<u>**Experiment No: 1**</u>

AIM: TO VERIFY THE THEVENIN THEOREM.

APPARATUS REQUIRED:

SL NO.	NAME OF COMPONENT	SPECIFICATION	QUANTITY
1	Ac/Dc Source	0-230 V / 50Hz	1
2	Voltmeter	0-230V	1
3	Ammeter	0-10A	1
4	Resistances	1k, 47ohm	2
5	Capacitor	22µf,63V	1
6	Choke coil	1H	1
7	Breadboard	-	1
8	Wire	Single Stranded copper wires	As per required

CIRCUIT DIAGRAM:

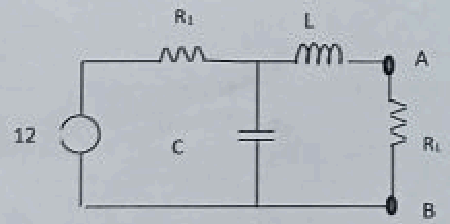


Figure-I

THEORY:

According to Thevenin Theorem, a linear active network constituting of independent and/or dependent voltage and current sources and linear passive elements can be replaced at any pairs of terminals by an equivalent voltage source V_{th} in series with an equivalent resistance R_{th}.

HOW TO THEVENIZE A GIVEN CIRCUIT:

1. Temporarily, remove the load resistance.
2. Find the open circuit voltage which appears across the 2 terminals from where load resistance has been removed.
3. Compute the resistance of the network as looked into from these two terminals after all voltage sources have been removed leaving behind internal resistances and current sources have been replaced by open circuit.
4. Replace the entire network by a single thevenin source, whose voltage is V_{th} & whose resistance is R_{th}
5. Connect R_L back to its terminals from where it was previously removed.
6. Finally, calculate the current flowing through R_L by using the equation,

$$I = V_{th} / (R_{th} + R_L).$$

PROCEDURE:

1. Remove R_L from the circuit terminals A and B and redraw the circuit.
2. Calculate the open circuit voltage Voc which appears across terminals Aand B when they are open i.e, when R_L is removed.
3. Now the battery is removed leaving the internal resistance. When viewed inwards from terminals A and B the equivalent resistance is given by; $Ri = R_2 \parallel (R_1 + r)$
4. Remove load from the circuit terminals A and B and redraw the circuit.
5. Calculate the open circuit voltage Voc which appears across terminals A and B when they are open i.e, when is removed.
6. R_L is now connected back across terminals A and B from where it was temporarily removed. Connect an ammeter to determine I_L

OBSERVATION TABLE:

Sl No	Supply Voltage (Vs)	Voc/Vth (Measured)	Voc/Vth (Calculated)	I_l (Measured)	I_l (Calculated)	Deviation
1						
2						
3						
4						
5						

RESULT:

PRECAUTIONS:

1. Connect the circuit as per diagram
2. Handle the instruments carefully.
3. Note down the readings properly.

CONCLUSION: Thevenin Theorem has been verified.

Experiment No: 2

AIM: TO VERIFY THE RESONANCE CONDITION OF A SERIES RLC CIRCUIT.

APPARATUS REQUIRED:

SL. NO.	NAME OF COMPONENTS	SPECIFICATIONS	QUANTITIES
1.	Resistance	47ohm	1
2.	Inductor	1H	1
3.	Capacitor	22µf, 63V	1
4.	Breadboard	-	1
5.	Voltage source (A.C)	Signal generator, 0-20V	1
6.	Connecting wires	Single stranded copper wires	As per required
7.	Voltmeter, Ammeter or Multimeter	as per ratings, Analogue/Digital	1

THEORY:

Resonance in electrical circuits consisting of passive & active elements represents a particular state of the circuit when the current or voltage in the circuit is maximum or minimum with respect to the magnitude of excitation at a particular frequency, the circuit impedances being either minimum or maximum at the power factor unity.

In parallel resonance, the current at resonance is minimum & the net impedance at resonance is maximum.

Let, f_o or ω_o be the frequency at which $X_L = X_c$,

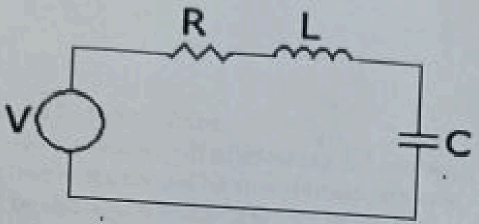
So, $\omega_0 = \frac{1}{\omega_0 C}$

Or, $\omega_0{}^2 = \frac{1}{LC}$

Or, $f_0 = \frac{1}{2\pi\sqrt{LC}}$

Where, f_0 is the resonant frequency.

CIRCUIT DIAGRAM:



PROCEDURE:

1. Connect the circuit as per circuit diagram.
2. Keeping voltage source constant say at 7V, measure the current through the circuit using an ammeter at different steps by varying the frequency.
3. After that the voltage drop is measured from the relation, V_R =IR volt.
4. Plot the graph between current and frequency of Series Resonance RLC circuit.
5. Find out the resonant frequency from the observation which can be s calculated as, $f_0 = \frac{1}{2\pi\sqrt{LC}}$
6. Mentioned the current at resonant frequency.

CALCULATION:

Resonant frequency, $f_0 = \frac{1}{2\pi\sqrt{LC}}$

OBSERVATIONS: Source voltage V_S (in volts) =

Sl No	Frequency, F (KHz)	Voltage Across Resistance, V_r	Current Across Resistance, I

RESULTS:

PRECAUTIONS:

1. All the connections should be tightly fixed.
2. The power supply should be switched off after taking the readings.
3. The ends of the connecting wires should be straightened properly.
4. The multimeter should be checked whether it works properly or not.

CONCLUSIONS:

Hence, the Series Resonance of RLC circuit is verified and the graph of current versus frequency is plotted.

Experiment No: 3

AIM: To verify the resonance condition of a parallel RLC circuit.

APPARATUS REQUIRED:

SL. NO.	EQUIPMENTS	SPECIFICATION	QUANTITY
01	Resistance	47ohm	1
02	Inductor	1H	1
03	Capacitor	22µf	1
04	Voltage source (A.C)	Signal generator, 0-20V	1
05	Multimeter	Digital	1
06	Breadboard	-	1
07	Connecting wires	Single stranded copper wire	As per Required

THEORY:

Resonance in electrical circuits consisting of passive & active elements represents a particular state of the circuit when the current or voltage in the circuit is maximum or minimum with respect to the magnitude of excitation at a particular frequency, the circuit impedances being either minimum or maximum at the power factor unity.

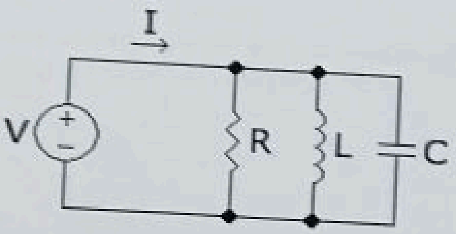
In parallel resonance, the current at resonance is minimum & the net impedance at resonance is maximum.

Frequency of parallel resonating circuit at resonance is given by –

$$f_0 = \frac{1}{2\pi}\sqrt{\left(\frac{1}{LC} - \frac{R^2}{L^2}\right)}$$

L=inductance, C=capacitance.

CIRCUIT DIAGRAM:



PROCEDURE:

1. Connect the circuit as per circuit diagram.
2. Now the resonating frequency is to be calculated using the above formula.
3. Set the supply voltage using the voltage source (e.g. 7V).
4. Frequency is to be varied step by step. Accordingly, current will also vary.
5. Repeat the same to get 15-16 readings.
6. Plot the graph: frequency vs. Current.

OBSERVATIONS:

Sl No	supply voltage(Vs)	Frequency,f (Hz)	Current,I mA

RESULT:

CONCLUSIONS:

PRECAUTIONS:

1. Circuit should not be connected loose.
2. Electrical equipment are to be checked with multimeter.
3. Proper handling of instruments is necessary.

Experiment No: - 4

AIM: TRANSIENT ANALYSIS OF SERIES R-L CIRCUIT

OBJECTIVE: (i) To verify the Transient Response of series RL Circuit, (ii) to draw the response and (iii) To find out the time constant.

APPARATUS REQUIRED:

SL NO	COMPONENT	SPECIFICATION	QUANTITY
1	Function Generator	0-20V, 5A, 50Hz	1
2	Breadboard	-	1
3	Resistance	1K/2K/220/330ohm	1
4	Inductance	1/2/3 henry	1
5	Oscilloscope	2 channel, 100MHz	1
6	Connecting wires	Single stranded copper wires	As per required

THEORY:

The time-varying currents and voltages resulting from the sudden application of sources, usually due to switching, are called transients. By writing circuit equations, we obtain integro-differential equations.

Step response of an RL circuit:

In an RL circuit shown in Fig-1, the initial conditions to determine the step response are assumed to be Io=0. The expressions for the current in the circuit, the voltage across the resistor and inductor after the voltage source is applied are:

$$i(t) = \frac{Vs}{R}\left(1 - e^{-\frac{R}{L}t}\right) A$$

$$V_R(t) = Vs\left(1 - e^{-\frac{R}{L}t}\right) V$$

$$V_L(t) = Vs\left(e^{-\frac{R}{L}t}\right) V$$

CIRCUIT DIAGRAM: The circuit diagram shown in fig. 4a

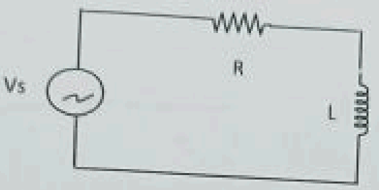


Figure-4a

PROCEDURE:

1) Connect the circuit as per circuit diagram.
2) Fix the supply voltage at 10V and frequency at 50 Hz.
3) Apply the voltage to the circuit.
4) Connected the oscilloscope across the inductor.
5) Trace the input voltage waveform and the response.
6) Vary the supply voltage, resistance and capacitor and repeat step 3 to 5.

CALCULATION: Time constant of RL circuit will be..

RESULT:

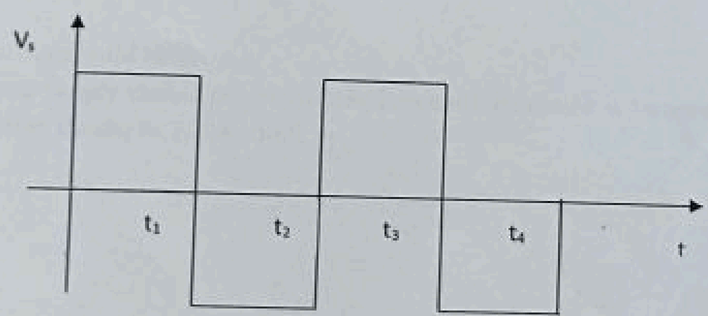


Figure-4b: Supply voltage

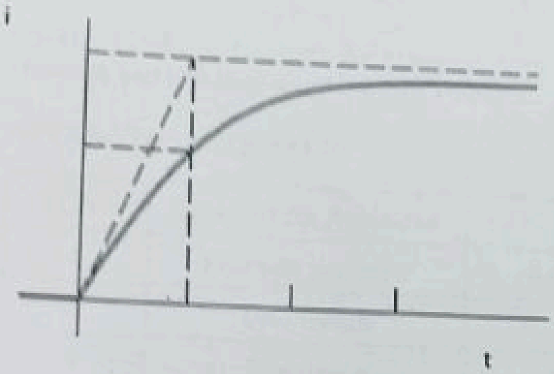


Figure-4c: Current versus time
for the circuit of fig-4a

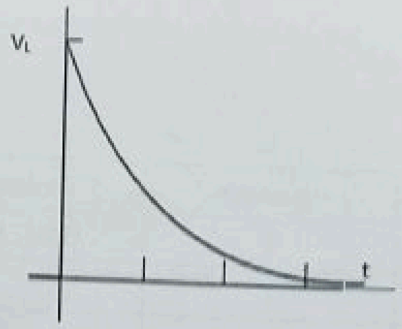


Figure-4d: voltage versus time
for the circuit of fig-4a

CONCLUSION: The transient response of first order circuit has verified and also tested with different time constant.

PRECAUTION:

1) Connection should be proper.
2) The Power supply should not be switched on until the circuit is complete.
3) The reading should be taken carefully.

Experiment No: 5

AIM: TRANSIENT ANALYSIS OF SERIES R-C CIRCUIT

OBJECTIVE: (i) To verify the Transient Response of series RC Circuit, (ii) to draw the response and (iii) to find out the time constant.

APPARATUS REQUIRED:

Sl. No	Name of the Apparatus	Specification	Quantity
1	Function generator	0-20V, 5A, 50Hz	1
2	Breadboard	-	1
3	Resistance	1Kohm	1
4	Capacitor	32μF	1
5	Oscilloscope	2 channel, 100 MHz	1
6	Connecting wires	Single stranded copper wires	As per required

THEORY: The time-varying currents and voltages resulting from the sudden application of sources, usually due to switching, are called transients. By writing circuit equations, we obtain integro differential equations.

Step response of an RL circuit:

In an RL circuit shown in Fig-1, the initial conditions to determine the step response are assumed to be $I_o=0$. The expressions for the current in the circuit, the voltage across the resistor and inductor after the voltage source is applied are:

$$V_c(t) = V_s\left(1 - e^{-\frac{1}{RC}t}\right)V$$

$$V_R(t) = V_s\left(e^{-\frac{1}{RC}t}\right)V$$

$$i(t) = \frac{V_s}{R}\left(e^{-\frac{1}{RC}t}\right)A$$

CIRCUIT DIAGRAM:

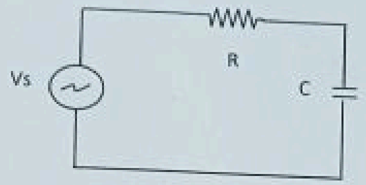


Figure-5a

PROCEDURE:

1) Connect the circuit as per circuit diagram.
2) Fix the supply voltage at 10V and frequency at 50 Hz.
3) Apply the voltage to the circuit.
4) Connected the oscilloscope across the capacitor.
5) Trace the input waveform and response.
6) Vary the supply voltage, resistance and capacitor and repeat step 3 to 5.

CALCULATION: Time constant of series RC circuit will be

RESULT:

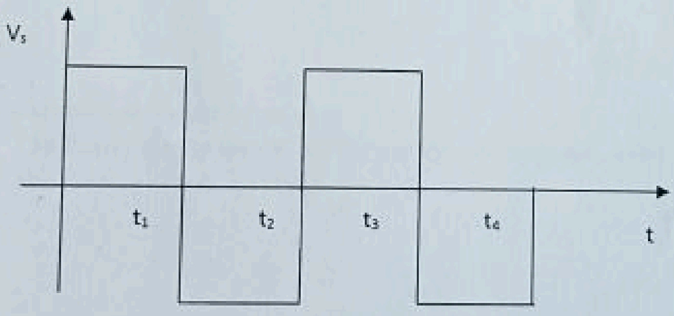


Figure-5b: Supply voltage

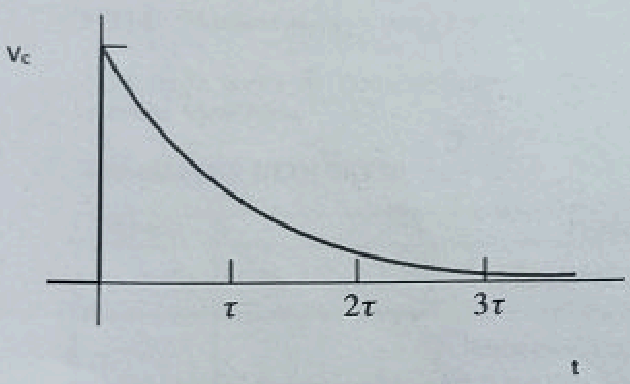


Figure-5c: Current versus time for the circuit of fig-5a

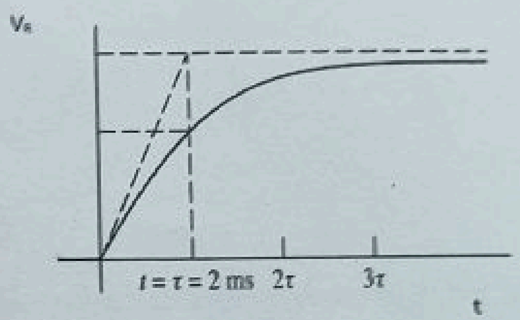


Figure-5d: voltage versus time for the circuit of fig-5a

CONCLUSION: The transient response of first order circuit has verified and also tested with different time constant.

PRECAUTIONS:

1) Connection should be proper.
2) The Power supply should not be switched on until the circuit is complete.
3) The reading should be taken carefully.

Experiment No-6a

TITLE: Transient analysis using software

AIM: (i) To verify the Transient Response of series RL and RC Circuit, and (ii) to draw the response wave form.

APPARATUS REQUIRED:

Sl No	Component
1	MATLAB SOFTWARE
2	Resistance, Capacitor, Inductor
3	Connecting Wire

THEORY: The time-varying currents and voltages resulting from the sudden application of sources, usually due to switching, are called transients. By writing circuit equations, we obtain integro-differential equations. This equation then transforms in frequency domain and desired transfer function (TF) obtain for the current response.

Step response of an RL circuit:
In an RL circuit shown in Fig-6a, the initial conditions to determine the step response are assumed to be *Io*=0. The KVL equation of the circuit, and TF are;

$$V(t) = Ri(t) + L\frac{di(t)}{dt}$$

The transform equations is,

$$V(s) = I(s)[R + sL]$$

and, the transfer function (TF) is,

$$T.F = H(s) = \frac{I(s)}{V(s)} = \frac{1}{s + \frac{R}{L}}$$

Step response of an RC circuit:
In an RC circuit shown in Fig-6b, the initial voltage across the capacitor is assumed to be *Vo*=0.
The time domain and frequency domain equations are as follows;

$or,\ i(t) = \frac{V(t)}{R} + C\frac{dV(t)}{dt}$

Laplace transform the above equation will be as,

$I(s) = V(s)[\frac{1}{R} + sC]$, and

The transfer function (TF) is given by,

$$T.F = H(s) = \frac{I(s)}{V(s)} = \frac{sC}{s + \frac{1}{RC}}$$

CIRCUIT DIAGRAM:

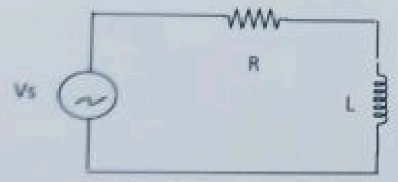


Figure-6a

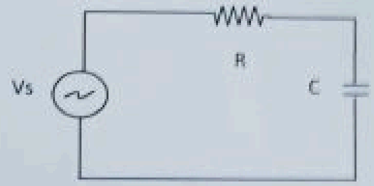
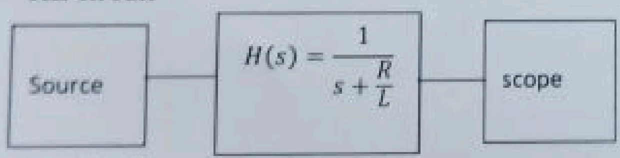


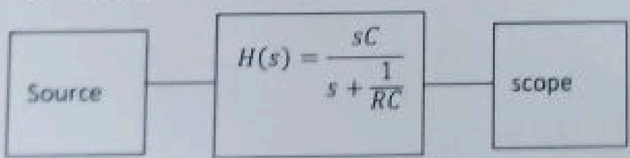
Figure-6b

BLOCK DIAGRAM (SIMULINK):

(i) RL circuit



(ii) RC circuit



PROCEDURE:

1. Open the MATLAB command window.
2. Go to the Simulink model
3. Open a Simulink model file
4. Drag the the constant source from source link, transfer function from continuous and scope from sink model
5. Connect the block as per block diagram.
6. Save file and Run it.
7. Plot the response
8. Change the circuit component and repeat it.

CALCULATION:

RESULT:

CONCLUSION:

PRECAUTIONS:

1. Connection should be proper.
2. The Power supply should not be switched on until the circuit is complete.
3. The reading should be taken carefully.

Experiment No-6b

TITLE: Transient analysis of second order circuit using software

AIM: To verify the nature of response of series RLC and parallel LCR circuit in different coefficient condition.

APPARATUS REQUIRED: MATLAB Software

THEORY: The time domain circuit and its transform circuit are shown in Fig. 6c and 6d respectively

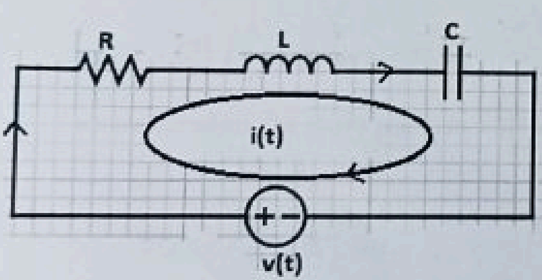


Figure-6c: Series RLC circuit

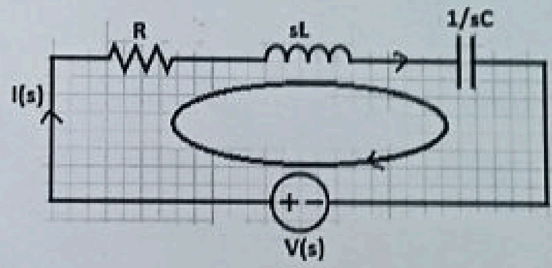


Figure-6d: Series RLC circuit

By applying KVL in the circuit of Fig. 6d, the voltage of the circuit is,

$$V(t) = Ri(t) + L\frac{di(t)}{dt} + \frac{1}{c}\int i(t)dt$$

Applying Laplace transform the above equation will become-

$V(s) = I(s)[R + \frac{1}{sC} + sL]$ and,

The transfer function (TF) is given by,

$$T.F = \frac{I(s)}{V(s)} = \frac{sC}{s^2+\frac{R}{L}s+\frac{1}{LC}}$$

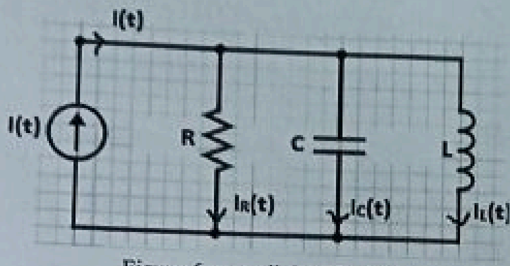


Figure-6e: parallel LCR circuit

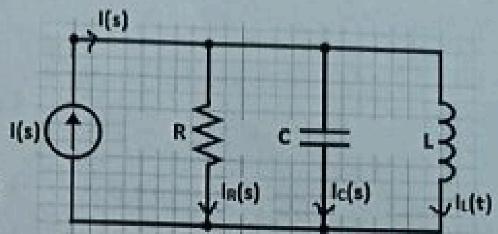


Figure-6f: parallel LCR circuit

Parallel LCR circuit:

By applying KCL in Fig. 6e & 6f, the current is given as,
From the circuit, the KCL equation is-

$$i(t) = i_R(t) + i_c(t) + i_L(t)$$

or, $i(t) = \frac{V(t)}{R} + \frac{1}{L}\int V(t)dt + C\frac{dV(t)}{dt}$

Laplace transform the above equation will be as,

$I(s) = V(s)[\frac{1}{R} + \frac{1}{sL} + sC]$, and

The transfer function(TF) is given by,

$$T.F = H(s) = \frac{I(s)}{V(s)} = \frac{s\,LR}{s^2 + \frac{1}{RC}s + \frac{1}{LC}}$$

OBSERVATION:

For series RLC circuit:

Set - 1

Case 1: Over damped

R=4 ohm. L=0.5 H. C=1 F T.F = $\frac{s}{0.5s^2 + 4s+1}$

Case 2: critically damped

R= 4 ohm. L= 1 H. C= 0.25 T.F = $\frac{0.25s}{0.25s^2 + s+1}$

Case 3: under damped

R= 1 ohm. L= 3 H. C= 1 F. T.F = $\frac{s}{3s^2 + s+1}$

Case 4: oscillatory

R= 0 ohm. L=0.5 H. C= 2 F. T.F = $\frac{2s}{s^2+1}$

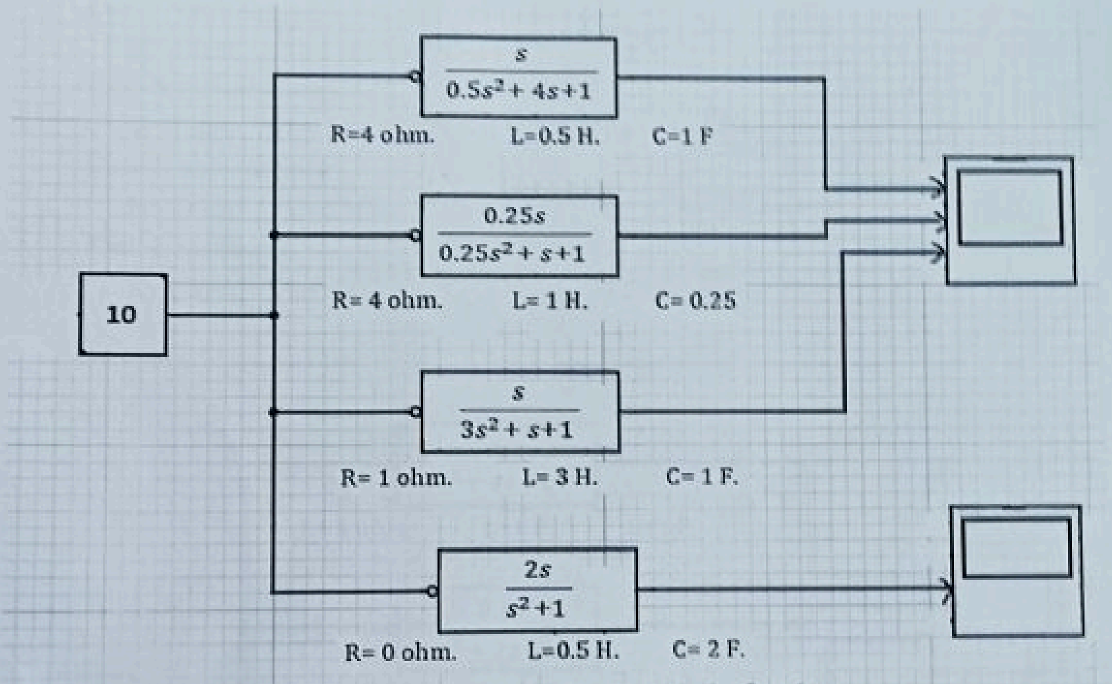


Figure-6g: Simulink block of set-1

<u>**Set - 2**</u>

Case 1: Over damped

R= 4 ohm. L=1 H. C=1 F T.F = $\frac{s}{s^2+4s+1}$

Case 2: critically damped

R= 4 ohm. L= 2 H. C= 0.5 F T.F = $\frac{0.5s}{s^2+2s+1}$

Case 3: under damped

R= 4 ohm. L= 3 H. C= 0.5 F. T.F = $\frac{0.5s}{1.5s^2+2s+1}$

Case 4: oscillatory

R= 0 ohm. L=1 H. C= 2 F. T.F = $\frac{2s}{2s^2+1}$

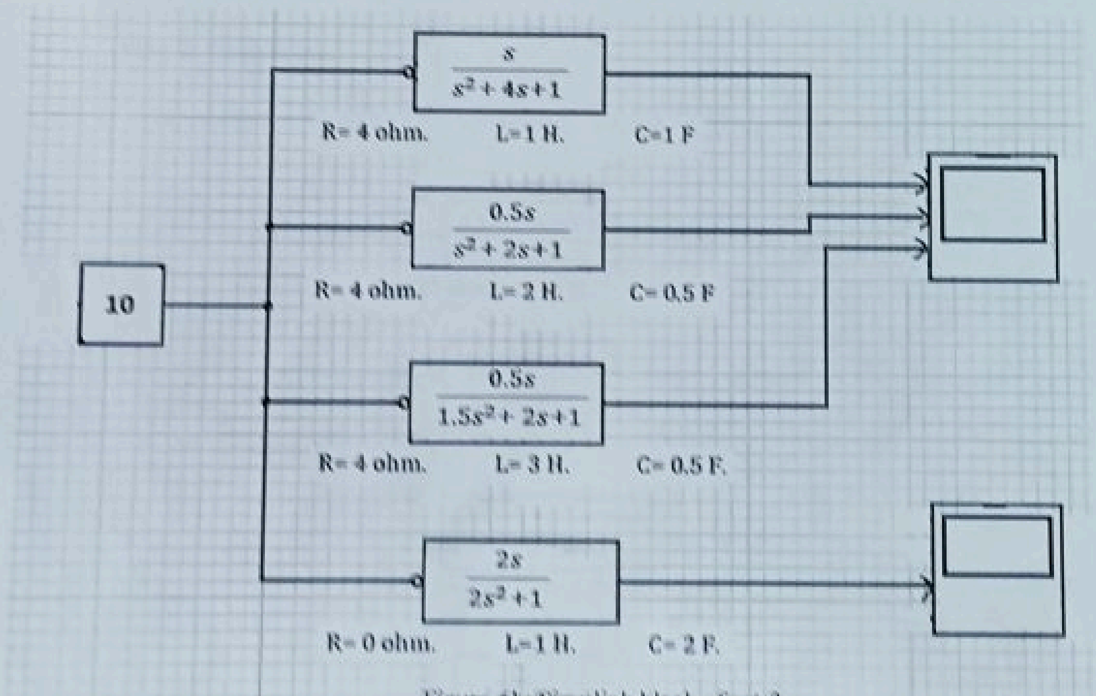


Figure-6h: Simulink block of set-2

For parallel LCR circuit:

Case 1: over damped:

R= 0.25 ohm. L= 1 H. C= 1 F. T.F= [illegible]

Case 2: critically damped:

R= 0.5 ohm. L= 1 H. C= 1 F. T.F= [illegible]

Case 3: under damped:

R= 0.5 ohm. L= 0.25 H. C= 1 F. T.F= [illegible]

Case 4: Oscillatory:

R= ∞ (open) L= 2 H. C= 2 F. T.F = $\frac{4s^2+1}{2s}$

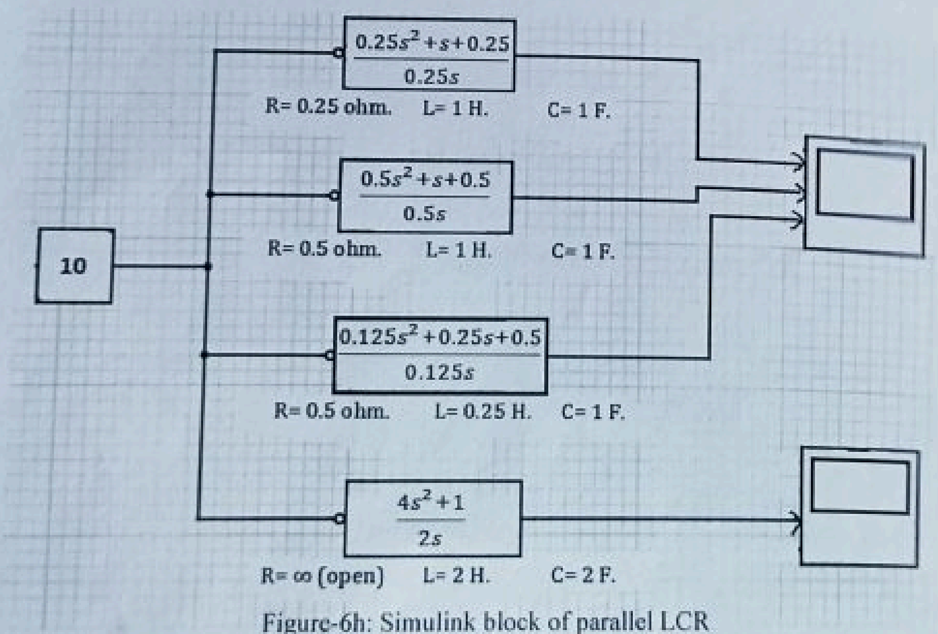
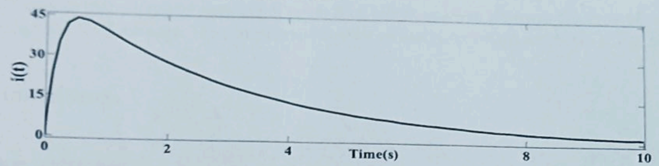


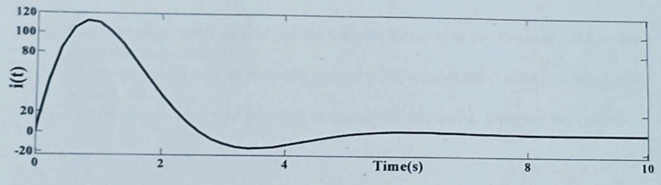
Figure-6h: Simulink block of parallel LCR

Second order transient responses:

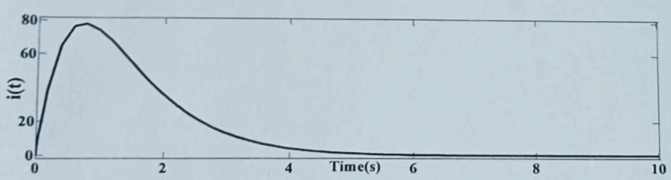
(i) overdamped



(ii) underdamped



(iii) critically damped



(iv) undamped

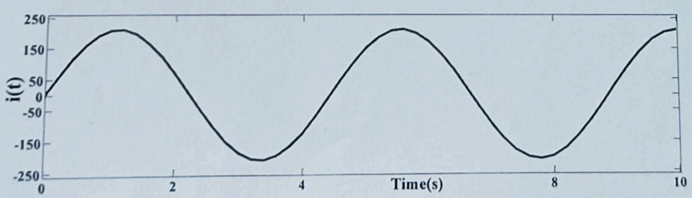


Figure- 11i: Current responses of series RLC second order circuit

RESULT:

The corresponding transient response of series RLC circuit has been shown in this experiment using MATLAB software. The current responses for second order circuit are shown in Fig. 6i.

CONCLUSION:

PRECAUTIONS:

1) Calculation in order to find out the transfer function in each case should be done carefully and correctly.
2) The response should be properly plotted with appropriate X-label, Y-label, title, legend, etc.
3) Proper attention should be taken in saving the file and in entering the values.

Experiment No- 7

AIM: TO DETERMINE THE IMPEDENCE PARAMETERS OF A GIVEN CIRCUIT OF TWO PORT NETWORK.

APPARATUS REQUIRED:

SL NO	EQUIPMENTS	SPECIFICATION	QUANTITY
1.	Function generator	0-20, 5A, 50Hz	1
2.	Resistance	33.7 ohm	2
3.	Multimeter	Digital	1
4.	Capacitor	4.7µf, 63 V	1
5.	Inductor	1H	1
6.	Breadboard	-	1
7.	Connecting wires	Single stranded copper wires	As per required

THEORY:

In two port network the voltage V_1 and V_2 can be expressed in terms of I_1 and I_2 as

$$V_1=Z_{11} I_1+ Z_{12} I_2$$

$$V_2=Z_{21} I_1+ Z_{22} I_2$$

Therefore,

$Z_{11}= V_1/ I_1$ when $I_2=0$, i.e-open circuit

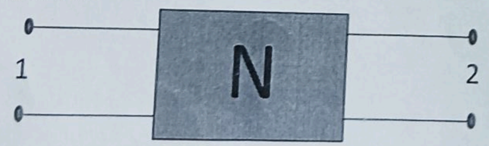
$Z_{21}= V_2/ I_1$ when $I_2=0$,i.e- open circuit

$Z_{12}= V_1/ I_2$ when $I_1=0$,i.e-open circuit

$Z_{22}= V_2/ I_2$ when $I_1=0$, i.e- open circuit,

Hence impedence parameter can also be called open circuit parameter.

CIRCUIT DIAGRAM:



CALCULATION:

OBSERVATION:

parameters	Measured values	Calculated values	Deviation
Z_{11}			
Z_{12}			
Z_{21}			
Z_{22}			

RESULT:

CONCLUSION:

Therefore, the Z parameters are calculated and measured & it is seen from the observation table that the deviation between the values is ___________________________.

PRECAUTIONS:

1. Connect the circuit as per the circuit diagram.
2. Connections should not be short circuited & wires should be rust free.
3. Voltage supply should not be very high.
4. The circuit should not be modified by keeping the power on.
5. Resistances/inductances/capacitances should be checked before performing the experiment.

Experiment No: 8

AIM: TO DETERMINE THE ADMITTANCE PARAMETERS OF A GIVEN CIRCUIT OF TWO PORT NETWORK.

APPARATUS REQUIRED:

Srl no	Equipments	Specification	Quantity
1.	Bread board	-	1
2.	Connecting wires	Single stranded copper wires	As per required
3.	Multimeter	Digital	1
4.	Resistance	33 ohm, 33 ohm	2
5.	Function generator	0-20, 5A, 50hz	1
6	Inductor	1H	1
7	Capacitor	3.3μf	1

THEORY:

In two port network the voltage I_1 and I_2 can be expressed in terms of V_1 and V_2 as

$$I_1 = Y_{11} V_1 + Y_{12} V_2$$

$$I_2 = Y_{21} V_1 + Y_{22} V_2$$

Therefore,

$Y_{11} = I_1 / V_1$ when $V_2 = 0$, i.e-short circuit

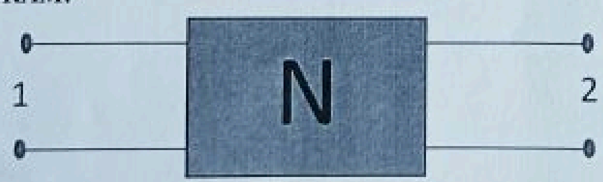
$Y_{21} = I_1 \ V_2$ when $V_2 = 0$, i.e- short circuit

$Y_{12} = I_2 / V_1$ when $V_1 = 0$, i.e-short circuit

$Y_{22} = I_2 / V_2$ when $V_1 = 0$, i.e- short circuit,

Hence Admittance parameter can also be called short circuit parameter of two port network.

CIRCUIT DIAGRAM:



CALCULATION:

OBSERVATION:

parameters	Measured values	Calculated values	Deviation
Y_{11}			
Y_{12}			
Y_{21}			
Y_{22}			

RESULT:

CONCLUSION:

Therefore, the Y parameters are calculated and measured & it is seen from the observation table that the deviation between the values is ____________________.

PRECAUTIONS:

1. Connect the circuit as per the circuit diagram.
2. Connections should not be short circuited & wires should be rust free.
3. Voltage supply should not be very high.
4. The circuit should not be modified by keeping the power on.
5. Resistances/inductances/capacitances should be checked before performing the experiment.

Experiment No: 9

AIM: TO DETERMINE THE HYBRID PARAMETERS OF A GIVEN CIRCUIT OF TWO PORT NETWORK.

APPARATUS REQUIRED:

SL NO	EQUIPMENTS	SPECIFICATION	QUANTITY
1.	Bread board	-	1
2.	Connecting wires	Single stranded copper wire	As per required
3.	Multimeter	Digital	1
4.	Resistance	33 ohm, 33 ohm	2
5.	Function generator	0-20 V, 5A, 50Hz	1
6.	Inductor	1H	1
7.	Capacitor	3.3μF,63V	1

THEORY:

In two port network the voltage V_1 and I_2 can be expressed in terms of I_1 and V_2 as

$$V_1=h_{11}\, I_1+ h_{12}\, V_2$$

$$I_2=h_{21}\, I_1+ h_{22}\, V_2$$

Therefore,

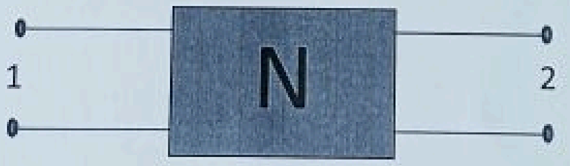
$h_{11}= I_1/ V_1$ when $V_2=0$, i.e-short circuit

$h_{21}= I_2/ I_1$ when $V_2=0$,i.e- short circuit

$h_{12}= V_1 /V_2$ when $I_1=0$,i.e-open circuit

$h_{22}= I_2/ V_2$ when $I_1=0$, i.e- open circuit,

CIRCUIT DIAGRAM:



CALCULATION:

OBSERVATION:

parameters	Measured values	Calculated values	Deviation
h_{11}			
h_{12}			
h_{21}			
h_{22}			

RESULT:

CONCLUSION:

Therefore, the h parameters are calculated and measured & it is seen from the observation table that the deviation between the values is ____________________________.

PRECAUTIONS:

1. Connect the circuit as per the circuit diagram.
2. Connections should not be short circuited & wires should be rust free.
3. Voltage supply should not be very high.
4. The circuit should not be modified by keeping the power on.
5. Resistances/inductances/capacitances should be checked before performing the experiment.

Experiment No: 10

AIM: TO DETERMINE THE ABCD PARAMETERS OF A GIVEN CIRCUIT OF TWO PORT NETWORK.

APPARATUS REQUIRED:

SL NO	EQUIPMENTS	SPECIFICATION	QUANTITY
1.	Bread board	-	1
2.	Connecting wires	Single stranded copper wires	As per required
3.	Multimeter	Digital	1
4.	Resistance	33ohm, 33 ohm	2
5.	Function generator	0-20V, 5A, 50Hz	1
6.	Inductor	1H	1
7.	Capacitor	220µf, 63V	1

THEORY:

ABCD parameters are widely used in analysis of power transmission engineering where they are termed as "General Circuit Parameters" ABCD parameters are also as "transmission parameters".

It is conventional to designate the input port as sending end and the output port as receiving end while representing ABCD parameters. Moreover the output current direction is taken reverse. Here, the ABCD parameters equations are given as,

Therefore,

$$V_1=AV_2+B(-I_2)$$

$$I_1=CV_2+D(-I_2)$$

Therefore,

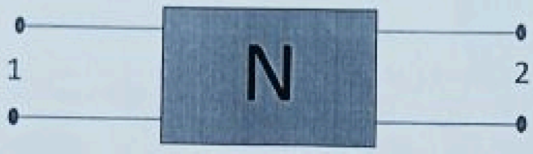
$A= V_1/ V_2$ when $I_2=0$, i.e-open circuit(reverse voltage ratio)

$B= V_1/ (-I_2)$ when $V_2=0$,i.e-short circuit(transfer impedence)

$C= I_1/ V_2$ when $I_2=0$,i.e-open circuit(transfer admittance)

$D= I_1/ (-I_2)$ when $V_2=0$,i.e-short circuit(reverse current ratio)

CIRCUIT DIAGRAM:



CALCULATION:

OBSERVATION:

parameters	Measured values	Calculated values	Deviation
A			
B			
C			
D			

RESULT:

CONCLUSION:

Therefore, the ABCD parameters are calculated and measured & it is seen from the observation table that the deviation between the values is __________________.

PRECAUTIONS:

1. Connect the circuit as per the circuit diagram.
2. Connections should not be short circuited & wires should be rust free.
3. Voltage supply should not be very high.
4. The circuit should not be modified by keeping the power on.
5. Resistances should be checked before performing the experiment.

Experiment No-11

AIM: TRANSIENT ANALYSIS USING NI-ELVIS.

OBJECTIVE : (i) To verify the Transient Response of series RL Circuit, (ii)to draw the response and (iii) To find out the time constant.

APPARATUS REQUIRED:

SL NO	COMPONENT	SPECIFICATION	QUANTITY
1	NI-ELVIS II	100 MHz Eight different channels,Vdc:100mV- 60V, Vac: 200mV-20V, 16 bit resolution, INL-60 ppm max	1
3	Resistance	1k/2k/220/330ohm	1
4	Inductance	1H	1
5	Connecting Wires	Single stranded copper wire	As per required

THEORY: The time-varying currents and voltages resulting from the sudden application of sources, usually due to switching, are called transients. By writing circuit equations, we obtain integro-differential equations.

Step response of an RL circuit:

In an RL circuit shown in Fig-1, the initial conditions to determine the step response are assumed to be *Io*=0. The expressions for the current in the circuit, the voltage across the resistor and inductor after the voltage source is applied are:

$$i(t) = \frac{Vs}{R}(1 - e^{-\frac{R}{L}t})A$$

$$V_R(t) = Vs(1 - e^{-\frac{R}{L}t})V$$

$$V_L(t) = Vs(e^{-\frac{R}{L}t})V$$

Step response of an RC circuit:

In an RC circuit shown in Fig-2, the initial voltage across the capacitor is assumed to be $V_0=0$. The expressions for the current in the circuit, the voltage across the resistor and capacitor after the voltage source is applied are:

$$V_c(t) = V_s\left(1 - e^{-\frac{1}{RC}t}\right)V$$

$$V_R(t) = V_s\left(e^{-\frac{1}{RC}t}\right)V$$

$$i(t) = \frac{V_s}{R}\left(e^{-\frac{1}{RC}t}\right)A$$

CIRCUIT DIAGRAM: The NI ELVIS II is shown in Fig. 11a, series RL and RC circuit shown in Fig. 11b and 11c respectively.

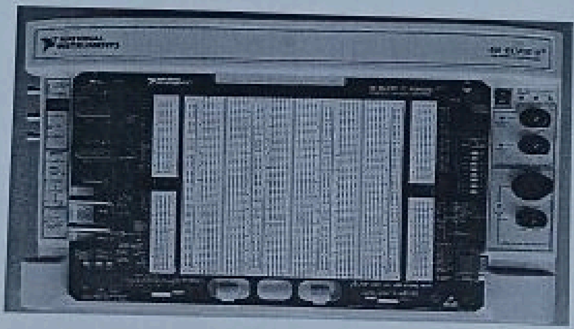


Figure-11a

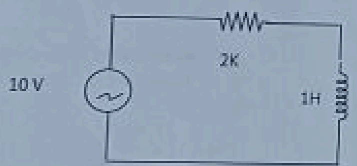


Figure-11b

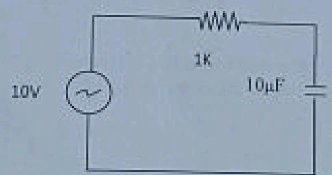


Figure-11c

PROCEDURE:

1. Connect the circuit as per circuit diagram in the bread board of Elvis.
2. Give the supply by connecting one terminal to function from the supply voltage at 10V and frequency at 50 Hz.
3. Apply the voltage to the circuit.
4. Connected the oscilloscope across the inductor.
5. Trace the input voltage waveform and the response.
6. Vary the supply voltage, resistance and capacitor and repeat step 3 to 5.

CALCULATION: Time constant of RL circuit and RC circuit will be.

RESULT:

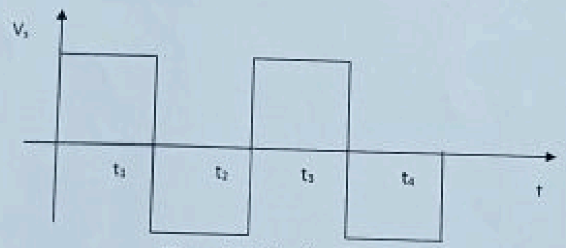


Figure-11d: Supply voltage

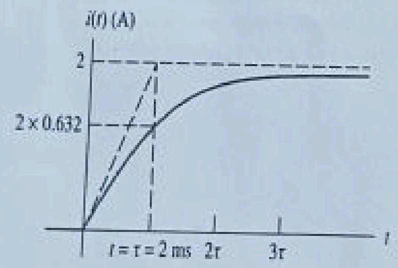


Figure-11e Current versus time for the series RL circuit

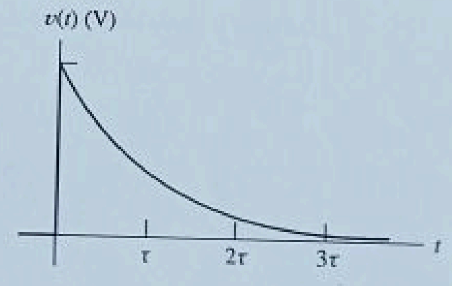


Figure-11f Voltage versus time Time for the series RL circuit

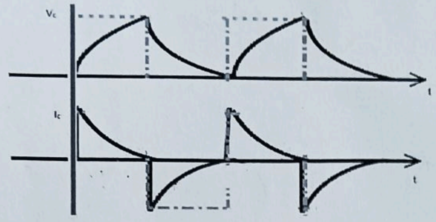


Figure-11g Current versus time and voltage versus time for the series RC circuit

CONCLUSION:

PRECAUTIONS:

1. Connection should be proper.
2. The Power supply should not be switched on until the circuit is complete.
3. The reading should be taken carefully.

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