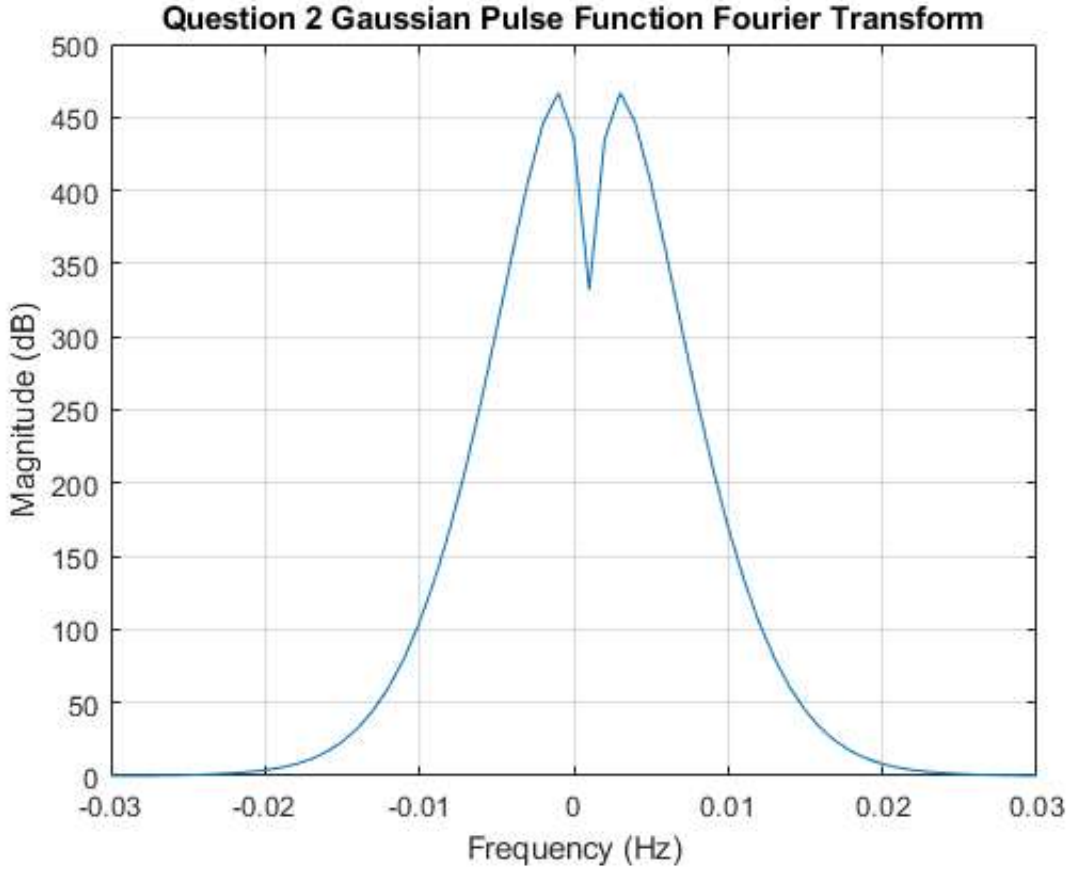

Question 2 Sine Function f = 1/0.03
Output Voltage
Input Voltage
Voltage (v)
Time (s)
4
3
2
1
0
-1
-2
-3
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1


Question 2 Sine Function f = 1/0.03 Fourier Transform
Magnitude (dB)
Frequency (Hz)
1000
900
800
700
600
500
400
300
200
100
0
-0.1
-0.08
-0.06
-0.04
-0.02
0
0.02
0.04
0.06
0.08
0.1

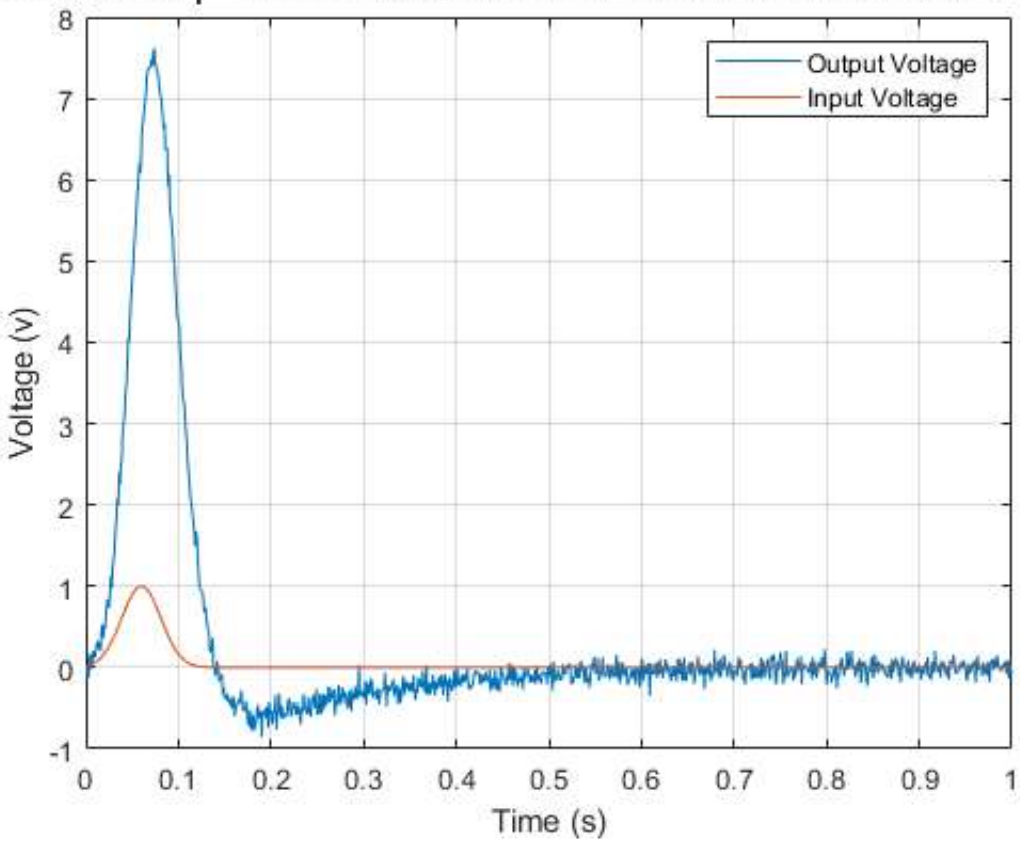

Question 2 Sine Function f = 1/0.1
Output Voltage
Input Voltage
Voltage (v)
Time (s)
8
6
4
2
0
-2
-4
-6
-8
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1


Question 2 Sine Function f = 1/0.5
Output Voltage
Input Voltage
Voltage (v)
Time (s)
10
8
6
4
2
0
-2
-4
-6
-8
-10
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

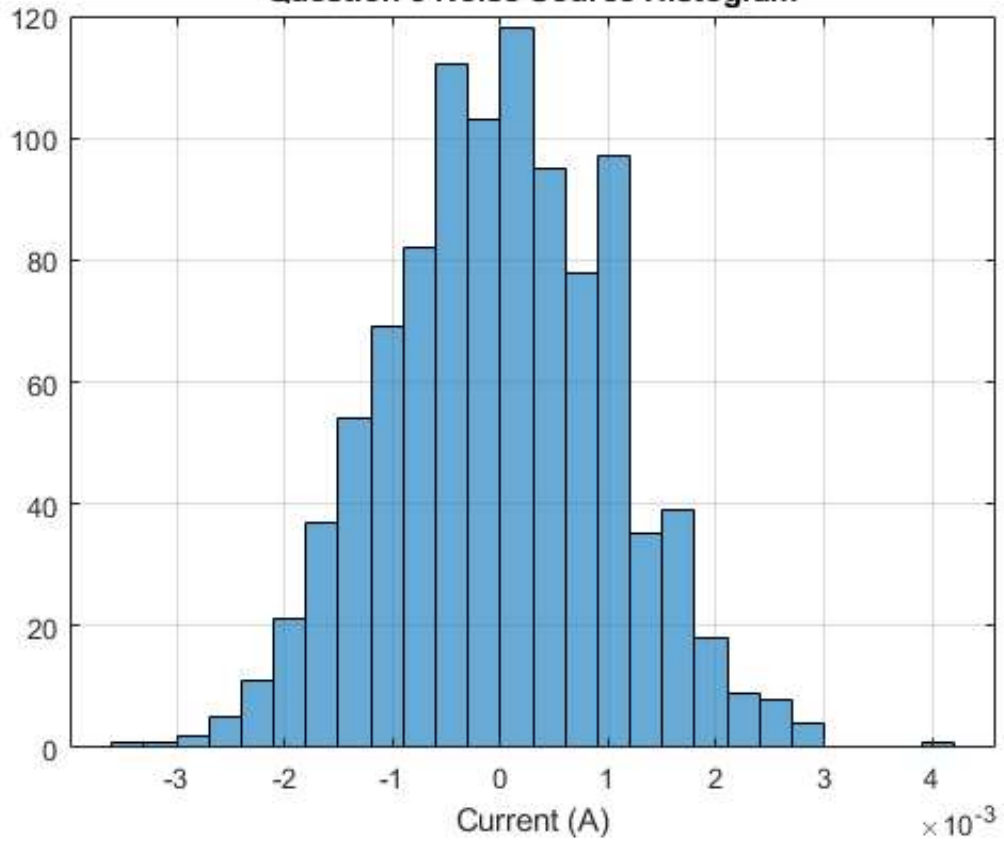

Question 2 Gaussian Pulse Function
Output Voltage
Input Voltage
Voltage (v)
Time (s)
8
7
6
5
4
3
2
1
0
-1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1


Question 2 Gaussian Pulse Function Fourier Transform
Magnitude (dB)
Frequency (Hz)
500
450
400
350
300
250
200
150
100
50
0
-0.03
-0.02
-0.01
0
0.01
0.02
0.03

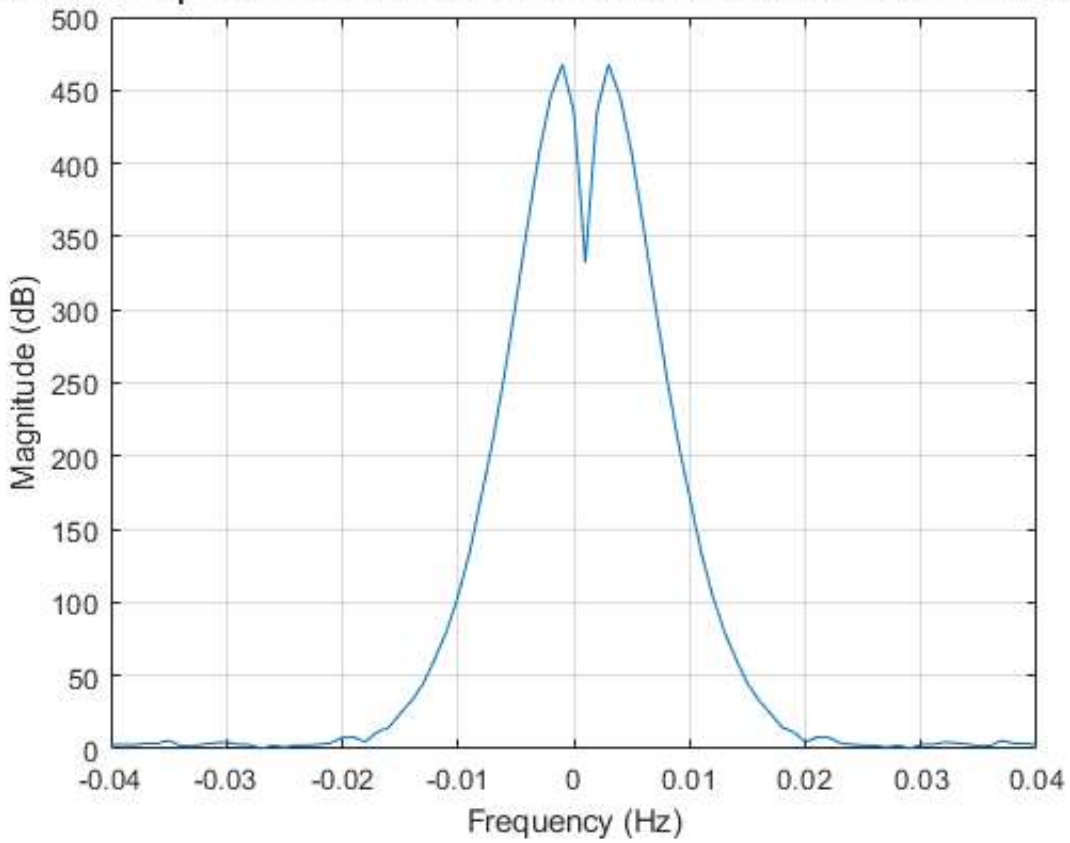
Question 3 CN_1 = 0.00001 Gaussian Pulse Function with Added Noise Source



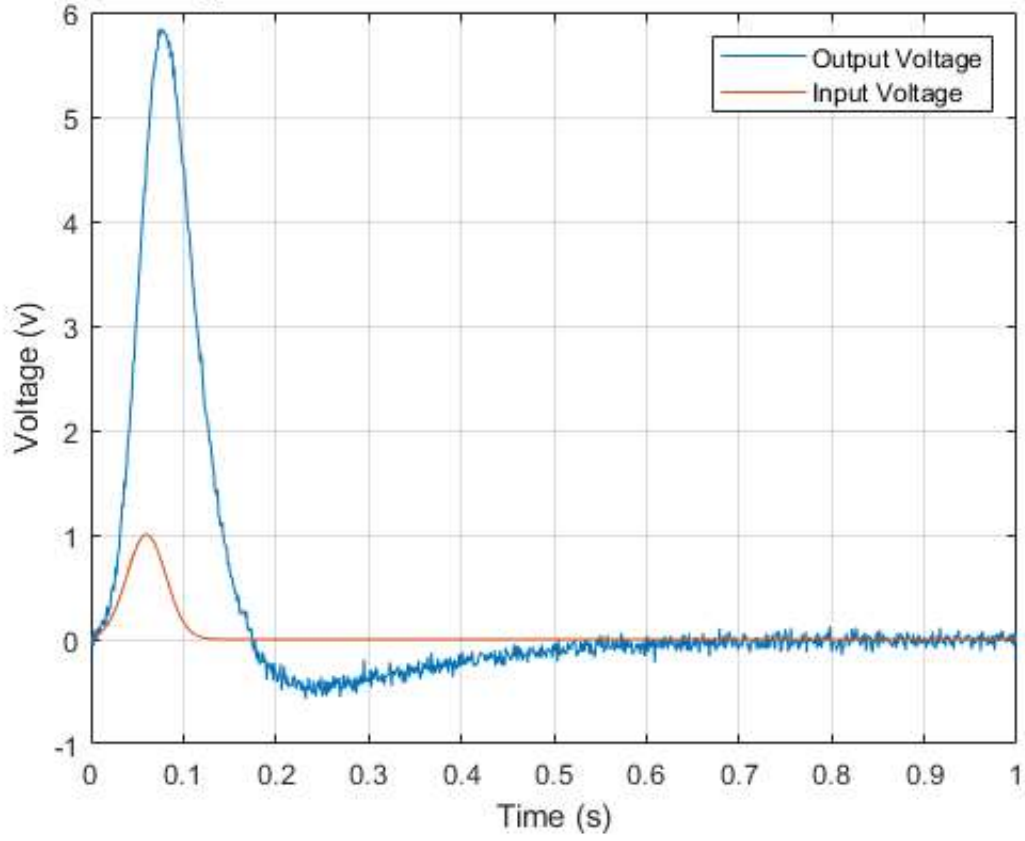
Question 3 Noise Source Histogram



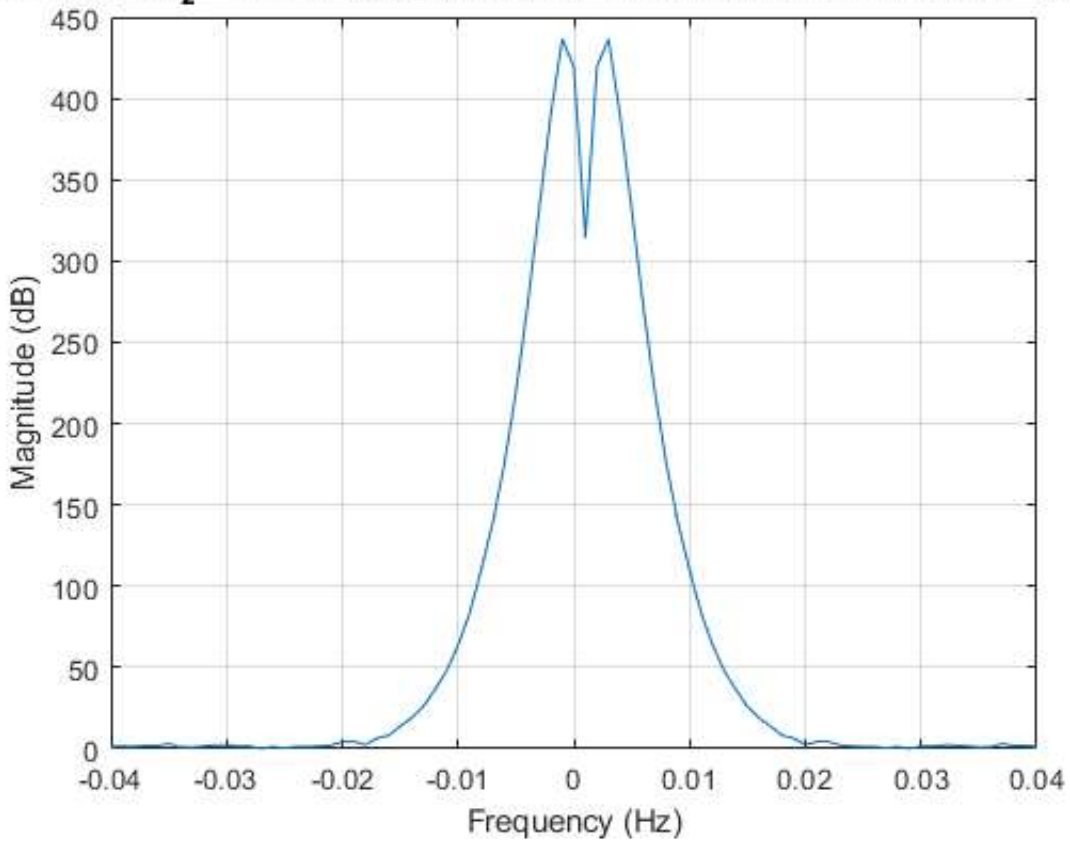
Question 3 CN_1 = 0.00001 Gaussian Pulse Function (With Noise) Fourier Transfo



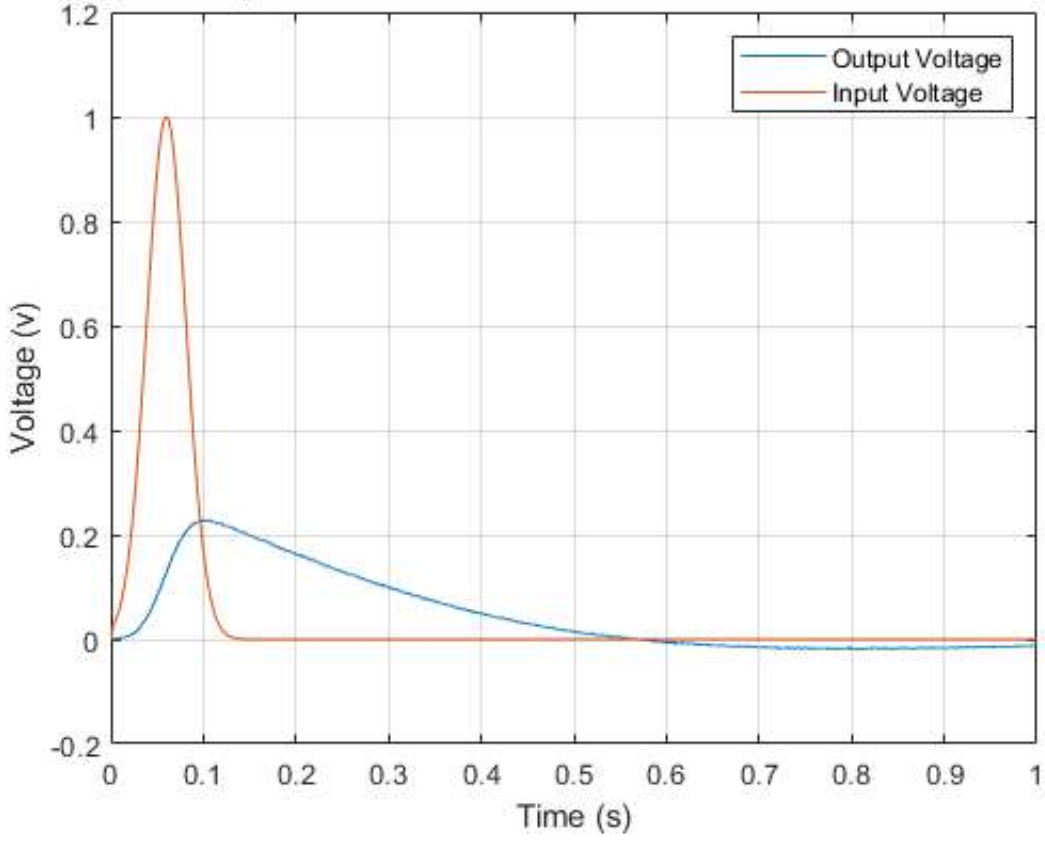
Question 3 CN_2 = 0.0001 Gaussian Pulse Function with Added Noise Source

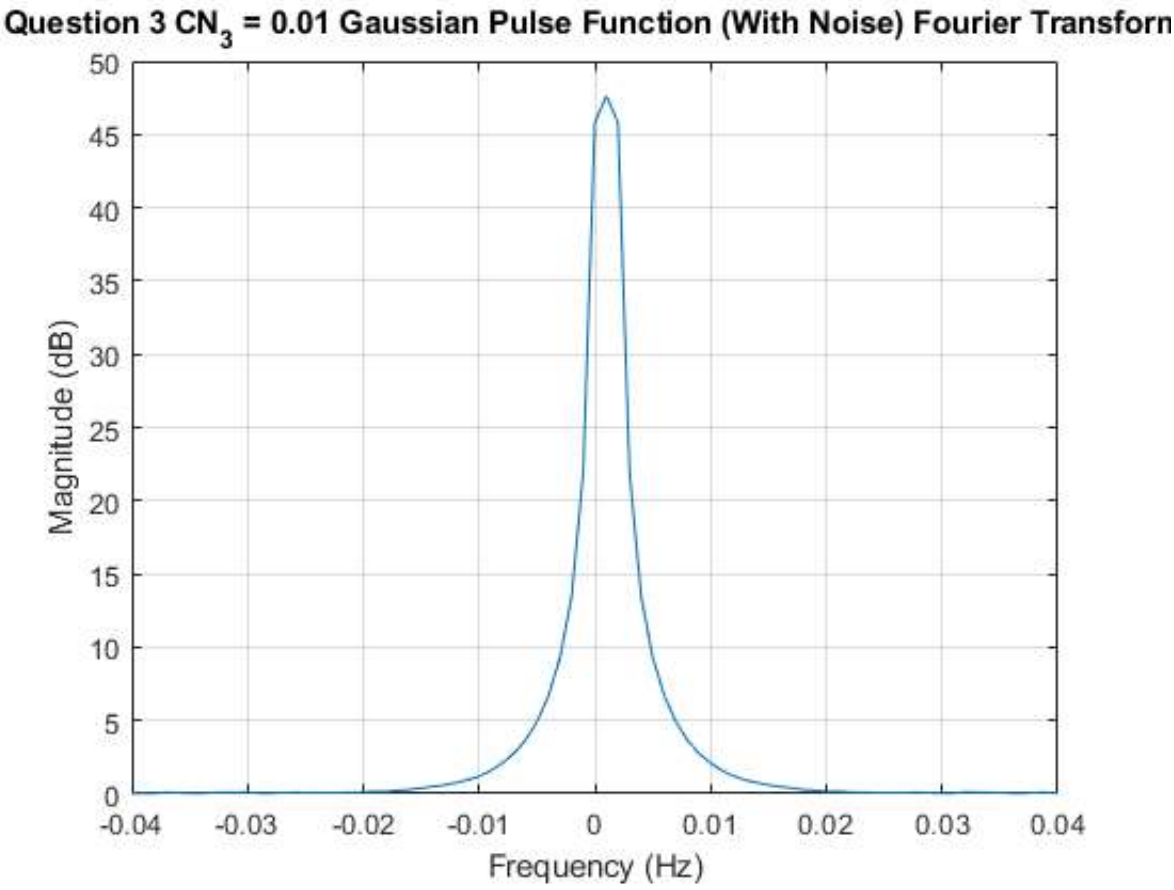


Question 3 CN_2 = 0.0001 Gaussian Pulse Function (With Noise) Fourier Transfor



Question 3 CN_3 = 0.01 Gaussian Pulse Function with Added Noise Source





Published with MATLAB® R2018b