Fall 2021

EEE/ETE 141L

Electrical Circuits-I Lab(Sec-5)

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Lab No. : 07

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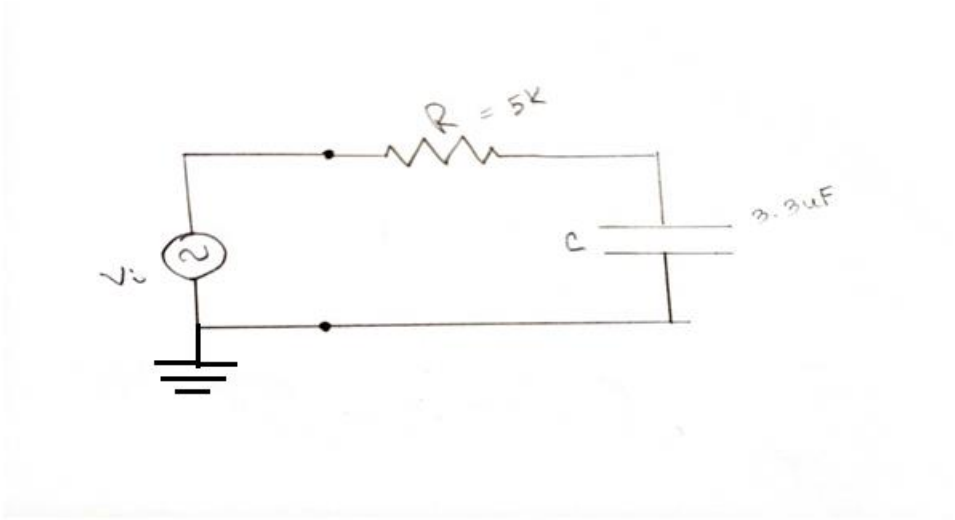
Objective:

- To learn the use of Signal Generators and Oscilloscope.
- Investigate the behavior charging and discharging of RC circuits with changing Time Period, T of the input Square wave.

List of Equipment:

- Oscilloscope
- Capacitor
- Resistor
- The function Generator

Circuit Diagram:



Data Table:

(From the hardware video)

Measurement	T=10RC	T=30RC	T=3.5ms
Frequency of input signal	90.91Hz		
Time constant, τ	1.2ms		
Final Output Vc	9.40V		
Measure the time the capacitor charges up to Vc	5.50ms		
Time the capacitor starts to discharge	5.50 ms		
Time the capacitor stops discharging	11ms		

Result:

Here,

R=5kohm

C=0.22 uF

Vin=10V

Time constant, τ =10RC

=(10*5000*0.22*10^{-6})s

=1.2ms.

Again,

Frequency of input signal, f = 1/T

=90.91 Hz

We know that, $Vc = Vin(1-e^{-t/RC})$

$= 10*(1-e^{RC/RC})$

$= 10*(1-e^{-1})$

$= (10*0.63)V$

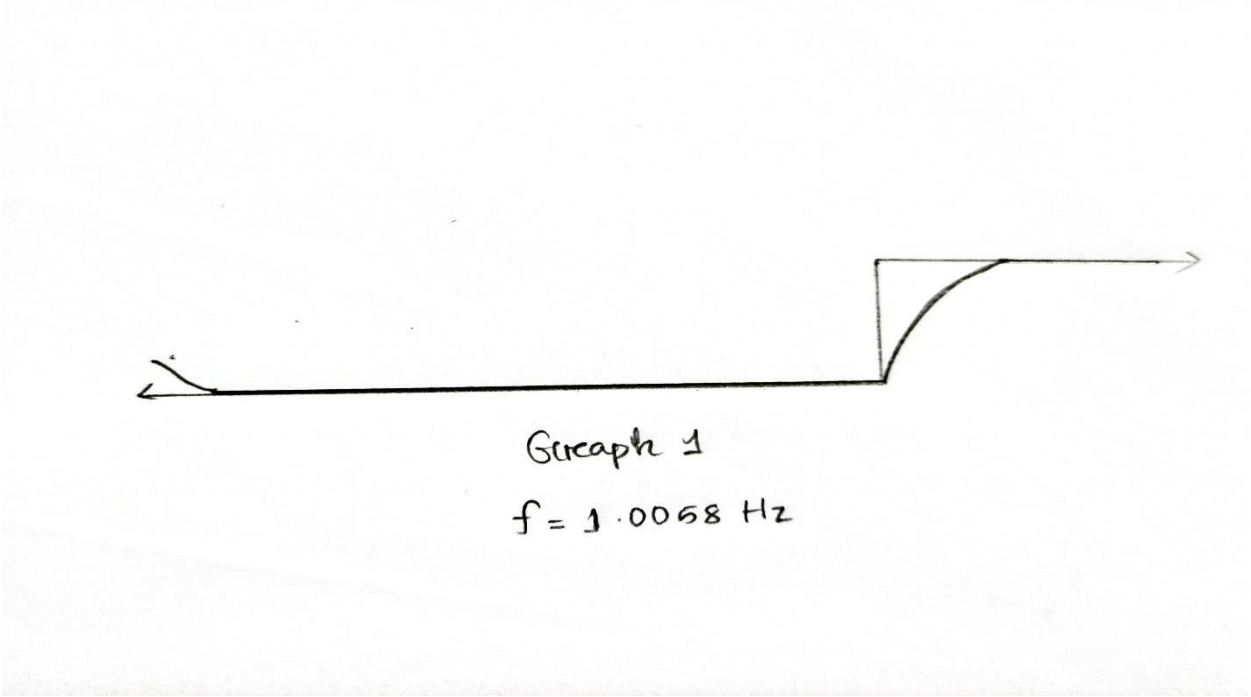
$= 6.3\ V$

Question-Answers:

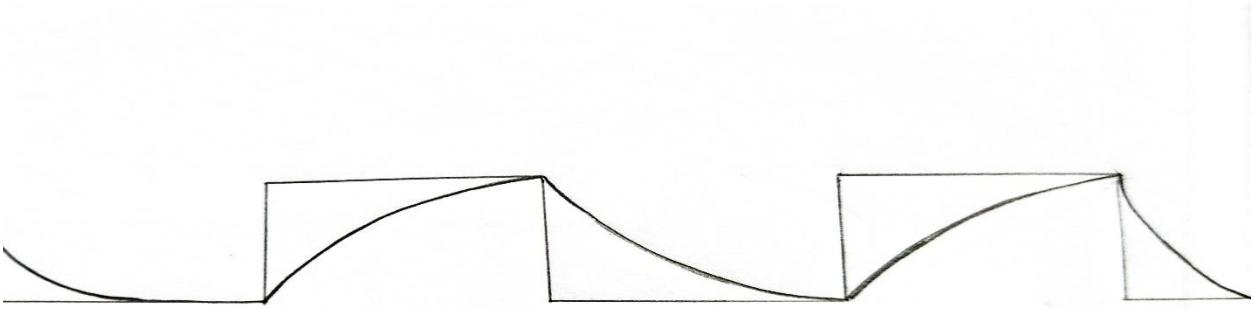
1.In separate graph papers, draw the charging-discharging phase for the RC circuit for 3 different values of T. The graphs should be drawn using values from Table-1.

Answer: Here is the graphs for charging-discharging pahse for the RC circuit for 3 different values from the hardware lab.

Graph 1:

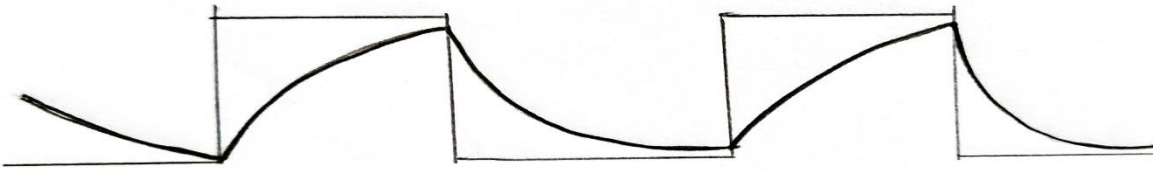


Graph 2:



Graph 2
f = 3.03

Graph 3:



Graph 3
f = 5.00

2.Explain what is time constant, τ.

Answer: The time constant, τ is the parameter characterizing the response to a step input of a first-order, linear time-invariant system. The time constant is the main characteristic unit of a first-order LTI system.

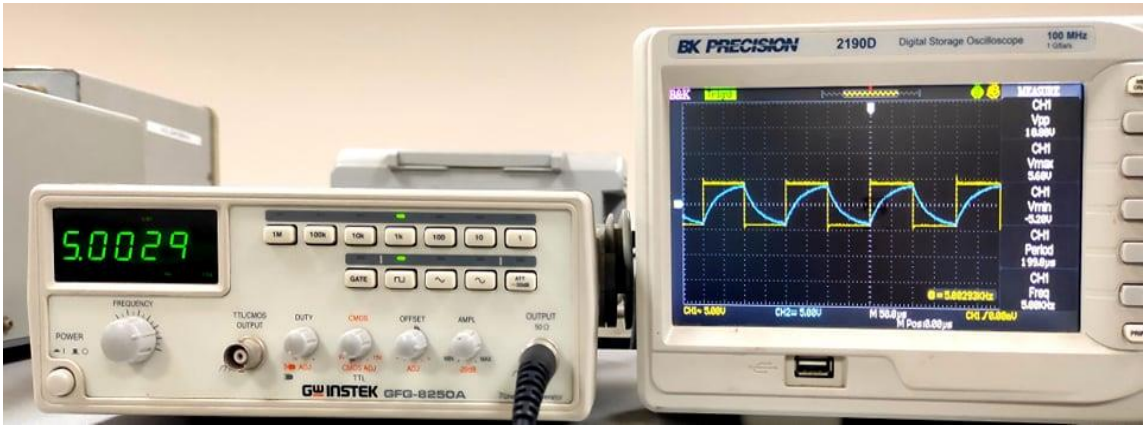
3.Theoretically calculate τ and compare with the measured value of τ.

Answer: We can get the value of τ from the lab which is 33 ms.
We know that,
τ= RC
=10kohm*3.3uF
=33 ms.
So, τ is the same for theoretically calculation and measured calculation.

4. Using the data table,**explain in details** the charging-discharging pattern for all the 3 cases.
Answer:
We can see the changes of charging and discharging pattern clearly.
Case 1: Here, we can see that the frequency is 1.0058 and the graph shows that it has been storing the charge for a long time. Also it is discharging slowly same as like charging.

Case 2: In this case, we can see that the frequency is 3.031 and the graph shows that it is storing the charge in a fair amount of time and discharging it in the same way.

Case 3: In the last case, we can see that the frequency is the graph shows that it is not storing charge at all and also discharging in a very short time.



The first case is the best because it is storing charge and discharging for the longest time. 2nd case is the average because it is storing chanrge and discharging in a moderate way. And the 3rd on is the worst of all because it is storing charge and discharging in a very short time.

Discussion:

From the lab 7, we learned about Charging and Discharging of RC circuits, Relationship between T and f, about time constant or τ and many more**.**

As, it was an offline lab, we had to use Oscilloscope, Capacitor and the function Generator to do the experiments. As it was our first offline lab, our instructor showed us all the process carefully. We could find the theoretical values easily though it was an offline lab.