Lab Session 4 – Hardware

Objectives:

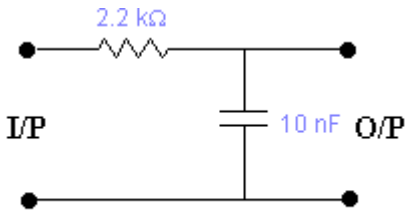
Upon completion of this experiment, the student will be able to:
-Verifying of Transient response, two port network and Fourier analysis circuits

Equipment and Components Required:

- NI-ELVIS II+ Kit
- NI Prototyping Board
- Resistors (0.33 k, 1 k, 2.2 k, 3.3 k).
- Capacitors (10 nF, 100 nF).
- Coil 100mH
- Diodes.

A: Transient Analysis (circuit 1):

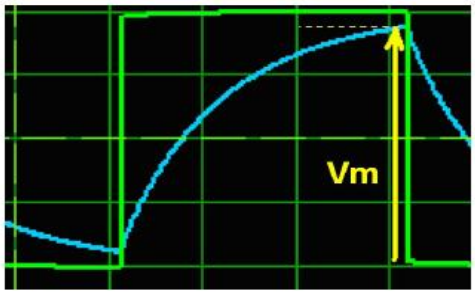
1. Adjust the function generator module in the NI software interface to generate a square wave of frequency 5000 Hz with voltage level 0 and 5V.
2. Connect the input wave produced by the generator to channel(0) of the oscilloscope (You can do this by connecting FGEN node which is the output of the function generator to any of AI0+,AI1+,AI2+…..AI7+. Then **if** you chose AI0+ then you should connect AI0- to ground. Afterwards, set channel (0) source to AI0 in the software interface) and run its software interface.
3. Now, connect the (FGEN) node to the input node (ground is common) of the shown circuit which you are supposed to build on the bread-board:

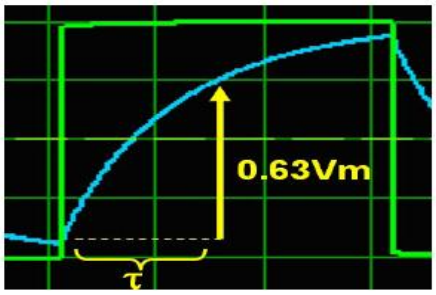


4. Connect the output node of the circuit to channel (1) (You can use the same procedure as in step 2 with a different AI of course) of the oscilloscope.

Q1: Draw the voltage waveform on C and the input voltage for one period cycle.

Q2. Find the time constant τ from the output across C which appears on oscilloscope. Use the below figure to figure out how to get the time constant from the output across C.

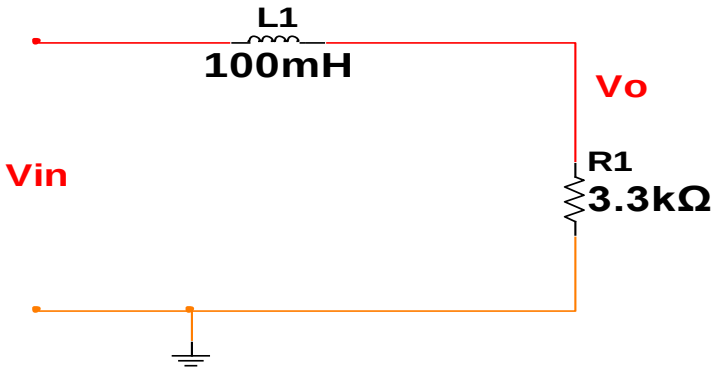




Q3: Calculate the time constant using equation $\tau = RC$ and compare it to the measured value from Q2.
Q4: What happens at low frequencies and high frequency?
Q5: Why does the output waveform differ for different frequencies?

B: Transient Analysis (circuit 2):

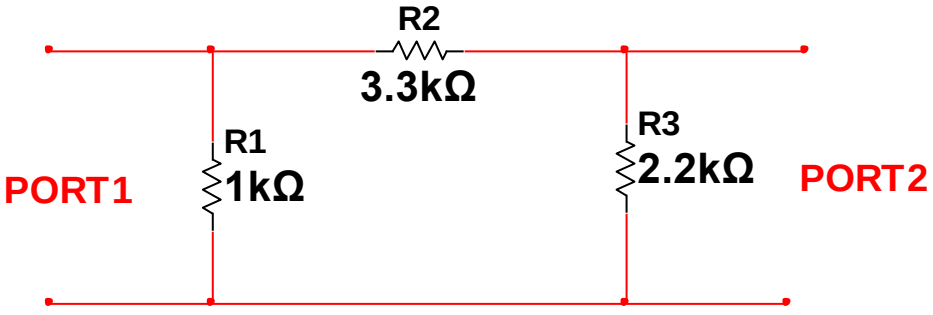
1. Connect the shown circuit on the NI kit bread-board
2. Repeat the steps of the Transient Analysis (circuit 1).



Q6: Draw the voltage waveform on R1 and the input voltage for one period cycle.
Q7. Find the time constant τ from the output across R1 which appears on oscilloscope.
Q8: Calculate the time constant using equation $\tau = L/R$ and compare it to the measured value from Q7.

C: 2-port network (circuit 1):

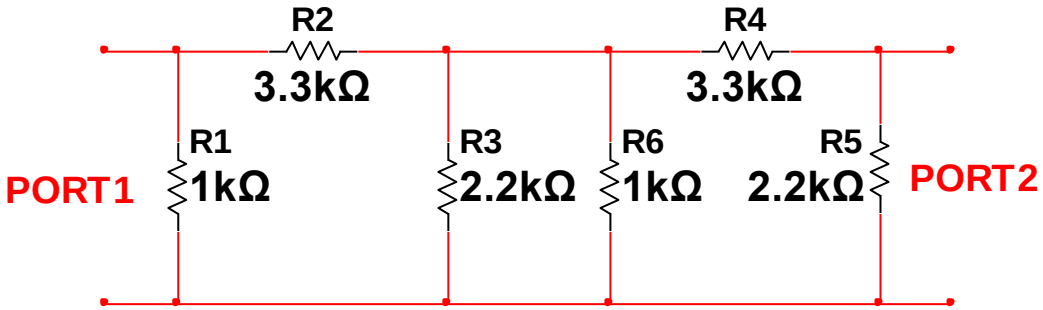
1. Connect the shown circuit:



Q10: Find the Z-parameter Z, Y-parameter Y, H-parameter H and Transmission parameter T.

D: 2-port network (circuit 2):

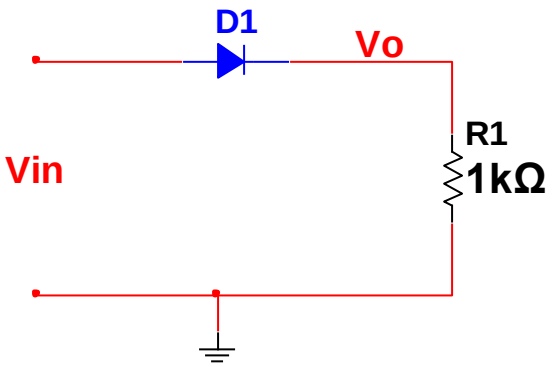
1. Connect the shown circuit:



Q11: Find Transmission parameter T2 for the above circuit.
Q12: compare the T2 with the obtained transmission parameter T from Q10, is that the relation of T2=T*T.

E: Fourier Analysi (circuit 1):

1. Connect the shown circuit:
2. Adjust the function generator module in the NI software interface to generate a sine wave of frequency 1KHz with voltage level -2.5 and 2.5V.
3. Connect the input wave produced by the generator (FGEN) to channel(0) of the oscilloscope (You can do this by connecting FGEN node to any of AI0+ Then you should connect AI0- to ground. Afterwards, set channel (0) source to AI0 in the software interface) and run its software interface.
4. Connect Vo to AI1+ and ground to AI1- and choose AI1 to appear on Channel 2 of the oscilloscope.



Q13: Draw the voltage waveform of Vo and the input voltage for one period cycle

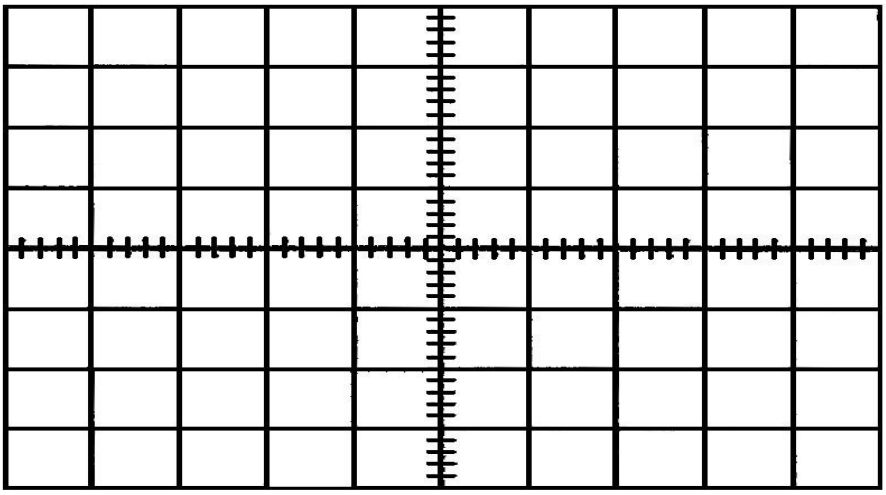
5. To get the Fourier series for Vo select DSA instrument from NI ELVISmx Instrument Launcher. Adjust source channel to AI1.

Q14: Find Fourier series for Vo.

Lab Session 4 – Hardware – Answer Sheet

Name:

Q1:



Q2:

$\tau_{measured} =$

Q3:

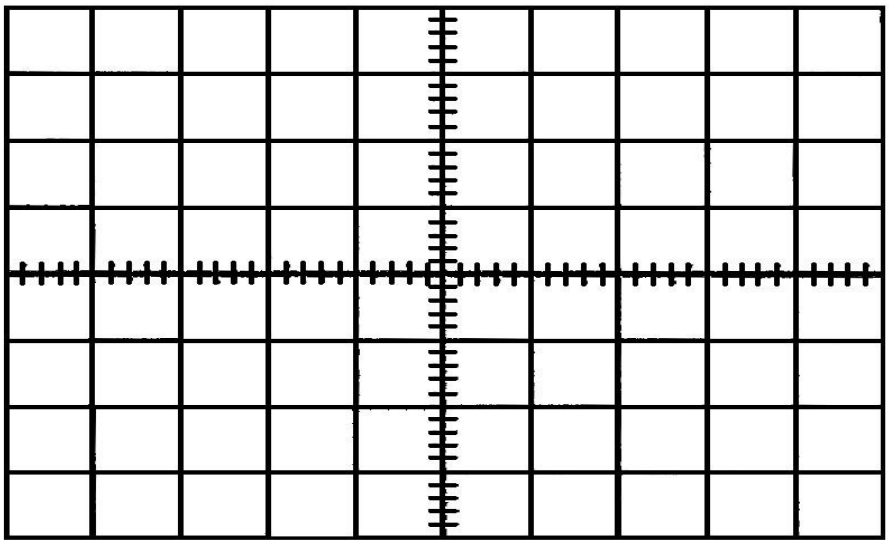
$\tau_{theoritcal} =$

Q4:

- At low frequencies:.....
  .....
- At high frequencies:.....
  .....

Q5: The output waveform differs for different frequencies because: .....
.....

Q6:



Q7:

$\tau_{measured} =$

Q8:

$\tau_{theoritcal} =$

Q10: the Z-parameter

Z=

Y-parameter

Y=

H-parameter

H =

Transmission parameter

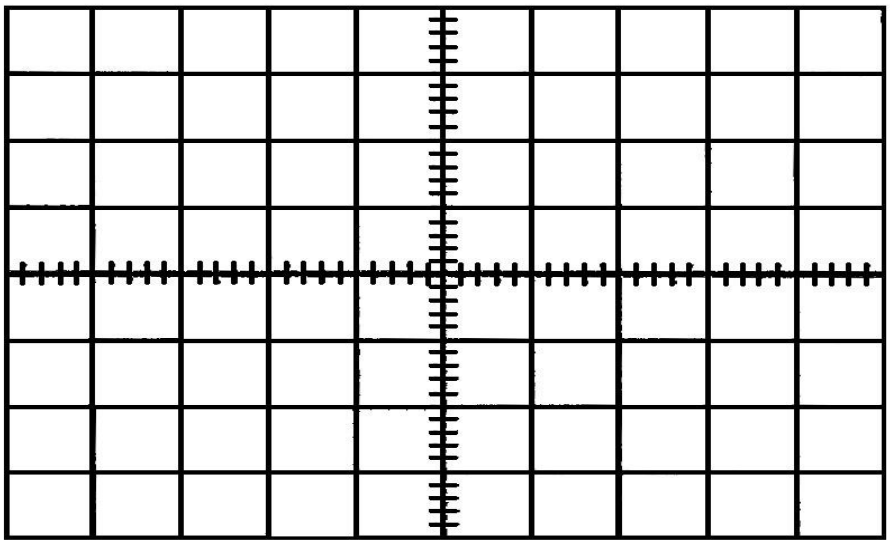
T=

Q11: Find Transmission parameter

T2 =

Q12: compare the results…

Q13:



Q14:

Harmonic	Magnitude
DC	
f_0	
$2f_0$	
$3f_0$	
$4f_0$	
$5f_0$	