Varuvan Vadivelan Institute of Technology

Dharmapuri – 636 703

LAB MANUAL

Regulation : 2013

Branch : *B.E* - EEE

Year & Semester : I Year / II Semester

EE6211- ELECTRIC CIRCUITS LABORATORY

ANNA UNIVERSITY- CHENNAI

REGULATION - 2013
EE6211 – ELECTRIC CIRCUITS LAB

LIST OF EXERIMENTS:

1. Experimental verification of Kirchhoff's voltage and current laws
2. Experimental verification of network theorems (Thevenin's, Norton, Superposition and Maximum power transfer Theorem).
3. Study of CRO and measurement of sinusoidal voltage, frequency and power factor.
4. Experimental determination of time constant of series R-C electric circuits.
5. Experimental determination of frequency response of RLC circuits.
6. Design and Simulation of series resonance circuit.
7. Design and Simulation of parallel resonant circuits.
8. Simulation of low pass and high pass passive filters.
9. Simulation of three phases balanced and unbalanced star, delta networks circuits.
10. Experimental determination of power in three phase circuits by two-watt meter method.
11. Calibration of single phase energy meter.
12. Determination of two port network parameters.

Total: 45 Periods

INTRODUCTION

CHARGE (Q):

Charge is the physical quantity of n electrical circuit. The unit is coulomb(C) One coulomb = 1/ ($1.602*10^{-19}$) electrons = $0.24*10^{18}$ electrons. The atom contains positive charge ($1.602*10^{-19}$) coulomb it is called proton, negative charge ($-1.602*10^{-19}$) coulomb it is called electron, and neutron (neutral (or) ground).

CURRENT (I):

Free flow of electrons in a conductor is known as current (or) rate of change of charge with respect to time. Unit is ampere.

$$I = \frac{dq}{dt} amps$$

Here

I- Current (*Amps*)

$\frac{dq}{dt}$ - Rate of change of charge with respect to time

VOLTAGE (V):

The potential difference between two points is known as voltage

$$V = \frac{dW}{dQ} volt$$

Where

V –Voltage (*Volts*)

$\frac{dW}{dQ}$ - Rate of change of work with respect to charge

POWER (P):

Multiple values of voltage and current or the rate of change of work done with respect to time is known as power.

$$P=\frac{dW}{dt} \textit{watts}$$

Where

P –Power (*Watts*)

$\frac{dW}{dt}$ -Rate of change of work with respect to time

NET WORK:

Two are more circuit elements will be connected together is known as network

CIRCUIT:

Each and every network is having at least one closed path

RESISTOR:

The property of the substance which opposes the flow of current through it and its denoted by R, unit is Ohm (Ω)

$$R=\frac{\rho L}{\triangle} \textit{Ohm}\ (\Omega)$$

Here,

R- Resistance (*Ohms*)

ρ -conductor resistivity

L- Inductance (***Henry***)

A – Area of the conductor (*meter*)

INDUCTOR:

The property of the substance which stores the energy in the form of electromagnetic field denoted by L, unit is Henry

$$P = Li\frac{di}{dt}\,\mathit{Henry}$$

CAPACITANCE:

The property of the substance which stores the energy in the form of electrostatic field denoted by C, unit is Farad

$$P = CV\frac{dv}{dt}\,\mathit{Farad}$$

INDEX

S.No	Date	Name of the Experiments	Signature	Remarks
1		Verification of Ohm's laws and Kirchhoff's laws		
2		Verification of Thevenin's and Norton's Theorem		
3		Verification of Superposition Theorem		
4		Verification of Maximum power transfer theorem		
5		Verification of Reciprocity theorem		
6		Measurement of Self-inductance of a coil.		
7		Verification of Mesh and Nodal analysis.		
8		Transient response of RL and RC circuits for DC input.		
9		Frequency response of Series and Parallel resonance circuits		
10		Frequency response of Single tuned coupled circuits		
11		Experimental determination of power in three phase circuits by two-watt meter method		
12		Calibration of single phase energy meter		
13		Design and Simulation of series resonance circuit		
14		Design and Simulation of parallel resonance circuit		
15		Design and Simulation of low pass and high pass passive filter circuit		

EX.NO. 1	VERIFICATION OF OHM`SLAW
DATE:	

AIM:

To conduct a suitable Experiment for verifying the ohm's law.

APPARATUS REQUIRED:

S.NO.	NAME OF THE EQUIPMENTS	RANGE	TYPE	QTY
1.	RPS	(0-30)V	DC	1
2.	Ammeter	(0-10)A	MC	3
3.	Voltmeter	(0-130)V	MC	3
4.	Resister	10KΩ	MC	3
5.	Bread board	-	-	1
6.	Connecting wires	-	Single strand	As required

OHM`S LAW:

Ohm's law states that at constant temperature the current flow through a conductor is directly propotional to the potential difference between the two ends of the conductor.

$$I \; \alpha \; V \text{ (or) } V \; \alpha \; I$$

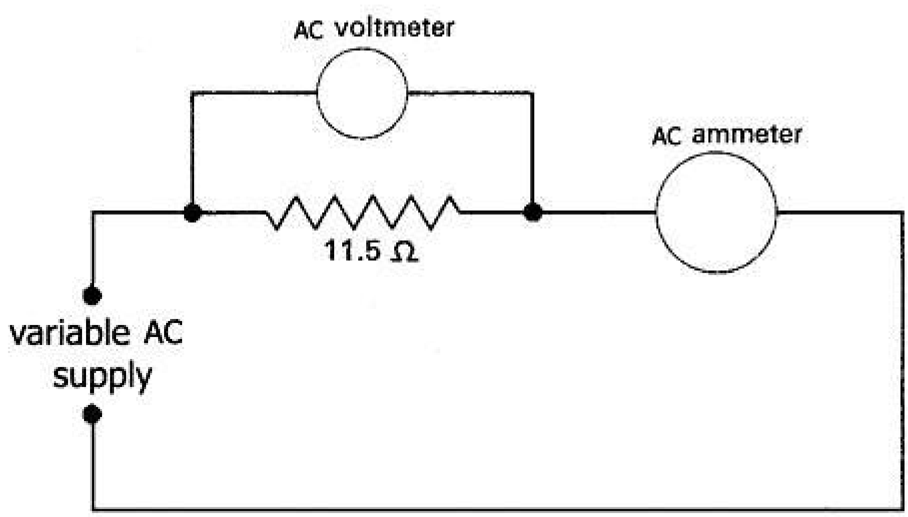
Where,

R - Resistance of the conductor

PROCEDURE:

1. Connections are made as per the circuit diagram
2. Switch on the power supply.
3. For various values of voltage V, note the values of current I.
4. Draw a graph of Voltage Vs Current.
5. The Slope of the graph gives the resistance value.
6. Ohm's law is verified by measuring the value of R using multi meter and comparing with the Experimental value.

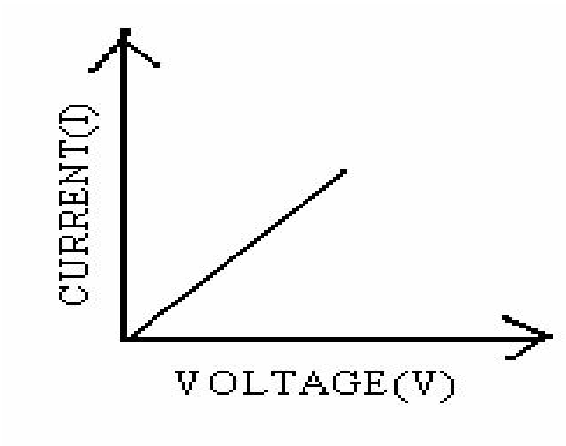
OHM`S LAW:



TABULATION :(OHM'S LAW)

S.NO	**APPLIED VOLTGE(V)** ***Volts***	**CURRENT (I)** ***amps***	**RESISTANCE R=V/I Ω**

MODEL GRAPH :(OHM'S LAW)



RESULT:

Thus the ohm's law is verified.

EX.NO. 2	VERIFICATION OF KVL & KCL
DATE:	

AIM:

To verify (i) Kirchhoff’s current law (ii) Kirchhoff’s voltage law

APPARATUS REQUIRED:

S.NO.	NAME OF THE EQUIPMENTS	RANGE	TYPE	QTY
1	RPS	(0-30)V	DC	1
2	Ammeter	(0-10)A	MC	3
3	Voltmeter	(0-130)V	MC	3
4	Resister	10KΩ	MC	3
5	Bread board	-	-	1
6	Connecting wires	-	Single strand	as required

THEORY:

Kirchhoff’s current law:

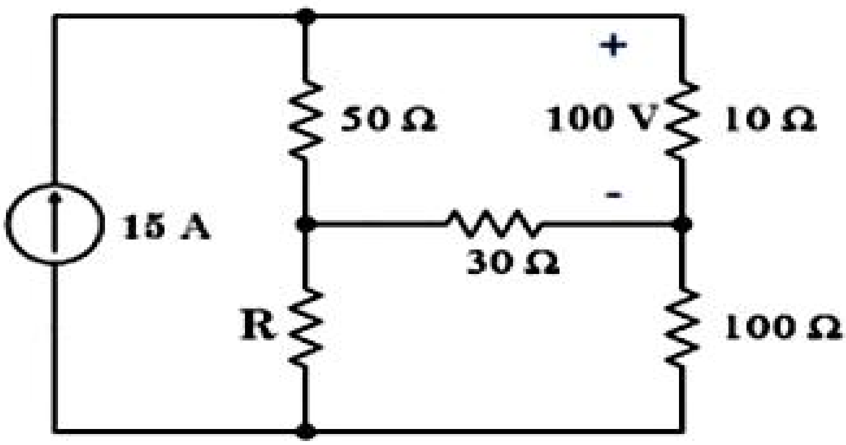
The algebraic sum of the currents entering in any node is Zero. The law represents the mathematical statement of the fact change cannot accumulate at a node. A node is not a circuit element and it certainly cannot store destroy (or) generate charge. Hence the current must sum to zero. A hydraulic analog sum is zero. For example consider three water pipes joined PN the shape of Y. we defined free currents as following into each of 3 pipes. If we insists that what is always.

PROCEDURE:

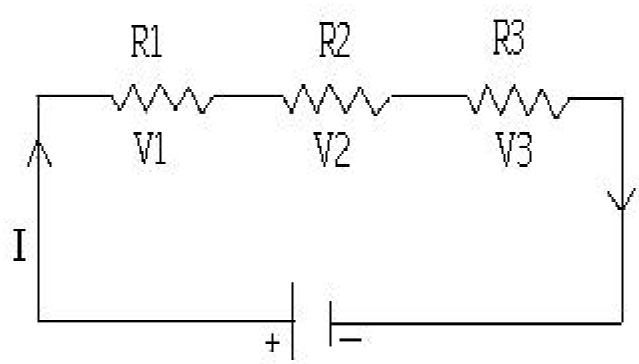
1. Connections are made as per the circuit diagram.
2. Check your connections before switch on the supply.
3. Vary the regulated supply.
4. Measure the current using ammeter.
5. Note the readings in the tabulation.
6. Compare the observation reading to theoretical value.

CIRCUIT DIAGRAM:

KIRCHOFF'S CURRENT LAW



KIRCHOFF'S VOLTAGE LAW



TABULATION: (KIRCHHOFF'S CURRENT LAW)

Voltage	**Total current (I)** *mA*	**Current (I_1)** *mA*	**Current (I_2)** *mA*

TABULATION: (KIRCHHOFF'S VOLTAGE LAW)

Voltage *volts*	**Voltage (V_1)** *volts*	**Voltage (V_2)** *volts*	**Voltage (V_3)** *volts*

RESULT:

Thus the Kirchhoff's current law and voltage law were verified.

EX.NO. 2	VERIFICATION OF THEVENIN'S THEOREM
DATE:	

AIM:

To verify Thevenin's theorem and to find the current flowing through the load resistance.

APPARATUS REQUIRED:

S.NO.	NAME OF THE EQUIPMENTS	RANGE	TYPE	QTY
1	RPS	(0-30)V	DC	1
2	Ammeter	(0-10)A	MC	3
3	Voltmeter	(0-130)V	MC	3
4	Resister	10KΩ,1 KΩ,3.3 KΩ,4.4 KΩ	MC	3
5	Bread board	-	-	1
6	Connecting wires	-	Single strand	as required

THEORY:

THEVENIN`S THEOREM:

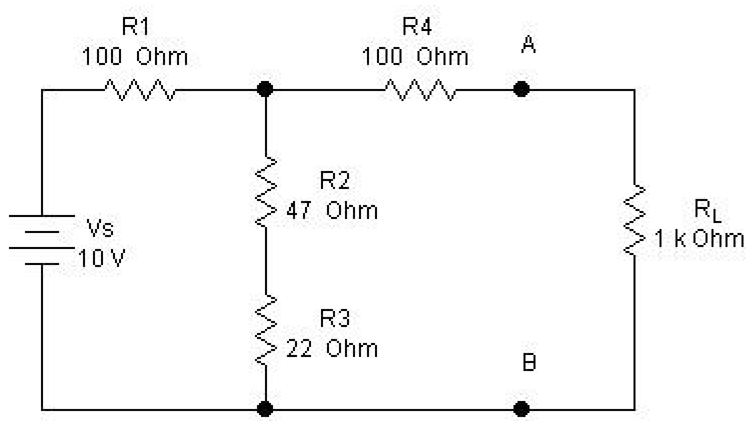
Any linear active network with output terminals can be replaced by a single voltage source V_{th}in series with a single impedance Z_{th}. $V_{th}$is the Thevenin`s voltage. It is the voltage between the terminals on open circuit condition, Hence it is called open circuit voltage denoted by $V_{oc}$. $Z_{th}$is called Thevennin`s impedance. It is the driving point impedance at the terminals when all internal sources are set to zero too. If a load impedance $Z_L$is connected across output terminals, we can find the current through it

$$I_L = V_{th} / (Z_{th} + Z_L)$$

PROCEDURE:

1. Connections are made as per the circuit diagram.
2. Check your connections before switch on the supply.
3. Find the Thevenin's voltage (or) open circuit voltage.
4. Replace voltage source by internal resistor.
5. Determine the Thevenin's resistance.
6. Find I_L by using Thevenin's formula.
7. Compare the observation reading to theoretical value.
8. switch off the supply

CIRCUIT DIAGRAM: (THEVENIN'S THEOREM)



TABULATION: (THEVENIN'S THEOREM)

Thevenin's Voltage (V_{TH}) *Volts*		**Thevenin's Resistance (R_{TH}) Ω**		**Load Current (I_L) *ma***	
Theoretical	**Practical**	**Theoretical**	**Practical**	**Theoretical**	**Practical**

CALCULATION:

RESULT:

Thus the Thevenin's theorem was verified.

Theoretical:

V_{th}=

R_{th}=

I_L=

Practical:

V_{th}=

R_{th}=

I_L=

EX.NO. 3	SUPER POSITION THEOREM
DATE:	

AIM:

To verify the superposition theorem and determine the current following through the load resistance.

APPARATUS REQUIRED:

S.NO.	NAME OF THE EQUIPMENTS	RANGE	QTY
1	RPS	(0-15)V 1KΩ,220Ω,470Ω	1
2	Resistor	(0-1)mA, mc (0-5)mA mc	Each 1
3	Ammeter	------	1
4	Bread board	------	1
5	Connecting wires		As required

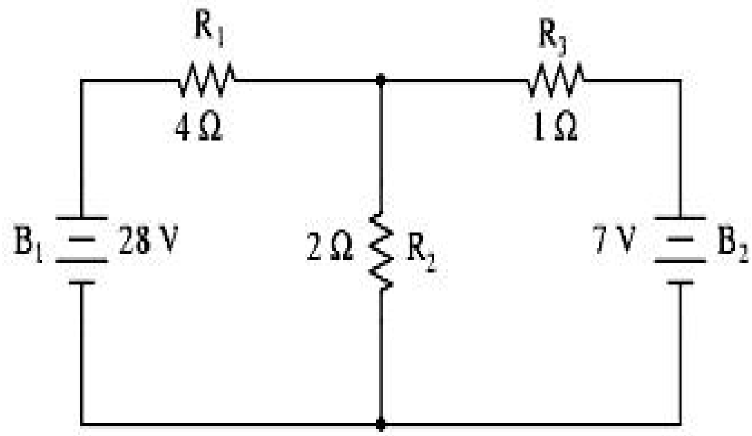
SUPERPOSITION THEOREM

In a linear circuit containing more than one source, the current that flows at any point or the voltage that exists between any two points is the algebraic sum of the currents or the voltages that would have been produced by each source taken separately with all other sources removed.

PROCEDURE:

1. Connections are made as per the circuit diagram.
2. Check your connections before switch on the supply.
3. Determine the current through the load resistance.
4. Now one of the sources is shorted and the current flowing through the resistance I_L measured by ammeter.
5. Similarly, the other source is shorted and the current flowing through the resistance I_L measured by ammeter.
6. Compare the value obtained with the sum of I_1& I_2 should equal to I
7. Compare the observation reading to theoretical value.
8. Switch off the supply
9. Disconnect the circuit.

CIRCUIT DIAGRAM: (SUPER POSITION THEOREM)



TABULATION: (SUPERPOSITION THEOREM)

Voltage (V) *volt*		Primary current (I_1) *ma*		Secondary current (I_2) *ma*		Total Current (I) *ma*	
V_1	V_2	Theoretical	Practical	Theoretical	Practical	Theoretical	Practical

CALCULATION:

RESULT:

Thus the superposition theorem was verified

EX.NO. 4	**NORTON'STHEOREM**
DATE:	

AIM:

To verify Norton's theorem and to determine the current flow through the load resistance.

APPARATUS REQUIRED:

S.NO.	NAME OF THE EQUIPMENTS	RANGE	QTY
1	RPS	(0-15 V)	1
2	Resistor	10KΩ, 5.6 KΩ, 8.2 KΩ, 6 KΩ	Each 1
3	Ammeter	(0-10 mA), (0-5 mA)	Each 1
4	Bread board		1
5	Connecting wires		As required

NORTON'S THEOREM:

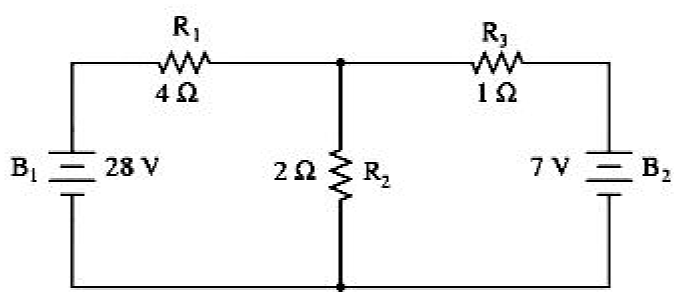
Any linear active network with output terminals can be replaced by a single current source. I_{sc} in parallel with single impedance Z_{th}. Isc is the current through the terminals of the active network when shorted. $Z_{th}$is called Thevennin`s impedance.

$$R_L = I_{sc}Z_{th}/ (Z_{th}+ Z_L)$$

PROCEDURE:

1. Connections are made as per the circuit diagram.
2. Check your connections before switch on the supply.
3. Find the Norton's current (or) short circuit current in load resistance.
4. Replace voltage source by internal resistor.
5. Determine the equivalent's resistance.
6. Find I_L by using Norton's formula.
7. Compare the observation reading to theoretical value.
8. Switch off the supply
9. Disconnect the circuit.

CIRCUIT DIAGRAM: (NORTON'S THEOREM)



TABULATION :(NORTON'S THEOREM)

Theoretical		Practical	
Short circuit current (I_{sc}) *A*	**Thevenin's resistance (R_{th}) Ω**	**Short circuit current (I_{sc}) *A***	**Thevenin's resistance (R_{th}) Ω**

CALCULATION

RESULT:

Thus the Norton's theorem was verified

Theoretical:

I_{sc}=

Rth=

I_L=

Practical:

I_{sc}=

Rth=

I_L=

EX.NO. 5	VERIFICATION OF MAXIMUM POWER TRANSFER THEOREM
DATE:	

AIM:

To find the value of resistance RL in which maximum power is transferred to the load resistance.

APPARATUS REQUIRED:

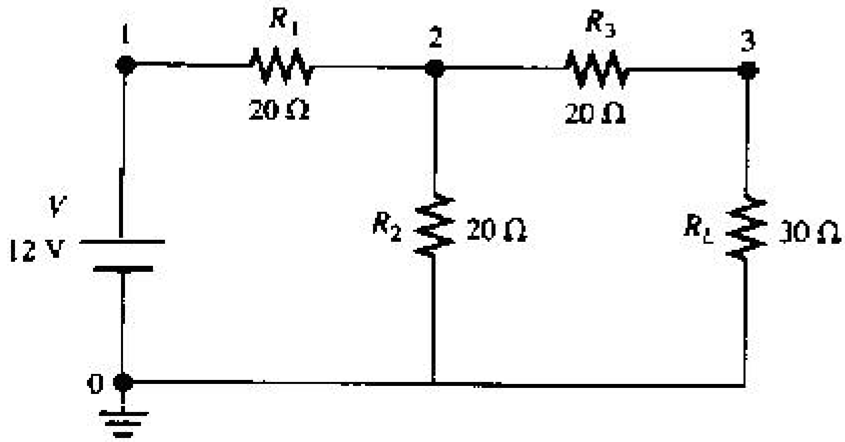
S.NO.	NAME OF THE EQUIPMENTS	RANGE	QTY
1	RPS	(0-15)V	1
2	Resistor	10KΩ,5.6KΩ,8.2KΩ 6KΩ	Each 1
3	Ammeter	(0-10)mA, mc (0-5)mc, mc	1
4	Bread board	------	1
5	Connecting wires	------	As required

PROCEDURE:

1. Connections are given as per the circuit diagram.
2. By giving various values of the resistance in DRB, note the ammeter reading.
3. Calculate the power and plot the power Vs resistance graph.
4. Note the maximum power point corresponding resistance from the graph.

CIRCUIT DIAGRAM:

MAX POWER TRANSFER THEOREM



TABULATION: (MAXIMUM POWER TRANSFER THEOREM)

Resistance *(R_L)* **Ω**	Current (I) *mA*	Power $=I^2R_L$ *W*

CALCULATION:

RESULT:

Thus the value of unknown resistance in which the maximum power is transferred to the load was found.

Theoretical load resistance =

Practical load resistance =

Maximum power =

EX.NO. 6	VERIFICATION OF RECIPROCITY THEOREM
DATE:	

AIM:

To verify Reciprocity theorem and to determine the current flow through the load resistance.

APPARATUS REQUIRED:

S.NO.	NAME OF THE EQUIPMENTS	RANGE	QTY
1	RPS	(0-15)V	1
2	Resistor	100Ω,470Ω, 820Ω, 100Ω	Each 1
3	Ammeter	(0-30)mA,	1
4	Breadboard		1
5	Connecting wires		As required

THEORY:

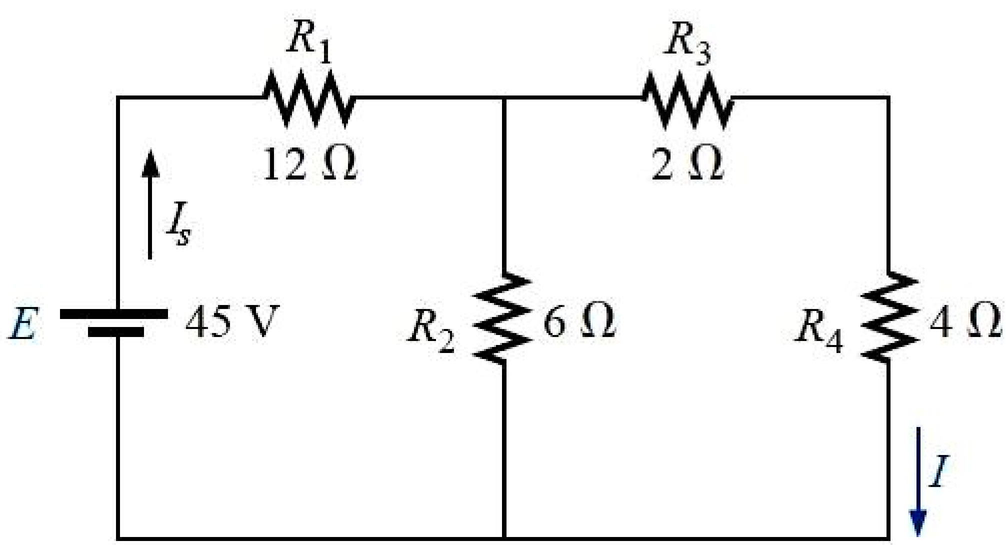
Reciprocity theorem

In a linear, bilateral network a voltage source V volt in a branch gives rise to a current I, in another branch. If V is applied in the second branch the current in the first branch will be I. This V/I are called transfer impedance or resistance. On changing the voltage source from 1 to branch 2, the current in branch 2 appears in branch 1.

PROCEDURE:

1. Connect the circuit as per the circuit diagram.
2. Switch on the supply and note down the corresponding ammeter readings.
3. Find ratio of input voltage to output current.
4. Interchange the position of the ammeter and power supply. Note down the Corresponding ammeter readings
5. Verify the reciprocity theorem by equating the voltage to current ratio.

CIRCUIT DIAGRAM: (RECIPROCITY THEOREM)



TABULATION: (RECIPROCITY THEOREM)

PRACTICAL VALUE :(CIRCUIT -I)

Voltage (V) ***volt***	**Current (I)** ***mA***	**Impedance Z=V/I Ω**

CALCULATION:

RESULT:

Thus the reciprocity theorem was verified.

EX.NO. 7	MEASUREMENT OF SELF INDUCTANCE OF A COIL
DATE:	

AIM:

To determine the values of self-inductance using Maxwell's Bridge.

APPARATUS REQUIRED:

S.NO.	NAME OF THE EQUIPMENTS	RANGE	QTY
1	Maxwell's bridge kit	-	1
2	Unknown resistance	-	1
3	Connecting wires	-	As required
4	Galvanometer	-	1

THEORY:

SELF INDUCTANCE OF A COIL

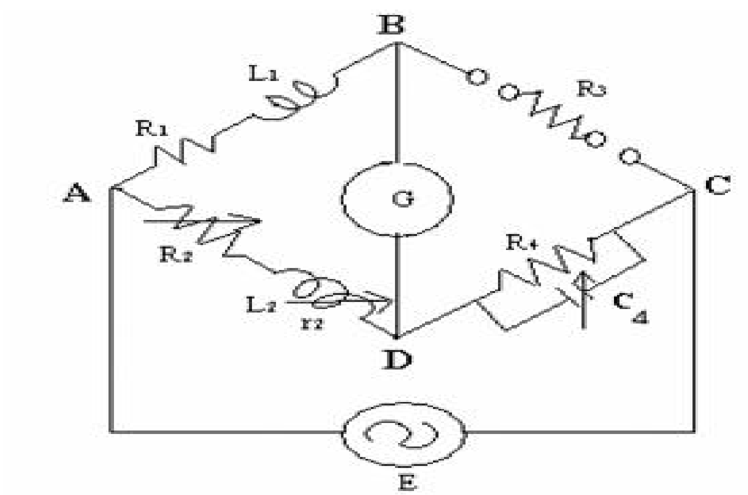
Maxwell's bridge is an AC bridge, which is used to measure self-inductance. The inductance Maxwell's bridge can be inductive or inductance – capacitance Bridge.

PROCEDURE:

1. Connect the oscillator to the Maxwell’s Inductance Bridge.
2. Connect the unknown inductance coil to the Maxwell’s Inductance Bridge.
3. Switch on the oscillator power supply.
4. Patch the Headphone.
5. If noise is produced in the head phone, tune the capacitance value to reduce the noise and the bridge is kept in balanced condition.
6. Note down the resistance and capacitance value.
7. The unknown inductance is calculated using

L1=R2R3C1 Henry

CIRCUIT DIAGRAM: (SELF INDUCTANCE OF A COIL)



L_1–Unknown Inductance

R_2-Variable resistance C_4-Standard capacitor

R_1-Effective resistance of inductance L_1 R_3, R_4- Known resistance

E- AC source, G- Null detector

RESULT:

Thus the self-inductance is measured using Maxwell’s bridge.

EX.NO. 8	VERIFICATION OF MESH & NODAL ANALYSIS
DATE:	

AIM:

To Verify Mesh & nodal analysis for a given electrical network.

APPARATUS REQUIRED:

S.NO.	NAME OF THE EQUIPMENTS	RANGE	QTY
1	RPS	(0-15)V	1
2	Resistor	100Ω,470Ω, 820Ω, 100Ω	Each 1
3	Ammeter	(0-30)mA,	1
4	Voltmeter	(0-30)V	1
4	Breadboard		1
5	Connecting wires		As required

THEORY:

Mesh is defined as a loop which does not contain any other loops within it. It is a basic important technique to find solutions in a network. If network has large number of voltage sources, it is useful to use mesh analysis.

Node is defined as a point where two or more elements meet together .But only nodes with three or more elements are considered. If the circuits consists of `N` nodes including the reference node, then (N-1) nodal equation is obtained.

To apply mesh analysis:

1. Select mesh currents.
2. Write the mesh equation using KVL.
3. Solve the equation to find the mesh currents

To apply nodal analysis:

1. Identify & mark the node assign node voltages.
2. Write the Kirchhoff's current law equations in terms of unknowns .Solve them to find the node voltages.

PRECAUTION:

1. Before giving connection all the power supply should be switched off.
2. Before switching on the power supply, ensure that the voltage adjustment knob is in minimum position and the current adjustment knob is in maximum position

PROCEDURE:

Mesh analysis:

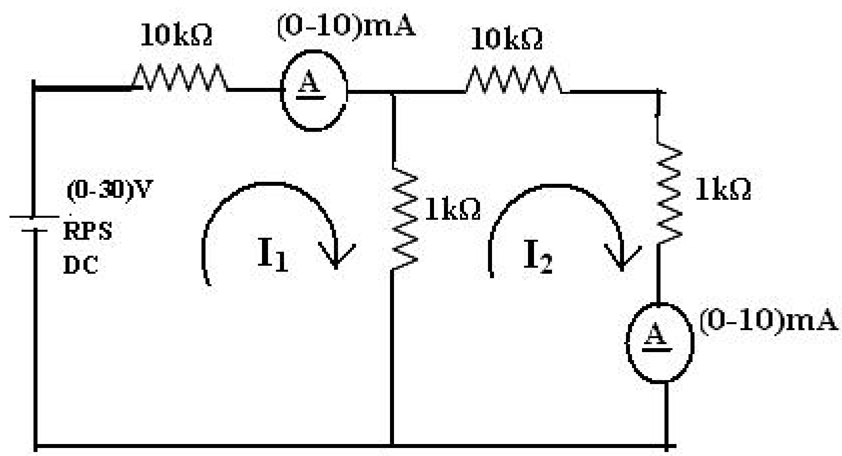
1. The given circuit is solved for mesh currents I1 &I2 using mesh analysis.
2. Connections are made as per the circuit diagram.
3. Mesh currents are measured and compared.

Nodal analysis:

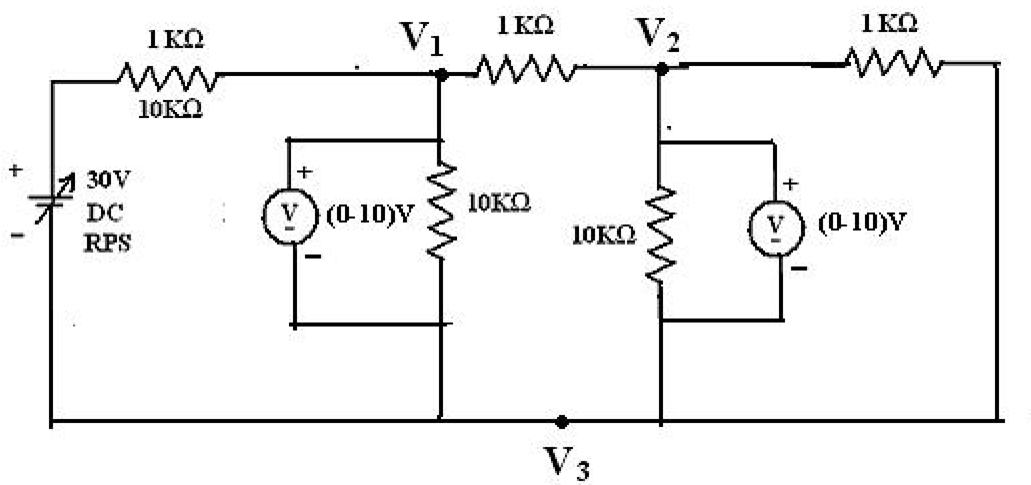
1. The given circuit is solved for nodal voltages V_1& V_2using mesh analysis.
2. Connections are made as per the circuit diagram.
3. Nodal voltages are measured and compared

CIRCIUT DIAGRAM:

MESH ANALYSIS:



NODAL ANALYSIS:



TABULATION:

MESH ANALYSIS:

Input voltage (V_1) *Volts*	Mesh currents			
	Current (I_1) *Amps*		Current (I_2) *Amps*	
	Measured value	Theoretical value	Measured value	Theoretical value

NODAL ANALYSIS:

Input voltage (V_1) *Volts*	Nodal Voltage					
	Measured value			Theoretical value		
	V_1	V_2	V_3	V_1	V_2	V_3

MODEL CALCULATION:

RESULT:

Thus the mesh & nodal analysis are verified.

EX.NO. 9	TRANSIENT RESPONSE OF RC AND RL CIRCUITS FOR DC INPUT'S
DATE:	

AIM:

To construct RL & RC transient circuit and to draw the transient curves.

APPARATUS REQUIRED:

S.NO.	NAME OF THE EQUIPMENT	RANGE	TYPE	QTY
1	RPS	(0-30)V	DC	1
2	Ammeter	(0-10)mA	MC	1
3	Voltmeter	(0-10)V	MC	1
4	Resistor	10 KΩ	-	3
5	Capacitor	1000 µ F	-	1
6	Bread board	-	-	1
7	Connecting wires	-	Single strand	As required

THEORY:

Electrical devices are controlled by switches which are closed to connect supply to the device, or opened in order to disconnect the supply to the device. The switching operation will change the current and voltage in the device. The purely resistive devices will allow instantaneous change in current and voltage.

An inductive device will not allow sudden change in current and capacitance device will not allow sudden change in voltage. Hence when switching operation is performed in inductive and capacitive devices, the current & voltage in device will take a certain time to change from pre switching value to steady state value after switching. This phenomenon is known as transient. The study of switching condition in the circuit is called transient analysis.

The state of the circuit from instant of switching to attainment of steady state is called transient state. The time duration from the instant of switching till the steady state is called transient period. The current & voltage of circuit elements during transient period is called transient response.

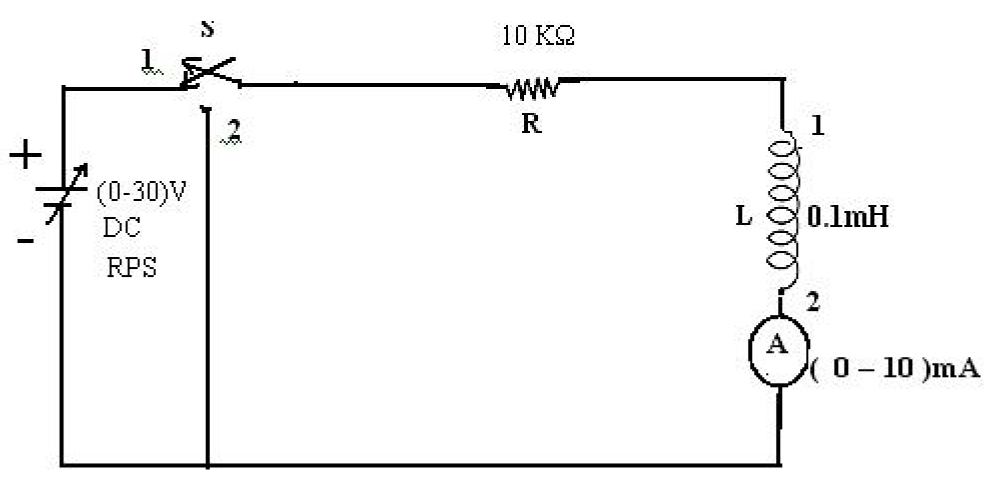
FORMULA:

Time constant of RC circuit = RC

PROCEDURE:

1. Connections are made as per the circuit diagram.
2. Before switching ON the power supply the switch S should be in off position
3. Now switch ON the power supply and change the switch to ON position.
4. The voltage is gradually increased and note down the reading of ammeter and voltmeter for each time duration in RC. In RL circuit measure the Ammeter reading.
5. Tabulate the readings and draw the graph of $V_C(t)$Vst

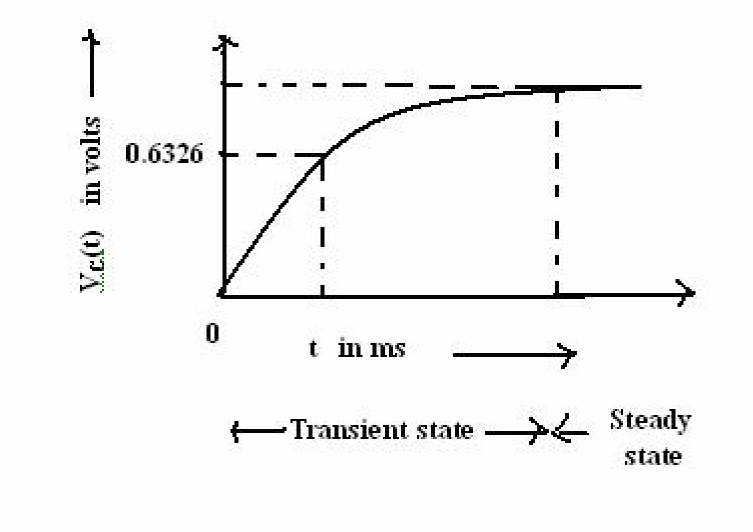
CIRCUIT DIAGRAM:(RL CIRCUIT)



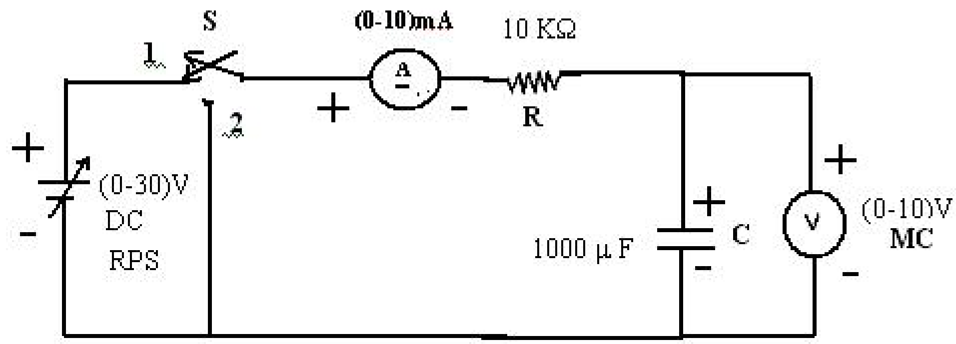
TABULATION: (RL CIRCUIT)

S.NO.	TIME *m sec*	CHARGING CURRENT (I) *Amps*	DISCHARGING CURRENT (I) *Amps*

MODEL GRAPH:

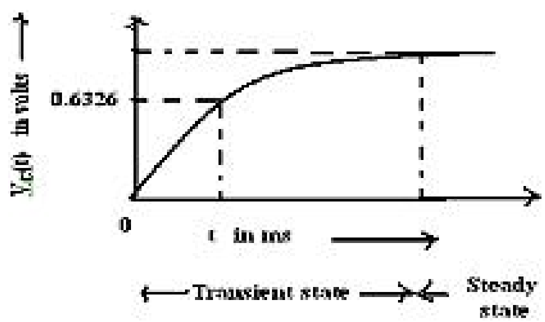


CIRCUIT DIAGRAM :(RC CIRCUIT)

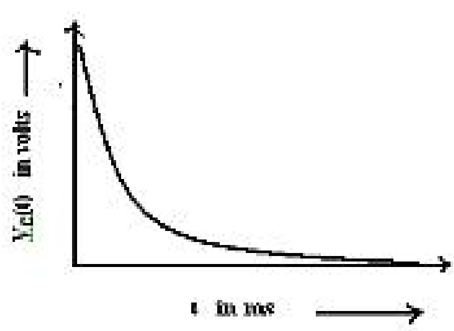


MODEL GRAPH:

CHARGING



DISCHARGING



TABULATION:

CHARGING

S.NO.	TIME *m sec*	VOLTAGE ACROSS 'C' *volts*	CURRENT THROUGH 'C' *mA*

DISCHARGING

S.NO.	TIME *m sec*	VOLTAGE ACROSS 'C' *volts*	CURRENT THROUGH 'C' *mA*

MODEL CALCULATION &ANALYSIS:

RESULT:

Thus the transient response of RL & RC circuit for DC input was verified.

EX.NO. 10	FREQUENCY RESPONSE OF SERIES RESONANCE CIRCUIT
DATE:	

AIM:

To obtain the resonance frequency of the given RLC series electrical network.

APPARATUS REQUIRED:

S.NO	NAME OF THE EQUIPMENT	RANGE	QTY
1	Function Generator	(0-3)MHz	1
2	Resistor	1KΩ	1
3	Voltmeter	(0-5)V	1
4	Capacitor	1µF	1
5	Bread Board	-	1
6	Connecting Wires	-	few

FORMULA USED:

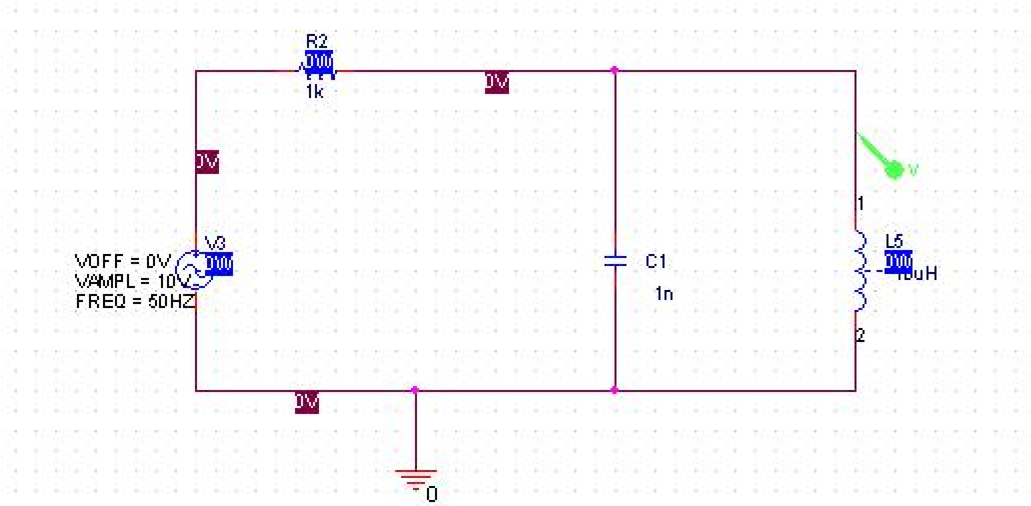
Series resonance frequency $F=1/(2\pi\sqrt{(LC)})$

PROCEDURE:

1. Connections are made as per the circuit diagram.
2. Vary the frequency of the function generator from 50 Hz to 20 KHz.
3. Measure the corresponding value of voltage across the resistor R for series RLC circuit.
4. Repeat the same procedure for different values of frequency.
5. Tabulate your observation.
6. Note down the resonance frequency from the graph.

CIRCUIT DIAGRAM:

SERIES RESONANCE



TABULATION: (SERIES RESONANCE CIRCUIT)

Frequency *Hz*	Reference voltage, (V_R) *volt*

CALCULATION:

RESULT:

Thus the resonance frequency of series RLC circuit is obtained.

Practical value =

Theoretical value =

EX.NO. 11	FREQUENCY RESPONSE OF PARALLEL RESONANCE CIRCUIT
DATE:	

AIM:

To obtain the resonance frequency of the given RLC parallel electrical network.

APPARATUS REQUIRED:

S.NO	NAME OF THE EQUIPMENT	RANGE	QTY
1	Function generator	0-3MHz	1
2	Resistor	1KΩ,	1
3	Voltmeter	(0-5) V	1
4	capacitor	1µ F	1
5	Bread board	-----	1
6	Connecting wires	------	As required
7	Decade inductance box	(0-100) mH	1

FORMULA USED:

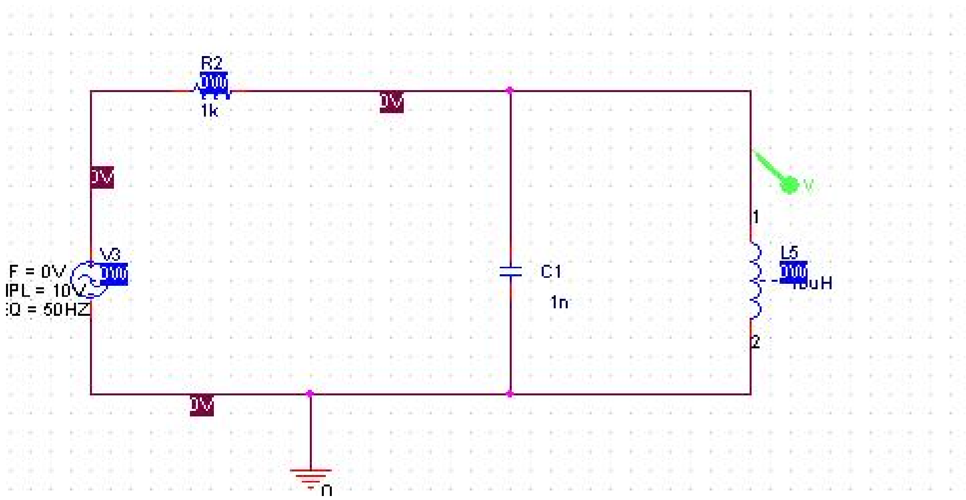
Parallel resonance frequency $F=1/(2\pi\sqrt{(LC)}$

PROCEDURE:

1. Connections are made as per the circuit diagram.
2. Vary the frequency of the function generator from 50 Hz to 20 KHz.
3. Measure the corresponding value of voltage across the resistor R for series RLC circuit.
4. Repeat the same procedure for different values of frequency.
5. Tabulate your observation.
6. Note down the resonance frequency from the graph

CIRCUIT DIAGRAM

PARALLEL RESONANCE



TABULATION:

Frequency *Hz*	Reference voltage, (V_R) *volt*

CALCULATION:

RESULT:

Thus the resonance frequency of series RLC circuit is obtained.

Practical value =

Theoretical value =

EX.NO. 12	FREQUENCY RESPONSE OF SINGLE TUNED COUPLED CIRCUIT
DATE:	

AIM:

To determine the frequency response of a single tuned coupled circuits.

APPARATUS REQUIRED:

S.NO	NAME OF THE EQUIPMENT	RANGE	QTY
1	Single tuned coupled circuits	-	1
2	Connecting wires		As required

THEORY:

When two coils are placed nearby and current passes through any one or both of the coils, they become magnetically coupled. Then the coils are known as coupled coils. If the coils are part of a circuit, the circuit is known as a coupled circuit. A Single tuned to resonance.

Frequency Response of Single Tuned Circuits

$$\frac{V_0}{V_I} = \frac{M}{C(R_S R_2 + \mu_r^2 M^2)}$$

The variation of the amplification factor or output voltage with frequency is called the frequency response. It can be observed that the output voltage, current and amplification depend on mutual inductance at resonance frequency. The maximum amplification depends on M and it occurs at resonance frequency.

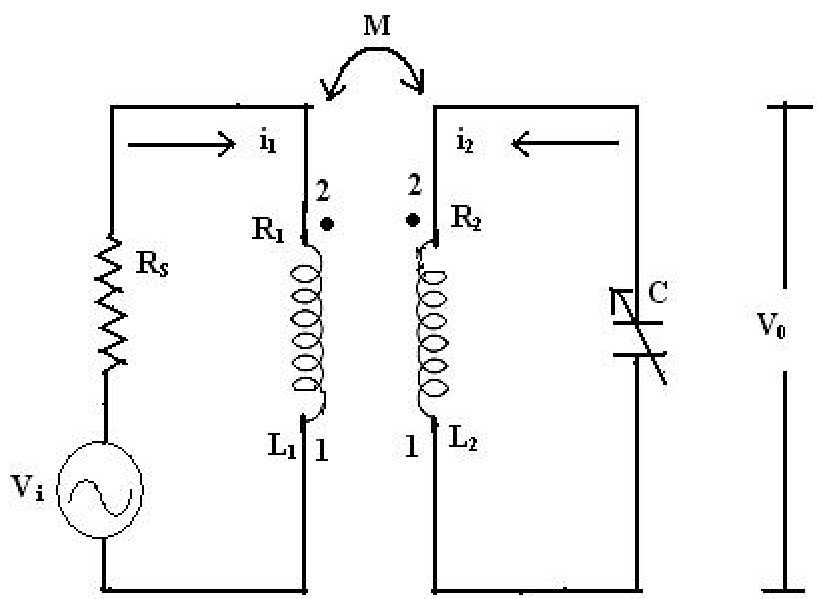
Maximum amplification is given by:

$$Am = \frac{1}{2C\mu_R^2}\left(\frac{1}{\sqrt{R_S R_2}}\right)$$

PROCEDURE:

1. Connections are given as per the circuit diagram.
2. Power supply is switched ON.
3. Input frequency is varied by AFO, corresponding input & output Voltage are noted.
4. Graph is drawn between Frequency & Amplification factor

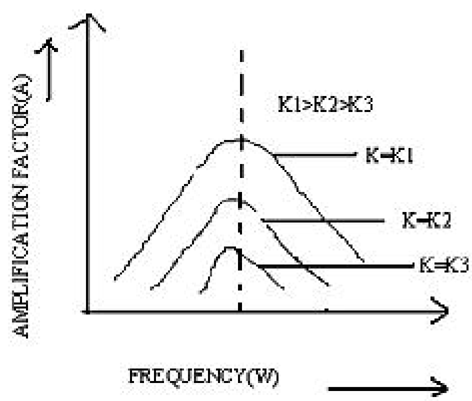
CIRCUIT DIAGRAM: (SINGLE TUNED COUPLED CIRCUIT)



<u>TABULATION: (</u>SINGLE TUNED COUPLED CIRCUIT)

Frequency ***Hz***	**Output Voltage V0** ***Volts***	**Input voltage Vi** ***Volts***	**Amplification factor** $A = V_0/V_i$

<u>MODEL GRAPH:</u>



<u>RESULT:</u>

The frequency of single tuned coupled circuits was verified.

EX.NO. 13	CALIBRATION OF SINGLE PHASE ENERGY METER
DATE:	

AIM:

To calibrate the single phase Energy meter by direct loading.

APPRARATUS REQUIRED:

S.NO	NAME OF THE EQUIPMENT	RANGE	TYPE	QTY
1	Ammeter	(0 – 10A)	MI	1
2	Voltmeter	(0 – 300V)	MI	1
3	Energy meter	10A/230V	Analog	1
4	Stop watch	1	Analog	1
5	Connecting wires	20		Required

FORMULA USED:

Power = Voltage (Volts) X Current (Amps)

True Energy = Number of revolutions / Energy meter constant

Actual Energy = [(Power X Time taken for ‘n’ revolutions) / (3600 X 1000)]

% of Absolute error = (Actual Energy – True Energy / True Energy) X 100

THEORY:

The calibration is the procedure for determining the correct values of measured by comparing ith the standard ones. The standard of device with which comparison is made is called as a standard instrument. The standard instrument which is unknown and it is said to be calibrated is called test instrument .Thus in calibration; test instrument is compared with the standard instrument. There are two fundamental methodologies for obtaining the comparison between the test instruments.

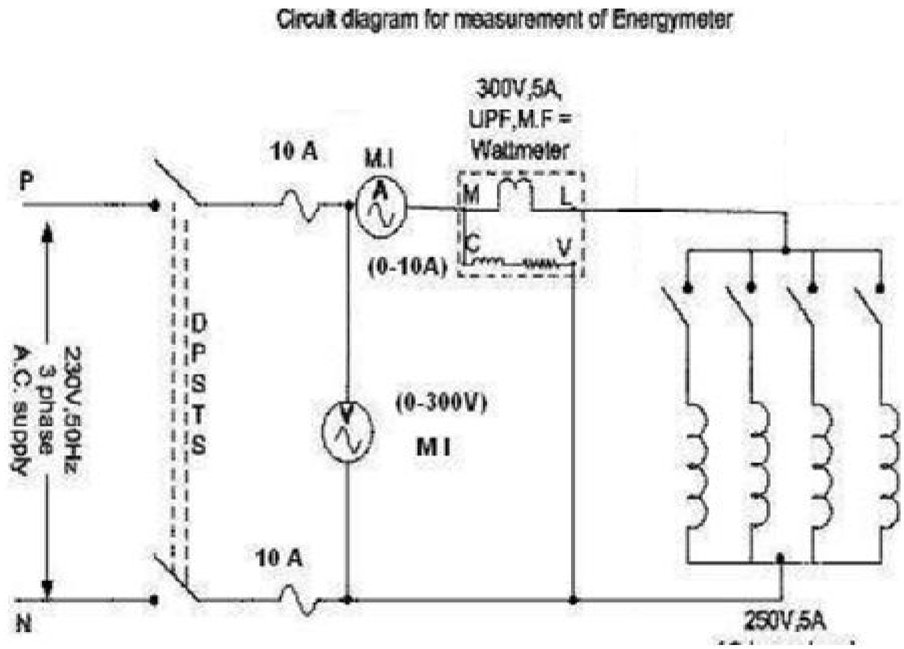
The calibration offers a guarantee to the device or instrument that is operating with Required accuracy under the stipulated environmental conditions. It creates the confidence of using the properly calibrated instrument, in user's mind. The periodic calibration of instrument is very much necessary.

The calibration procedure involves the steps like visual inspection for various defects, installations according to the specifications, zero adjustment, etc….

PROCEDURE:

1. Circuit connections are s per the circuit diagram
2. Supply is switched ON by closing the DPSTS
3. By increasing load in steps, the voltmeter, ammeter and wattmeter readings are noted. Also the time taken for the energy meter disc to rotate for 'n' revolutions is noted down.
4. Using the formula the percentage error is calculated for each set of readings

CIRCUIT DIAGRAM: (SINGLE PHASE ENERGY METER)



TABULATION:

Sl. No.	Voltage *volts*	Current *Amps*	power *Watts*	Energy *Joule*	No. of revolutions
1					
2					
3					
4					

RESULT:

Thus the calibration of the single phase Energy meter was done and the Absolute error was calculated.

EX.NO. 14	MEASUREMENT OF THREE PHASE POWER AND POWER FACTOR
DATE:	

AIM:

To measure the 3 phase power using two single element wattmeter with 3 phase resistive and inductive load.

APPRARATUS REQUIRED:

S.NO	NAME OF THE EQUIPMENT	RANGE	TYPE	QTY
1	Ammeter	(0 – 10A)	MI	1
2	Voltmeter	(0 – 300V)	MI	1
3	Energy meter	10A/230V	Analog	1
4	Stop watch	1	Analog	1
5	Connecting wires	20		Required

FORMULA USED:

Phase angle, Φ = tan- 1 [Higher reading – lower reading] [Higher reading + lower reading]

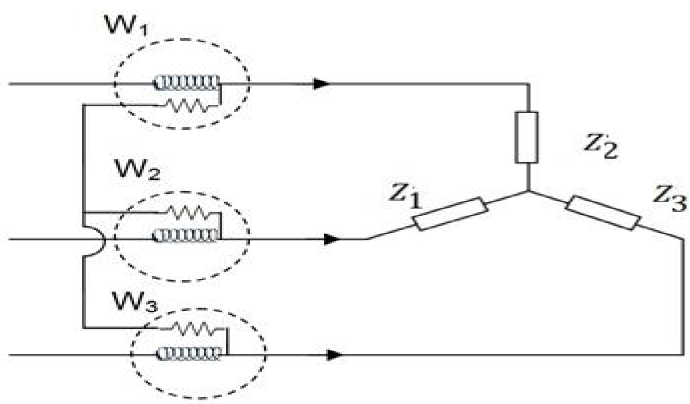
Total Power = W1 + W2 (watts) Power factor = Cos Φ

THEORY:

Three phase power measurements can be done by the following methods, by using three phase watt meter .By using 3-single element wattmeter i.e., three wattmeter method. By using 2-single element watt meter i.e., two watt meter method. By using 1-single element watt meter i.e., one watt meter method.

CIRCUIT DIAGRAM:

RESISTIVE LOAD



TABULATION:

Sl. No.	Voltage *volts*	Current *Amps*	power *Watts*	Energy *Joule*	No. of revolutions
1					
2					
3					
4					
5					

RESULT:

Thus the 3 phase power was measured by using two single element watt meters and the Power factor was calculated.

EX.NO. 15	DESIGN AND SIMULATION OF SERIES RESONANCE CIRCUIT
DATE:	

AIM:

To obtain the resonance frequency of the given RLC series electrical network using MATLAB.

FORMULA USED:

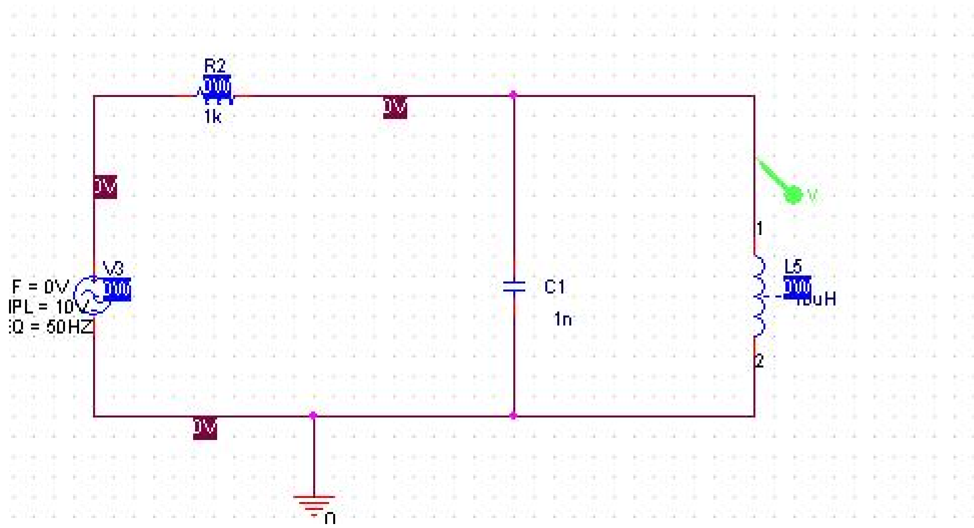
Series resonance frequency

$$F=1/\left(2\pi \sqrt{(LC)}\right)$$

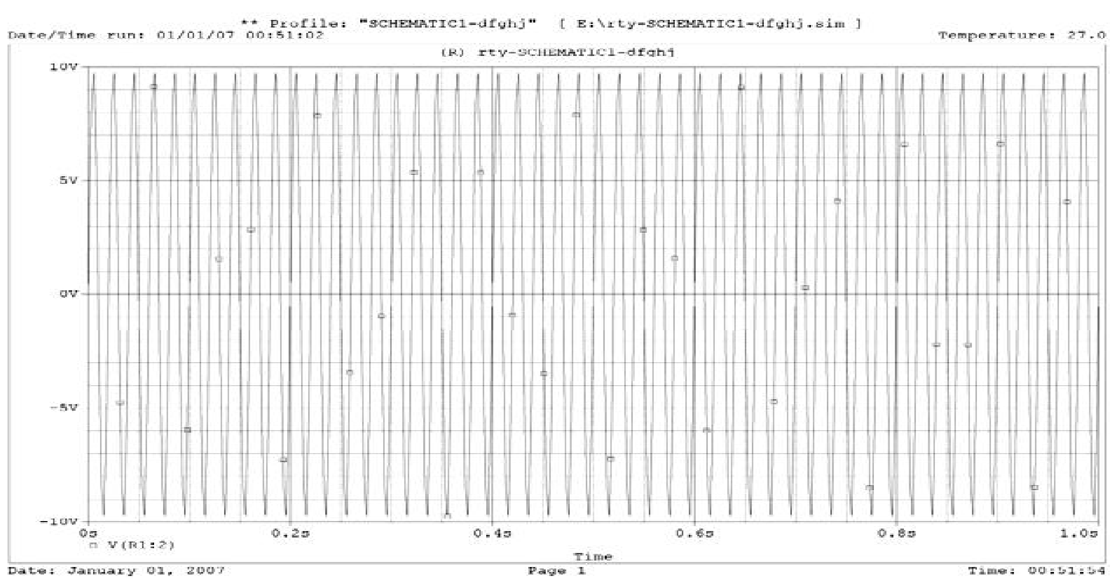
PROCEDURE:

1. Connections are made as per the circuit diagram using matlab.
2. Vary the frequency of the function generator from 50 Hz to 20 KHz.
3. Measure the corresponding value of voltage across the resistor R for series RLC circuit.
4. Repeat the same procedure for different values of frequency.
5. Simulate your observation.
6. Execute the resonance frequency from the graph of MATLAB.

CIRCUIT DIAGRAM: (SERIES RESONANCE CIRCUIT)



OUTPUT WAVE FORM:



RESULT:

Thus the resonance frequency of series RLC circuit is obtained.

EX.NO. 16	**DESIGN AND SIMULATION OF PARALLEL RESONANCE CIRCUIT**
DATE:	

AIM:

To obtain the resonance frequency of the given RLC parallel electrical network using MATLAB.

FORMULA USED:

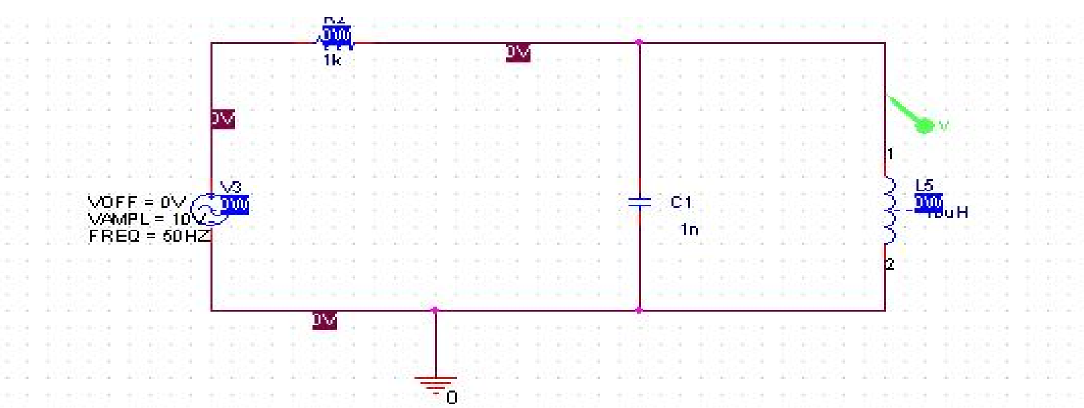
Parallel resonance frequency

$$F = 1/(2\pi\sqrt{(LC)})\ \text{HZ}$$

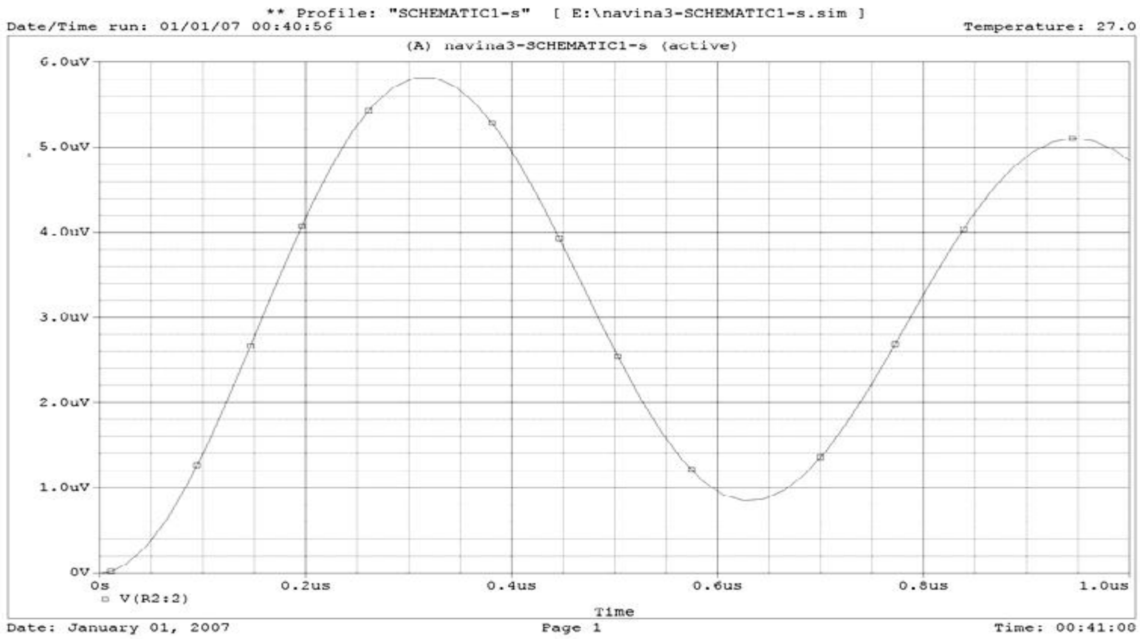
PROCEDURE:

1. Connections are made as per the circuit diagram using MATLAB.
2. Vary the frequency of the function generator from 50 Hz to 20 KHz.
3. Measure the corresponding value of voltage across the resistor R for series RLC circuit.
4. Repeat the same procedure for different values of frequency.
5. Tabulate your observation.
6. Note down the resonance frequency from the graph using matlab

CIRCUIT DIAGRAM: (PARALLEL RESONANCE CIRCUIT)



OUTPUT WAVE FORM: (PARALLEL RESONANCE CIRCUIT)



RESULT:

Thus the resonance frequency of parallel RLC circuit is obtained.

EX.NO. 17	DESIGN AND SIMULATION OF LOW PASS AND HIGH PASS PASSIVE FILTERS
DATE:	

AIM:

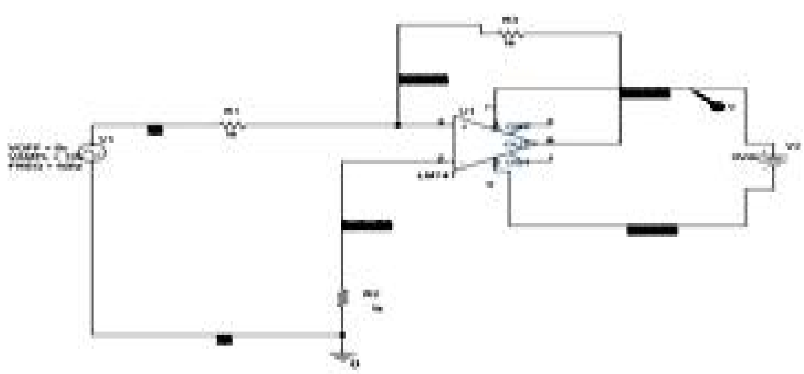
Design and simulation of low pass and high pass passive filters by using MATLAB.

PROCEDURE:

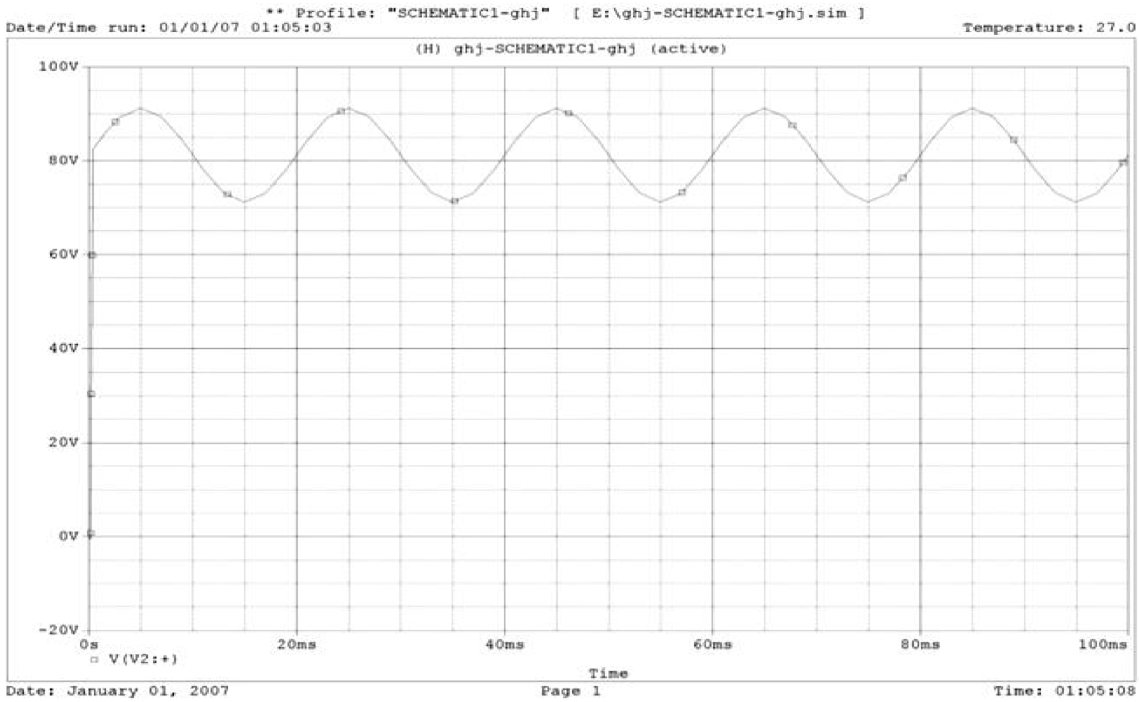
1. Connections are made as per the circuit diagram using MATLAB.
2. Vary the frequency of the function generator from 50 Hz to 20 KHz.
3. Measure the corresponding value of voltage across the resistor R for low pass and high pass passive filter circuit.
4. Repeat the same procedure for different values of frequency.
5. Tabulate your observation
6. Note down the resonance frequency from the graph using matlab.

CIRCUIT DIAGRAM:

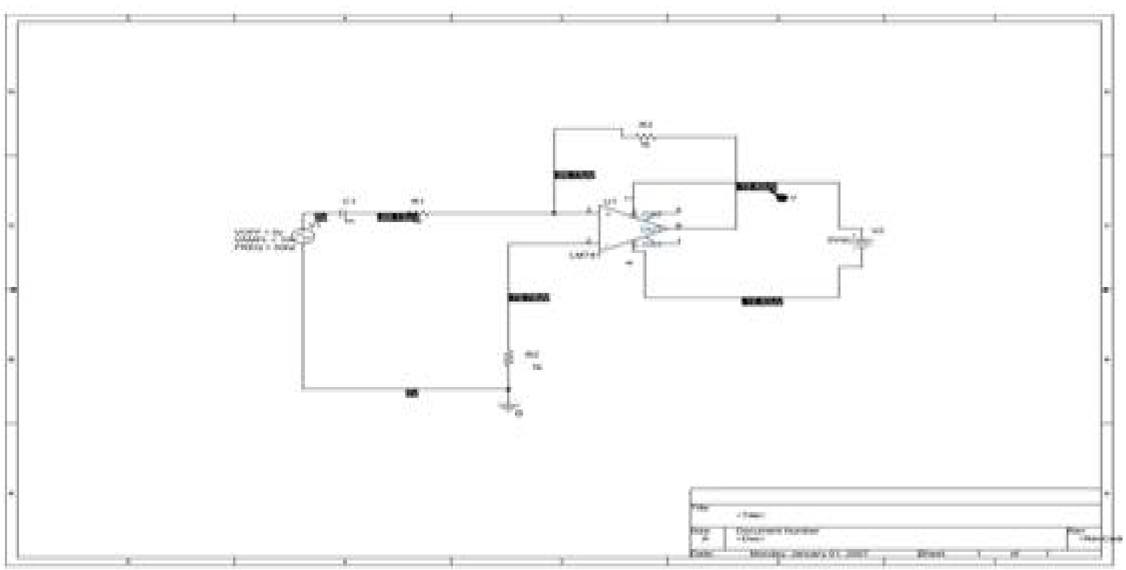
High Pass Filter Circuit (Active Filter Circuit)



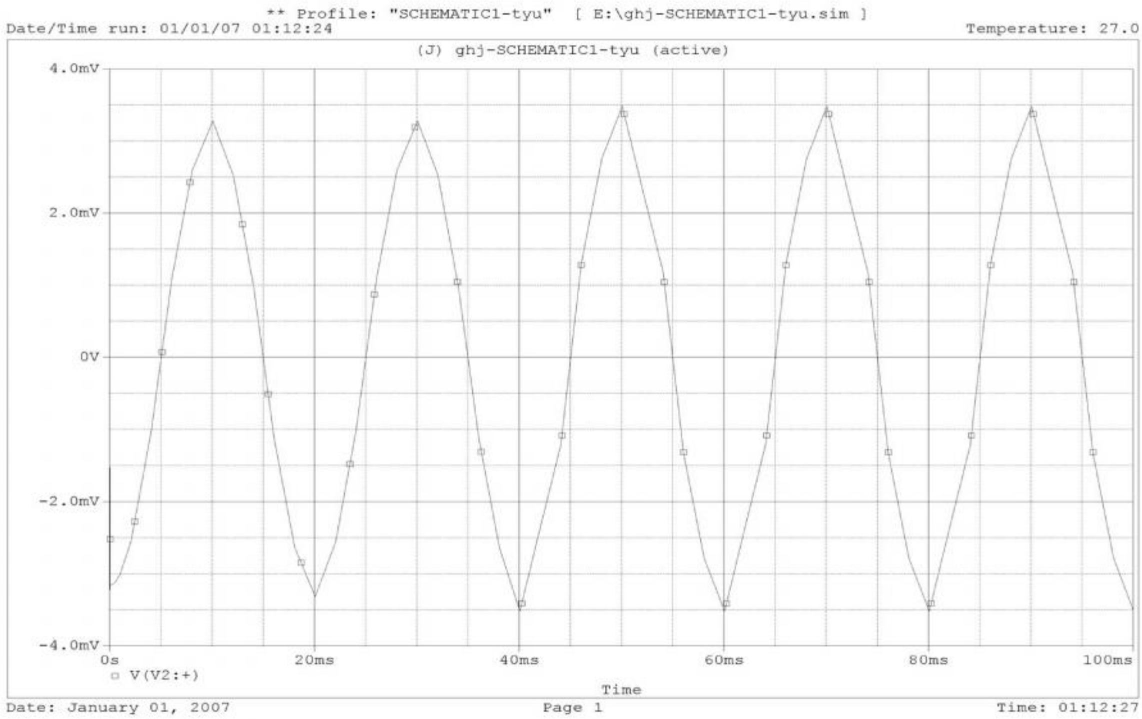
<u>OUTPUT WAVE FORM: (</u>High Pass Filter Circuit (Active Filter Circuit)



CIRCUIT DIAGRAM FOR LOW PASS PASSIVE FILTER:



OUTPUT WAVE FORM: (Low Pass Filter Circuit)



RESULT:

Thus the low pass and high pass passive filters are simulated by using MATLAB.