Laboratory Application Assignment

In this lab application assignment you will examine how complex numbers can be used to solve an ac circuit containing both series and parallel impedances. More specifically, you will use complex numbers to solve for the magnitude and phase angle of the output voltage in a series-parallel *RC* network. Finally, you will build the *RC* network and confirm, through measurement, that your calculations are correct.

Equipment: Obtain the following items from your instructor.

- Function generator
- Oscilloscope
- Two 1-kΩ resistors and two 0.01-μF capacitors

Circuit Calculations

Examine the *RC* network in Fig. 24–23. Note the frequency, magnitude, and phase angle of the input voltage, V_{in}. With the use of complex numbers, calculate the magnitude and phase angle of the output voltage, V_{out}. Show all your work in the space provided below. Circle your final answer.

Hint: *Convert the parallel connection of* R_2 *and* C_2 *into an equivalent series circuit.*

Circuit Measurements

Construct the circuit in Fig. 24–23. Connect channel 1 of the oscilloscope to measure the input voltage and channel 2 to measure the output voltage. Set the amplitude of the input voltage to 10 $V_{P\text{-}P}$, and adjust the frequency to approximately 16 kHz. Measure and record the magnitude of the output voltage, V_{out}. $V_{out} =$ _____

What is the ratio of V_{out}/V_{in} at 16 kHz? _____/_____

While viewing both V_{in} and V_{out} on the oscilloscope, measure and record the phase angle, θ, that exists between them. $\theta =$ _____

Adjust the frequency dial above and below 16 kHz. What happens to the magnitude of the output voltage as the frequency is increased and decreased from 16 kHz? _____

What happens to the phase relationship between V_{in} and V_{out} as the frequency is increased and decreased from 16 kHz?

_____

Figure 24–23