DEPT. OF ELECTRICAL & ELECTRONICS ENGINEERING

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY, Kattankulathur – 603 203

Title of Experiment	: **3.Transient analysis of Series RL, RC circuits**
Name of the candidate	:
Register Number	:
Date of Experiment	:

Sl. No.	Marks Split up	Maximum marks (50)	Marks obtained
1	Pre Lab questions	5	
2	Preparation of observation	15	
3	Execution of experiment	15	
4	Calculation / Evaluation of Result	10	
5	Post Lab questions	5	
Total		**50**	

Staff Signature

PRE LAB QUESTIONS

1) Define Transient and classify

2) Deduce the time constant for simple RL series circuit.

3) Deduce the time constant for simple RC series circuit.

4) How will you design the values of L & C in a transient circuit?

Experiment No. 3 **Date :**	**Transient analysis of series RL, RC circuits**

Aim:

To obtain the transient response and measure the time constant of a series RL and RC circuit for a pulse waveform.

Apparatus Required:

Sl. No.	Apparatus	Range	Quantity
1	Function Generator	800 Hz	1
2	Inductor	1 mH	1
3	Resistor	4 KΩ	1
4	Capacitor	1 nF	1
5	Bread Board & Wires	--	Required
6	CRO		1
7	CRO Probes		2

Theory

In this experiment, we apply a pulse waveform to the RL or RC circuit to analyze the transient response of the circuit. The pulse-width relative to a circuit's time constant determines how it is affected by an RC or RL circuit.

Time Constant (τ): A measure of time required for certain changes in voltages and currents in RC and RL circuits. Generally, when the elapsed time exceeds five time constants (5τ) after switching has occurred, the currents and voltages have reached their final value, which is also called steady-state response.

The time constant of an RC circuit is the product of equivalent capacitance and the Thevenin's resistance as viewed from the terminals of the equivalent capacitor.

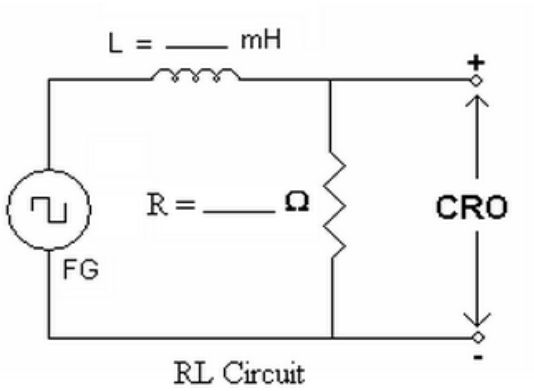
$$\tau = RC$$

A Pulse is a voltage or current that changes from one level to the other and back again. If a waveform's high time equals its low time, as in figure, it is called a square wave. The length of each cycle of a pulse train is termed its period (T). The pulse width (tp) of an ideal square wave is equal to half the time period.

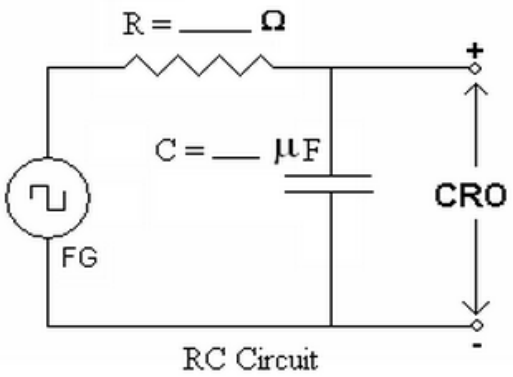
Procedure for RL:

1. Make the connections as per the circuit diagram.
2. Choose square wave mode in signal generator
3. Using CRO, adjust the amplitude to be 2 volts peak to peak.
4. Take care of the precaution and set the input frequency.
5. Observe and plot the output waveform.
6. Calculate the time required by the output to reach 0.632 times the final value (peak).
7. This value gives the practical time constant. Tabulate the theoretical and practical values.

Circuit Diagram:



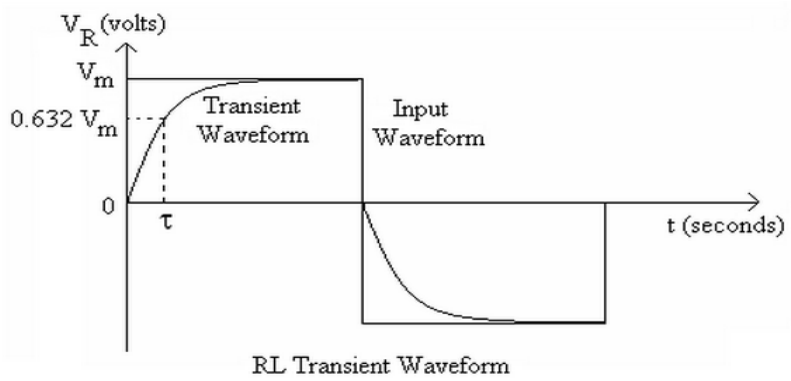
RL Circuit



RC Circuit

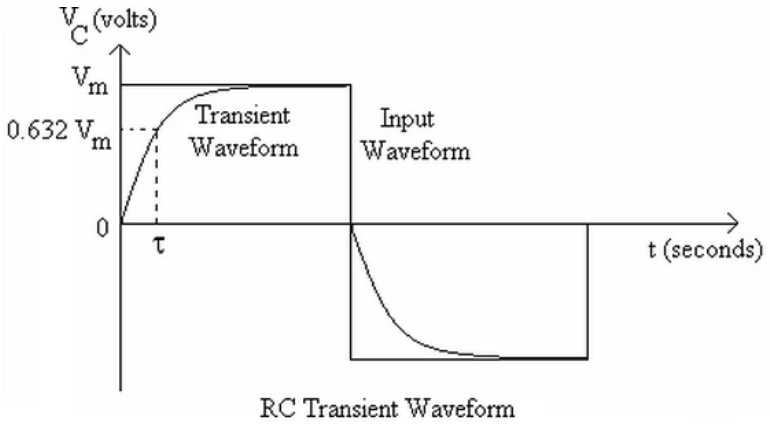
Model Graph:

a) RL Transient :Output voltage across Resistor:



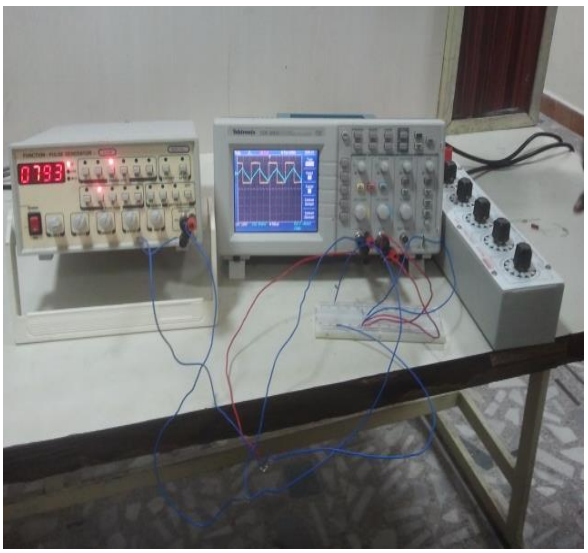
RL Transient Waveform

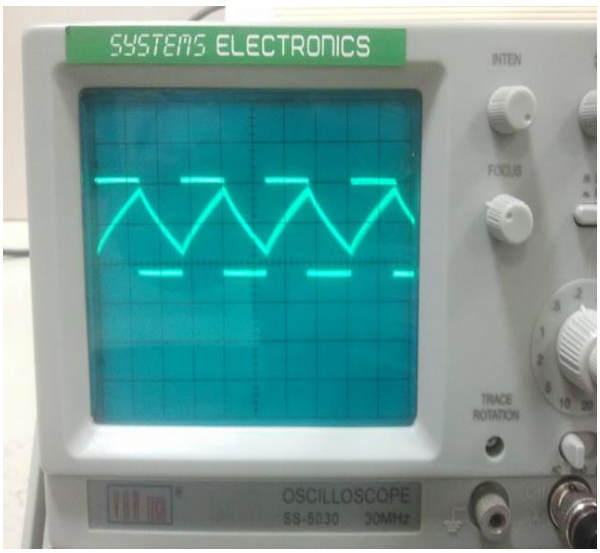
b) RC Transient :Output voltage across Capacitor:



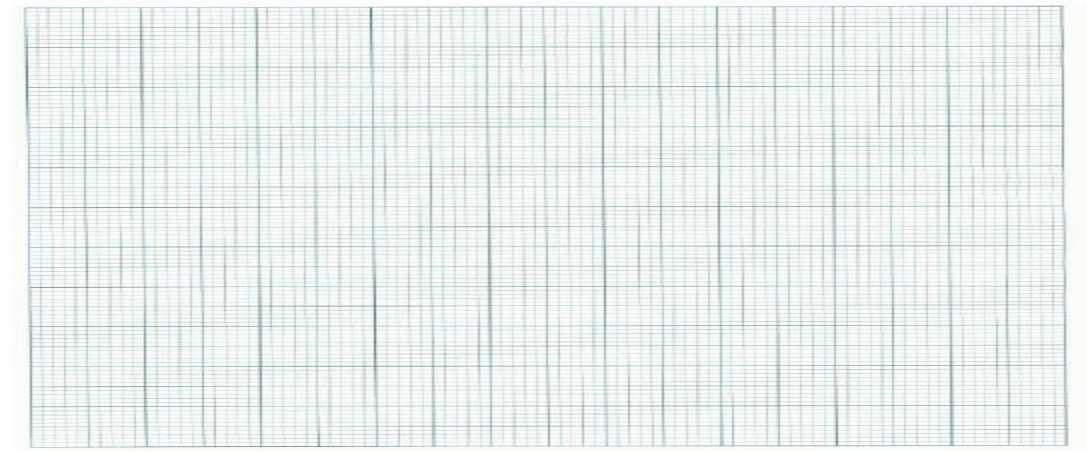
RC Transient Waveform

Hardware setup:

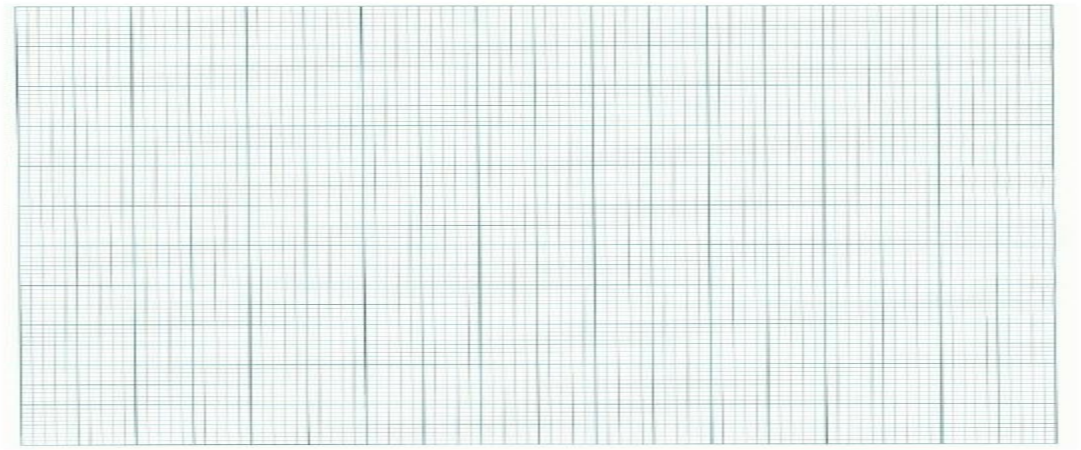




GRAPH:



GRAPH:



Result:

POST LAB QUESTIONS

1) Why it is necessary to discharge the capacitor every time you want to record another transient voltage across the capacitor?

2) If the capacitor remains charged, what would you expect to see across the capacitor when you re-close the switch to try to record another transient?

3) Give the expression for energy stored in the capacitor?

4) Draw the discharge of capacitor voltage with time in RC circuit?

5) What do you understand from the value of time constants (RL, RC)?