Practical Manual

Lab: Network Theory

Electronics &Communication Engg. (ECE)

RAO PAHALD SINGH GROUP OF INSTITUTIONS

BALANA(MOHINDER GARH)123029

Prepared By.

Mr.Manoj Saini

Checked By.

Mr.Pawan Kumar

EXPERIMENT NO :1

AIM:

To find resonance frequency , Bandwidth , Q - factor of RLC series circuit

APPARATUS REQUIRED :

Power Supply, Function Generator, CRO, Series Resonance kit,

Connecting Leads.

PRECAUTIONS :

a) Make the connections according to the circuit diagram. Power supply should be switched off.

b) Connections should be tight.

c) Handle the CRO carefully.

d) Note the readings carefully.

BRIEF THEORY :

The ckt. is said to be in resonance if the current is in phase with the applied

Voltage . Thus at Resonance, the equivalent complex impedance of the ckt. consists of only resistance R. Since V & I are in phase, the power factor of resonant ckt. is unity.

The total impedance for the series RLC ckt. is

CIRCUIT DIAGRAM:

P*OCEDURE :*

a) Make connection as per the circuit diagram & switch 'ON' the supply.

b) Feed the sine wave to the I/P terminal from function generator.

c) Adjust the peak to peak voltage of sine wave to 10V (V1) & frequency to 1 KHz.

d) O/P is connected to CRO.

e) Now change the I/P freq. with the help of function generator & note down the corresponding

f) Reading of O/P voltage from CRO screen.

g) At resonance freq. O/P will be max.

h) Plot the graph between freq. & O/P voltage. Calculate resonance freq., band width & Q.

OBSERVATION TABLE:

GRAPH:

RESULT/CONCLUSIONS:

The resonance frequency , bandwidth & Q - factor of RLC series

circuit has been calculated

DISCUSSIONS:

At cut-off frequencies the voltage becomes 1/(2)

EXPERIMENT NO : 2

AIM:

To study and plot the transient response of RL circuit

APPARATUS REQUIRED :

Power Supply, Circuit Board Kit., CRO, Function Generator,

Connecting Leads

PRECAUTIONS :

a) Make the connections according to the circuit diagram. Power supply should be switched off.

b) Connections should be tight.

c) Handle the CRO carefully.

d) Note the readings carefully.

BRIEF THEORY :

Let switch K be at position 1. When it is switched to 2 then the =n becomes

$L \frac{di}{dt} + Ri = 0$

$\frac{di}{i} = -\frac{R}{L} dt$

Integrating & then taking log on both sides

$\log i = -R t/L + \log c$ where c is constant

or, $\log i = -Rt / L + \log c$

or, $i = c e^{-Rt/l}$ ----------(1)

This is the general solution of RL circuit if the value of C2 is calculated

then the result is known as particular solution.

Just before switching at t = 0,

i(0) = V / R

P

utting in equation (1)

I(0) = C

e

, C

= V / R

V / R

2

2

Particular solution is

i = V / R e

CIRCUIT DIAGRAM:

PROCEDURE:-

a) Connect the circuit according to the fig. & switch 'ON' the Supply.

b) Feed square wave from function generator to the I/P terminal of the circuit

c) Connect the CRO to the O/P terminal & note down the O/P wave.

d) Draw the I/P & O/P wave on the graph paper.

GRAPH:

RESULT/CONCLUSIONS:

Transient response of RL circuit has been studied and the results obtained are shown on the graph.

EXPERIMENT NO – 3

AIM :-

To study and plot the transient response of RC circuit.

APPARATUS REQUIRED :

Power Supply, Circuit Board Kit., CRO, Function Generator,

Connecting Leads.

PRECAUTIONS :

a) Make the connections according to the circuit diagram. Power supply should be switched off.

b) Connections should be tight.

c) Handle the CRO carefully.

d) Note the readings carefully.

BRIEF THEORY :

Let initially the K is at 1, if it is moved to position 2, then apply KVL,

$1/C \int i\,dt + Ri = V$

Differentiating w.r.t 't'

$1/C\, i + R\, di/dt = 0$

$Rdi/dt = -1/Ci$

$di/i = 1/RCdt$

Integrating w.r.t to'i' & then taking log on both sides

$\text{Log } i = -1/RC\, t + C$

2

i = C

e-

-----(1)

t/CR

2

On putting I = V/R in equation (1)

e

V/R = C

-t/CR

2

At t = 0 , C

= V/R

2

i = V/R e

-t/RC

CIRCUIT DIAGRAM:

PROCEDURE :

a) Connect the ckt. according to the fig. & switch 'ON' the supply .

b) Feed square wave from function generator to the I/P terminal of the ckt.

c) Connect the CRO to the O/P terminal & note down the O/P wave .

d) Draw the I/P & O/P wave on the graph paper .

GRAPH:

RESULT/CONCLUSIONS:

Transient response of RC circuit has been studied and the results obtained are shown on the graph.

DISCUSSION:

The capacitor charges and discharges within one minute.

EXPERIMENT NO : 4

AIM:

To calculate and verify 'Z' parameters of two-port network

APPARATUS REQUIRED :

Power Supply, Bread Board, Five resistances, Connecting Leads

Voltmeter , Ammeter

PRECAUTIONS:

a) Make the connections according to the circuit diagram. Power supply should be switched off.

b) Connections should be tight.

c) Note the readings carefully.

BRIEF THEORY :

In Z parameters of a two-port , the input & output voltages V

& V

can be

1

2

expressed in terms of input & output currents I

& I

. Out of four variables (i.e V

,V

, I

, I

)

1

2

1

2

1

2

V

& V

are dependent variables whereas I

& I

are independent variables .Thus ,

1

2

1

2

V

= Z

I

+ Z

I

-----(1)

1

11

1

12

2

V

= Z

I

+ Z

I

----(2)

2

21

1

22

2

Here Z

& Z

are the input & output driving point impedances while Z

& Z

are the reverse

11

22

12

21

& forward transfer impedances.

CIRCUIT DIAGRAM:

PROCEDURE:

a) Connect the circuit as shown in fig. & switch 'ON' the experimental board.

b) First open the O/P terminal & supply 5V to I/P terminal. Measure O/P Voltage & I/P Current

c) Secondly, open the I/P terminal & supply 5V to O/P terminal. Measure I/P Voltage & O/P Current using Multimeter.

d) Calculate the values of Z parameter using Equation (1) & (2).

e) Switch 'OFF' the supply after taking the readings.

OBSERVATION TABLE:

When I/P is open ckted When O/P is open ckted

S.N.O V

V

I

V

V

I

2

1

2

2

1

1

SAMPLE CALCULATION:

(1) When O/P is open circuited i.e. I

= 0

2

Z

= V

/I

Z

=V

/I

11

1

1

21

2

1

(2) When I/P is open circuited i.e. I

= 0

I

Z

= V

/I

Z

= V

/I

12

1

2

22

2

2

RESULT/CONCLUSION:

The Z-parameters of the two port network has been calculated and verified .

DISCUSSION:

The Z-parameters are open circuit parameters

EXPERIMENT NO : 5

AIM:

To calculate and verify 'Y' parameters of two-port network

APPARATUS REQUIRED :

.Power supply, Bread Board, Five resistances, Connecting Leads,

Voltmeter , Ammeter .

PRECAUTIONS :

a) Make the connections according to the circuit diagram. Power supply should be switched off.

b) Connections should be tight.

c) Note the readings carefully.

BRIEF THEORY :

In Y parameters of a two-port , the input & output currents I

& I

can be

1

2

expressed in terms of input & output voltages V

& V

. Out of four variables (i.e I

, I

, V

V

1

2

1

2

1 ,

2

) I

& I

are dependent variables whereas V

& V

are independent variables.

1

2

1

2

I

= Y

V

+ Y

V

------(1)

1

11

1

12

2

I

= Y

V

+ Y

V

-------(2)

2

21

1

22

2

Here Y

& Y

are the input & output driving point admittances while Y

& Y

are the reverse

11

22

12

21

& forward transfer admittances.

CIRCUIT DIAGRAM:

PROCEDURE :

a) Connect the circuit as shown in fig. & switch 'ON' the experimental board.

b) First short the O/P terminal & supply 5V to I/P terminal. Measure O/P & I/P current

c) Secondly, short the I/P terminal & supply 5V to O/P terminal. Measure I/P & O/P current using multimeter.

d) Calculate the values of Y parameter using Eq. (1) & (2) .

e) Switch 'off' the supply after taking the readings.

OBSERVATION TABLE:

When I/P is short ckted When O/P is short ckted

S.N.O V

I

I

V

I

I

2

1

2

1

1

2

SAMPLE CALCULATION:

(1) When O/P is short circuited i.e. V

= 0

2

Y

= I

/V

Y

= I

/V

11

1

1

21

2

1

(2) When I/P is short circuited i.e. V

= 0

I

Y

= I

/V

Y

= I

/V

12

1

2

22

2

2

RESULT/CONCLUSION:

The Y-parameters of the two port network has been calculated and

verified .

DISCUSSION:

The Y-parameters are short circuit parameters

EXPERIMENT NO: 6

AIM:

To calculate and verify 'ABCD' parameters of two-port network

APPARATUS REQUIRED:

Power Supply, Bread Board, Five resistances, Connecting Leads

Voltmeter, Ammeter.

PRECAUTIONS:

a) Make the connections according to the circuit diagram. Power supply should be switched off.

b) Connections should be tight.

c) Note the readings carefully.

BRIEF THEORY:

ABCD parameters are widely used in analysis of power transmission

engineering where they are termed as " Generalized Circuit Parameters" . ABCD parameters are

also known as "Transmission Parameters". In these parameters, the voltage & current at the sending end terminals can be expressed in terms of voltage & current at the receiving end.

Thus,

V

= AV

+ B (-I

)

1

2

2

I

= CV

+ D (-I

)

1

2

2

Here “A” is called reverse voltage ratio, “B” is called transfer impedance “C” is called transfer admittance & “D” is called reverse current ratio.

CIRCUIT DIAGRAM:

PROCEDURE :

a) Connect the circuit as shown in fig. & switch ‘ON’ the experimental board.

b) First open the O/P terminal & supply 5V to I/P terminal. Measure O/P voltage & I/P current

c) Secondly, short the O/P terminal & supply 5V to I/P terminal. Measure I/P & O/P current using multimeter.

d) Calculate the A, B, C, & D parameters using the Eq. (1) & (2).

OBSERVATION TABLE:

When O/P is open ckted When O/P is short ckted

S.N.O V

V

I

V1 I

I

1

2

1

2

1

SAMPLE CALCULATION:

(1)When O/P is open circuited i.e. I2

= 0

A = V

/V

C = I

/V

1

2

1

2

(2) When O/P is short circuited i.e. V2

= 0

B = -V

/I

D = -I

/I

1

2

1

2

RESULT/CONCLUSION:

The ABCD-parameters of the two-port network has been calculated

and verified.

DISCUSSION:

ABCD parameters are transmission parameters

EXPERIMENT NO : 7

AIM:

To determine equivalent parameters of parallel connection of two-port network

APPARATUS REQUIRED:

Power Supply, Bread Board, Five Resistances, Connecting

Leads, Voltmeter, Ammeter

PRECAUTIONS:

a) Make the connections according to the circuit diagram. Power supply should be switched off.

b) Connections should be tight.

c) Note the readings carefully.

BRIEF THEORY:

Consider two port N/Ws connected in parallel so that they have common

reference node, then the equation of the N/Ws A&B in terms of Y parameters are given by

Y

= Y

A + Y

B

11

11

11

Y

= Y

A + Y

B

12

12

12

Y

= Y

A + Y

B

21

21

21

Y

= Y

A + Y

B

22

22

22

Thus we see that each Y parameter of the parallel N/W is given as the sum of the corresponding parameters of the individual N/Ws.

CIRCUIT DIAGRAM:

PROCEDURE:

a) Connect the N/Ws A&B separately on the Bread board according to the fig.

b) Take the Reading according to the observation table & calculate Y parameters

c) for both N/Ws & add them.

d) Connect the two N/Ws A&B in parallel & take the readings.

e) Calculate the Y parameters of llel connected N/Ws.

f) Verify that the sum of parameters of A&B N/Ws is equal to the parameters of

g) parallel connected N/Ws.

OBSERVATION TABLE:

When I/P is short ckted When O/P is short ckted

S.N.O V

I

I

V

I

I

2

1

2

1

1

2

SAMPLE CALCULATION:

(3) When O/P is short circuited i.e. V

= 0

2

Y

= I

/V

Y

= I

/V

11

1

1

21

2

1

(4) When I/P is short circuited i.e. V

= 0

1

Y

= I

/V

Y22 = I

/V

12

1

2

2

RESULT/CONCLUSION:

The Y-parameters of parallel connection of two-port network has been determined .

DISCUSSION:

The overall Y-parameters of a parallel connection is equal to sum of individual network parameters.

EXPERIMENT NO : 8

AIM:

To plot the frequency response of High pass filter and determine the half-power

frequency

APPARATUS REQUIRED:

Power Supply, Filter ckt. Kit, Resistances, Audio Frequency

Generator, two voltmeters .

BRIEF THEORY :

A HP filter attenuates all frequencies below a designated cut-off frequency

f

, & passes all freq. above f

. Thus the pass band of this filter is the freq. range above fc & the

c

c

stop band is the freq. range below fc. An attenuation characteristic of a HP filter is shown in fig.

fc f

CIRCUIT DIAGRAM:

PROCEDURE:

a) Connect the circuit. according to the circuit diagram

b) Connect the audio signal generator with 600 O source impedance to the I/P of the filter terminate that the O/P with a 600O resistive load.

c) Connect two voltmeter at I/P & O/P terminal.

d) Set the I/P voltage to app. 1Vrms at 1 KHz.

e) Vary the I/P freq. from 0 to 10KHz in small steps. Measure I/P& O/P voltage at each Step.

f) Take more reading where the attenuation roll off is predominant.

h) Draw the graph.

OBSERVATION TABLE:

S.N.O Frequency (KHz) I/P Voltage

O/P Voltage

a = 20 log V

/V

2

1

V

(Volts)

V

(Volts)

1

2

SAMPLE CALCULATION:

a = 20 log V

/V

2

1

RESULT/CONCLUSION:

The frequency response of High Pass Filter has been plotted on the graph .Also its half-power frequencies has been determined.

DISCUSSION:

High Pass Filter passes the frequencies above cut-off frequencies.

d) Take output carefully.

EXPERIMENT NO: 9

AIM:

To plot the frequency response of Low pass filter and determine the half-power frequency

APPARATUS REQUIRED:

Power Supply, Filter circuit Kit, Resistances, Audio

Frequency Generator, two Voltmeters.

PRECAUTIONS:

a) Make the connections according to the circuit diagram. Power supply should be switched off.

b) Connections should be tight.

c) Handle the CRO carefully.

d) Note the readings carefully.

e) Take output carefully.

BRIEF THEORY:

A Low pass filter is one which passes without attenuation all frequencies

up to the cut-off frequency f

& simultaneously attenuates all other frequencies greater than f

.

c

c

The attenuation characteristic of an ideal L P filter is shown in fig.

This filter transmits all frequencies from zero to cut-off frequency.The band is called pass band.

The frequency range over which transmission does not take place is called the stop band.

f

= 1/

p(LC)

½

c

CIRCUIT DIAGRAM:

PROCEDURE:

a) Connect the ckt. according to the ckt. diagram

b) Connect the audio signal generator with 600O source impedance to the I/P of the filter.

Terminate the O/P with a 600O resistive load.

c) Connect two voltmeters at I/P & O/P terminal.

d) Set the I/P voltage to app. 1V

at 1 KHz.

rms

e) Vary the I/P freq. from 0 to 10KHz in small steps. Measure I/P& O/P voltage at each

step.

f) Take more reading where the attenuation roll off is predominant.

g) Draw the graph.

OBSERVATION TABLE:

S.N.O Frequency (KHz) I/P Voltage

O/P Voltage

a = 20 log V

/V

2

1

V

(Volts)

V

(Volts)

1

2

SAMPLE CALCULATION:

a = 20 log V

/V

2

1

GRAPH:

RESULT/CONCLUSION:

The frequency response of Low Pass Filter has been plotted on the graph. Also its half-power frequencies has been determined.

DISCUSSION:

Low Pass Filter passes the frequencies below cut-off frequencies

EXPERIMENT NO : 10

AIM:

To study frequency response of Band pass filter.

APPARATUS REQUIRED:

Power Supply, Filter ckt. Kit, Resistances, Audio

Frequency Generator, two Voltmeters.

PRECAUTIONS:

a) Make the connections according to the circuit diagram. Power supply should be switched off.

b) Connections should be tight.

c) Handle the CRO carefully.

d) Note the readings carefully.

e) Take output carefully.

BRIEF THEORY:

A band pass filter passes freq. Between two designated cut-0ff fr eq.&

attenuates all other freq. . BPF has two cut-off freq. As shown in fig. f

is called lower cut-off

1

freq.& f

is upper cut-off freq.

2

CIRCUIT DIAGRAM:

PROCEDURE:

a) Connect the ckt. according to the ckt. Diagram

b) Connect the audio signal generator with 600O source impedance to the I/P of the filter terminate that the O/P with a 600O resistive load.

c) Connect two voltmeter at I/P & O/P terminal.

d) Set the I/P voltage to app. 1Vrms at 1KHz.

e) Vary the I/P freq. from 0 to 10KHz in small steps. Measure I/P& O/P voltage at each step.

f) Take more reading where the attenuation roll off is predominant.

g) Draw the graph.

OBSERVATION TABLE:

S.N.O Frequency (KHz) I/P Voltage

O/P Voltage

a = 20 log V

/V

2

1

V

(Volts)

V

(Volts)

1

2

SAMPLE CALCULATION:

a = 20 log V

/V

2

1

GRAPH:

RESULT/CONCLUSION:

The frequency response of Band Pass Filter has been plotted on the

graph and its bandwidth has been calculated .

DISCUSSION:

The Band Pass Filter is obtained by connecting Low Pass and High Pass Filter

in cascade provided that the Low Pass Filter has cut-off frequency higher than High Pass Filter.