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CSE 4030  
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## **Lab 11: AC Steady State Power Analysis**

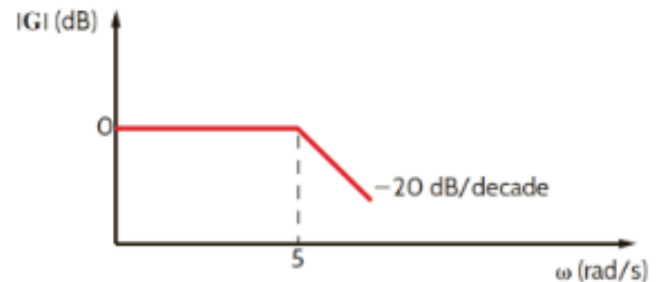
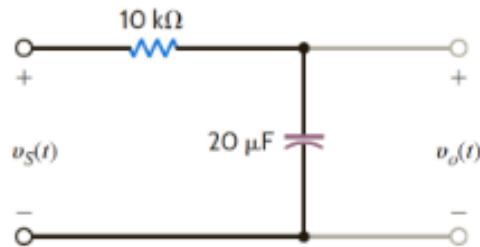
### **Introduction**

In this lab, we have to find the voltage, the bode plot of the amplitude, and phase of initial voltage of two circuits that consist of resistors and capacitors. First, we show our work by hand then use Pspice simulation software to check. The purpose of this lab is to understand AC characteristics and variable frequency network performance.

## Purpose

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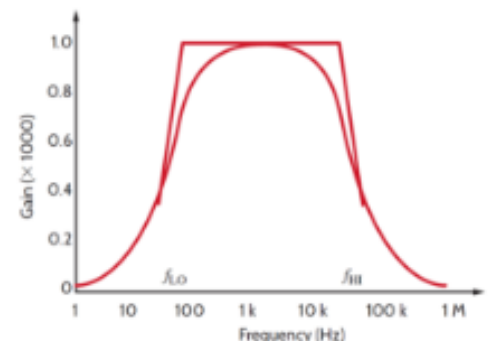
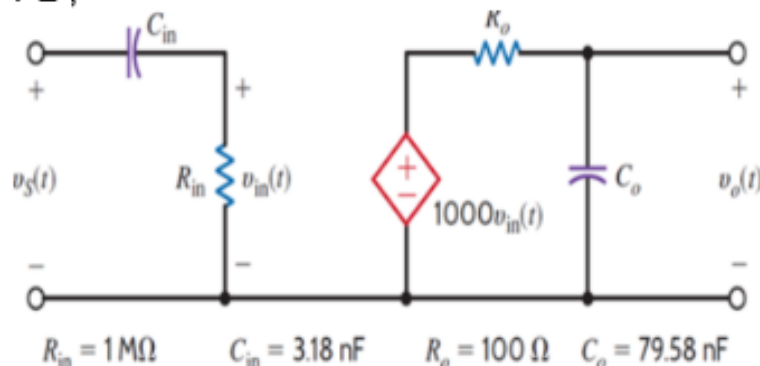
1-1



## Preparation

1. Find the bode plot of the amplitude and the phase of  $v_o(t)$  ( calculate by hand). Change from 20uF to 10uF.
2. By using pspice simulation, find  $v_S(t)$  and the bode plot of the amplitude and the phase of  $v_o(t)$ ..

1-2 ,

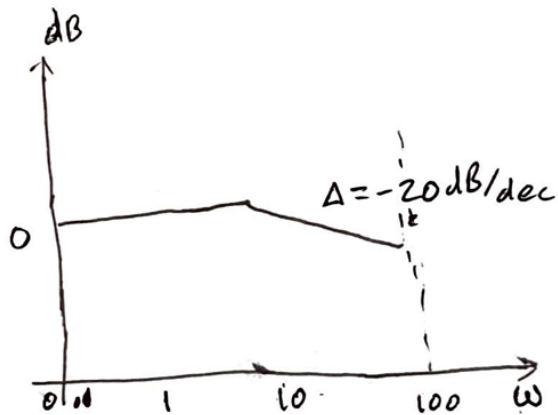
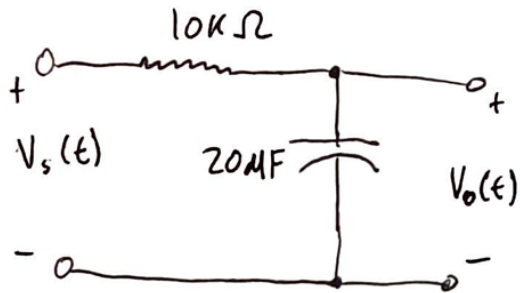


## Preparation

1. Find  $v_S(t)$  and the bode plot of the amplitude and the phase of  $v_o(t)$ . ( calculate by hand ),
2. By using pspice, find  $v_S(t)$  and the bode plot of the amplitude and the phase of  $v_o(t)$ .

## Hand Written Work

Circuit 1:



$$G_v(j\omega) = \frac{1}{1 + j\omega(10k)(20\mu)} \\ = \frac{1}{1 + j\omega(0.2)}$$

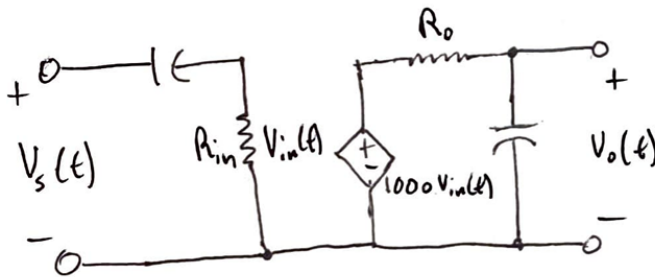
$$\rightarrow \omega_c = \frac{1}{0.2} = 5 \text{ rad/s}$$

$$\Delta = -20$$

$$20 \log(1) = 0 \text{ dB}$$

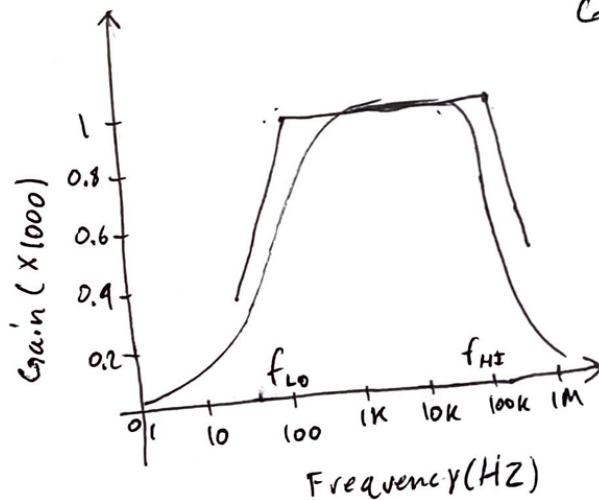
$$-20 \log\left(\frac{100}{5}\right) = \underline{\underline{-26.02 \text{ dB}}}$$

Circuit 2:



$$R_{in} = 1 \text{ M}\Omega \quad C_{in} = 3.18 \text{ nF} \quad R_o = 100 \Omega$$

$$C_o = 79.58 \text{ nF}$$



$$G_v(s) = \frac{V_o(s)}{V_s(s)} = \frac{V_{in}(s) V_o(s)}{V_s(s) V_{in}(s)} = \left( \frac{R_{in}}{R_{in} + 1/s C_{in}} \right) (1000) \left( \frac{1/s C_o}{R_o + 1/s C_o} \right)$$

$$\rightarrow G_v(s) = \left( \frac{s}{s + 100\pi} \right) (1000) \left( \frac{40,000\pi}{s + 40,000\pi} \right)$$

$$f_{Lo} < \frac{1}{f} < f_{Hi}$$

$$100\pi < |s| < 40,000\pi$$

$$G_v(s) \approx \left| \frac{s}{s} \right| (1000) \left( \frac{1}{1+0} \right)$$

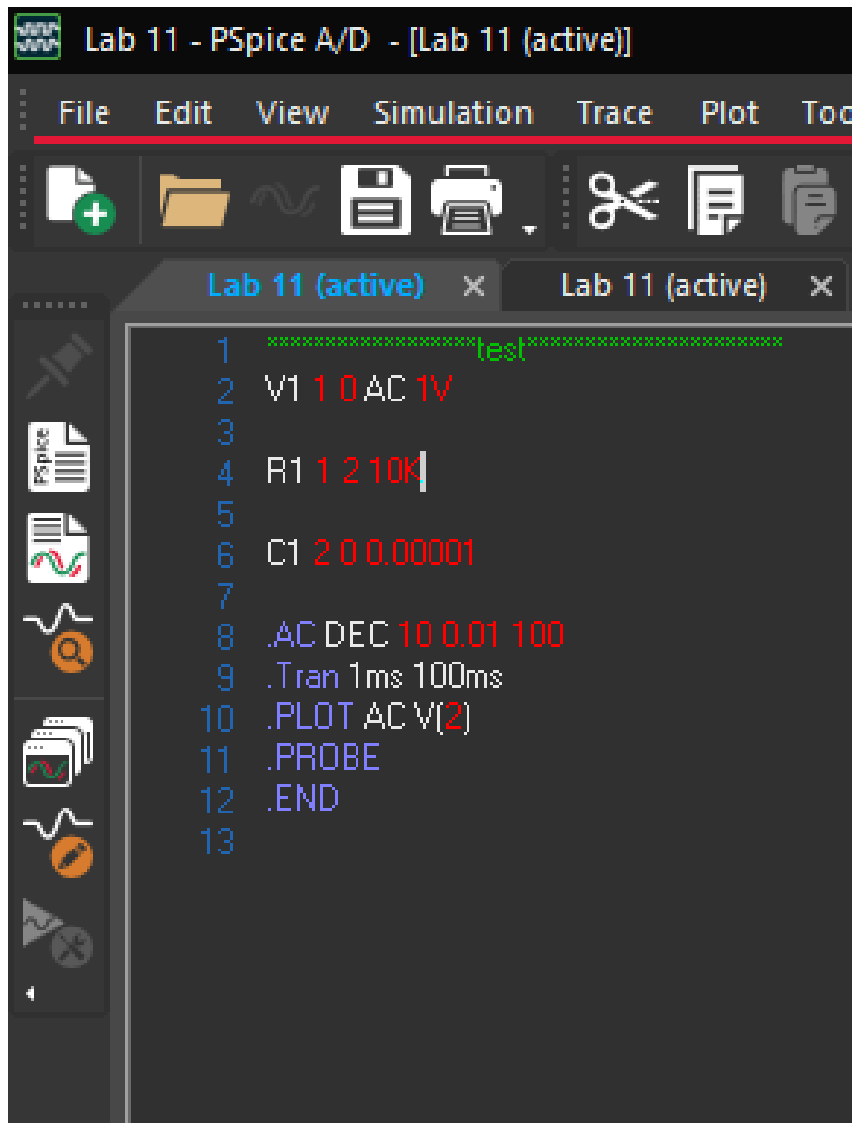
$$= 1000$$

$$\rightarrow G_v(s) \approx \left[ \frac{s}{s + 100\pi} \right] (1000)$$

## Pspice simulation

Circuit 1:

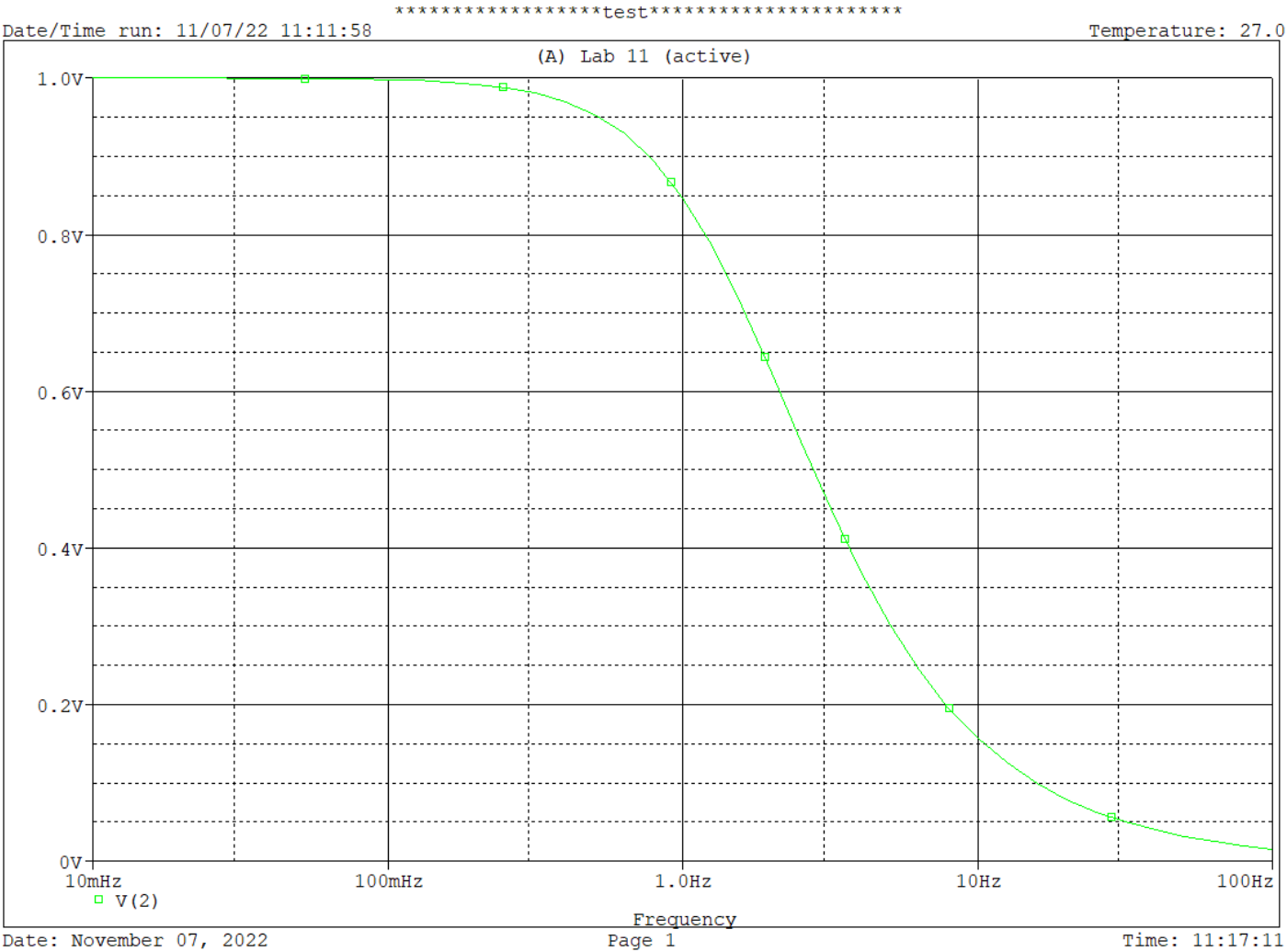
Code used



The screenshot shows the PSpice A/D software interface. The title bar reads "Lab 11 - PSpice A/D - [Lab 11 (active)]". The menu bar includes "File", "Edit", "View", "Simulation", "Trace", "Plot", and "Tools". The toolbar contains icons for creating a new file, opening a file, saving, printing, cutting, copying, and pasting. The workspace shows two tabs, both labeled "Lab 11 (active)". The left sidebar contains icons for various simulation and analysis tools. The main text area displays the following code:

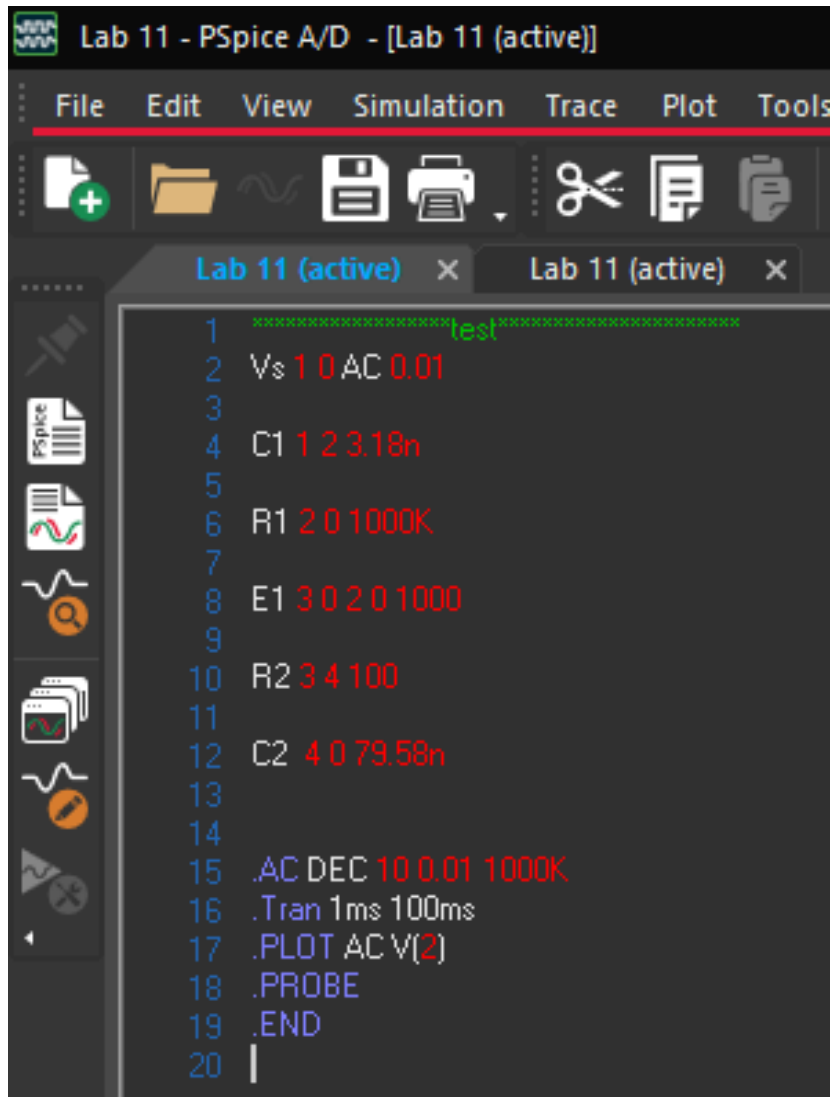
```
1  *****test*****  
2  V1 1 0 AC 1V  
3  
4  R1 1 2 10K  
5  
6  C1 2 0 0.00001  
7  
8  .AC DEC 10 0.01 100  
9  .Tran 1ms 100ms  
10 .PLOT AC V(2)  
11 .PROBE  
12 .END  
13
```

Bode plot



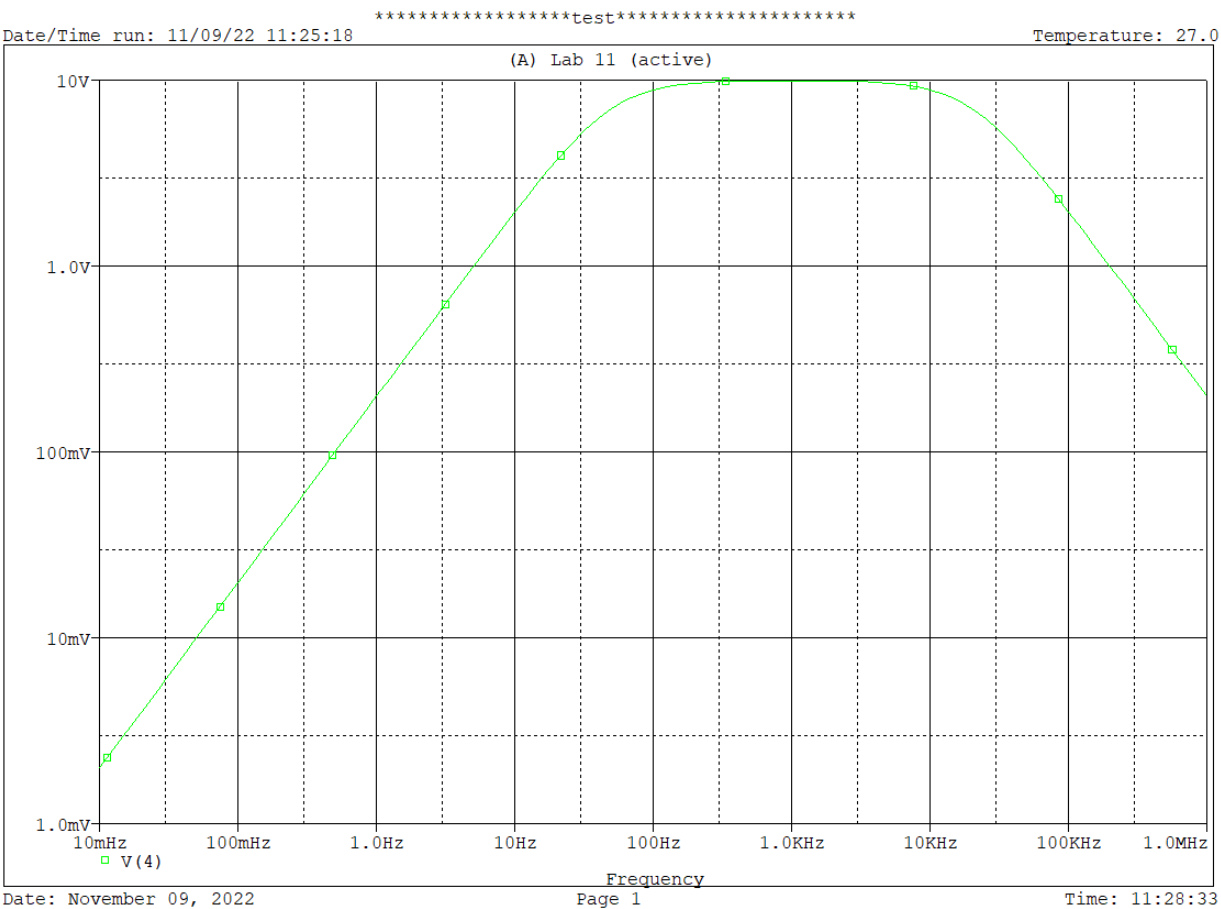
Circuit 2:

Code used

The image is a screenshot of the PSpice A/D software interface. The title bar at the top reads "Lab 11 - PSpice A/D - [Lab 11 (active)]". Below the title bar is a menu bar with the following options: File, Edit, View, Simulation, Trace, Plot, and Tools. Underneath the menu bar is a toolbar containing icons for creating a new file, opening a file, saving a file, printing, cutting, copying, and pasting. The main workspace is divided into two tabs, both labeled "Lab 11 (active)". The left tab is active and displays a list of circuit components and simulation commands. The components are: Vs 1 0 AC 0.01, C1 1 2 3.18n, R1 2 0 1000K, E1 3 0 2 0 1000, R2 3 4 100, and C2 4 0 79.58n. The simulation commands are: .AC DEC 10 0.01 1000K, .Tran 1ms 100ms, .PLOT AC V(2), .PROBE, and .END. The code is displayed on a dark background with a light-colored text editor. The text is color-coded: component names and values are in red, and simulation commands are in blue. The code is as follows:

```
1  test
2  Vs 1 0 AC 0.01
3
4  C1 1 2 3.18n
5
6  R1 2 0 1000K
7
8  E1 3 0 2 0 1000
9
10 R2 3 4 100
11
12 C2 4 0 79.58n
13
14
15 .AC DEC 10 0.01 1000K
16 .Tran 1ms 100ms
17 .PLOT AC V(2)
18 .PROBE
19 .END
20
```

Bode plot:





## **Conclusion**

In this lab, I learned how to find the bode plot of two different circuits. After reviewing the answers obtained from handwritten work and pspice, I can conclude the answers concur and are correct.