#### Course: DT008/2 Circuits & Devices 2

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# Subject: DT008/2 Circuits & Devices 2

# Laboratory Exercise: RC Circuit

# Purpose: To Build and test RC circuit

# Equipment:

Signal Generator, Digital Oscilloscope

# Procedure:



1. Build this RC circuit
2. Connect the Signal Generator across Vin. Set it to produce a 300 Hz sine wave of amplitude 5 V (10 Vp-p).
3. Connect the Oscilloscope to measure Vin on Channel 1, and Vout on Channel 2. Set Channel 2 to DC coupling.
4. Note the waveforms on Channel 1 and 2. Sketch these to scale.

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CH1: \_\_\_V/div CH2: \_\_\_V/div X‒scale \_\_\_\_ms/div

1. Measure phase delay time, t= 1.2\*250us = 0.300ms and period T= 3.4ms and calculate the phase angle, θ= t/T×360o = 31.7
2. Calculate the reactance of the capacitor *XC* at the frequency of 300 Hz. *Xc*= 5,305ohms.
3. Calculate the phase angle θ= tan-1(XC/R)= 27 and compare with θ, measured at step 5
4. Calculate the impedance Z= = 11.3k
5. Sketch the impedance triangle.

**R = 10 kΩ**

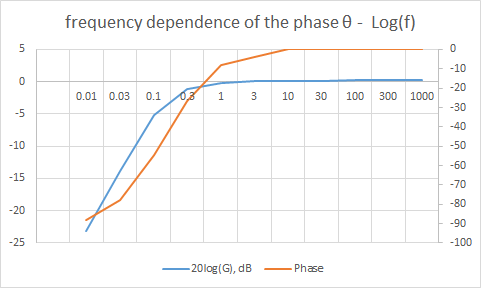
Xc = 5.3

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|  |  |  |  | Z = 11.3 k |  |  |  |  |  |
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1. Set the generator frequency to 10 Hz (0.01 kHz). Measure the output signal amplitude and the phase for different frequencies and fill the following table in MS Excel.

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| f (kHz) | Vout (V) | G= | 20log(G), dB | Phase |  |
| Vout/Vin |  |
| 0.01 | 0.544 | 0.05386139 | -25.3744495 | -70.2 |  |
| 0.03 | 2 | 0.1980198 | -14.0658276 | -75.1 |  |
| 0.1 | 5.12 | 0.50693069 | -5.90102826 | -57 |  |
| 0.3 | 8.8 | 0.87128713 | -1.19677403 | -27.1 |  |
| 1 | 9.92 | 0.98217822 | -0.15619403 | -9.78 |  |
| 3 | 10 | 0.99009901 | -0.08642748 | -3.25 |  |
| 10 | 10.2 | 1.00990099 | 0.08557596 | -0.366 |  |
| 30 | 10 | 0.99009901 | -0.08642748 | 0.53 |  |
| 100 | 10 | 0.99009901 | -0.08642748 | -0.727 |  |
| 300 | 10 | 0.99009901 | -0.08642748 | -0.439 |  |
| 1000 | 10 | 0.99009901 | -0.08642748 | 0.727 |  |
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1. At each frequency find the gain in dB (20log(G)). Determine the frequency at which the gain is 0.7 of G1 (or 3 dB lower than maximal gain). This is the cut-off frequency.
2. Use INSERT>CHART>SCATTER to plot the frequency dependence of the output voltage Vp‒p using Log(f) scales.
3. Plot the frequency dependence of the gain using dB - Log(f) scales.
4. Plot the frequency dependence of the phase θ - Log(f) scales.



1. Comment results.

The team built the circuit using a capacitor and resistor on a breadboard. As the frequency increases the phase shift angle decreases. By adjusting the vertical and horizontal scales on the oscilloscope the team was able to get a better curve. We got our curve from a digital oscilloscope. The team used a function generator to get a sine wave signal and used an oscilloscope to show the output sine waves. By using a digital oscilloscope this calculated Vin and Vout for us and also calculated our Phase shift. The team used excel to calculate our values and plot them on the graphs. We used formulas to calculate the impedance, reactance and resistance.

The team learned how to work with oscilloscope, function generator and excel to get the values for a complete circuit.