ELECTRICAL CIRCUIT ANALYSIS LAB

II B.Tech-I SEMESTER

STUDENT OBSERVATION RECORD

DEPARTMENT
OF
ELECTRICAL AND ELECTRONICS ENGINEERING

VEMU INSTITUTE OF TECHNOLOGY::P.KOTHAKOTA

NEAR PAKALA, CHITTOOR-517112

(Approved by AICTE, New Delhi & Affiliated to JNTUA, Anantapuramu)

VEMU INSTITUTE OF TECHNOLOGY

DEPT.OF ELECTRICAL AND ELECTRONICS ENGINEERING

VISION OF THE INSTITUTE

- To be a premier institute for professional education producing dynamic and vibrant force of technocrats with competent skills, innovative ideas and leadership qualities to serve the society with ethical and benevolent approach.

MISSION OF THE INSTITUTE

- To create a learning environment with state-of-the art infrastructure, well equipped laboratories, research facilities and qualified senior faculty to impart high quality technical education.
- To facilitate the learners to foster innovative ideas, inculcate competent research and consultancy skills through Industry-Institute Interaction.
- To develop hard work, honesty, leadership qualities and sense of direction in rural youth by providing value based education.

VISION OF THE DEPARTMENT

- To produce professionally deft and intellectually adept Electrical and Electronics Engineers and equip them with the latest technological skills, research & consultancy competencies along with social responsibility, ethics, Lifelong Learning and leadership qualities.

MISSION OF THE DEPARTMENT

- To produce competent Electrical and Electronics Engineers with strong core knowledge, design experience & exposure to research by providing quality teaching and learning environment.
- To train the students in emerging technologies through state - of - the art laboratories and thus bridge the gap between Industry and academia.
- To inculcate learners with interpersonal skills, team work, social values, leadership qualities and professional ethics for a holistic engineering professional practice through value based education.

PROGRAM EDUCATIONAL OBJECTIVES(PEOs)

Programme Educational Objectives (PEOs) of B.Tech (Electrical and Electronics Engineering) **program are:**

Within few years of graduation, the graduates will

PEO 1: Provide sound foundation in mathematics, science and engineering fundamentals to analyze, formulate and solve complex engineering problems.

PEO 2: Have multi-disciplinary Knowledge and innovative skills to design and develop Electrical & Electronics products and allied systems.

PEO 3: Acquire the latest technological skills and motivation to pursue higher studies leading to research.

PEO 4: Possess good communication skills, team spirit, ethics, modern tools usage and the life-long learning needed for a successful professional career.

PROGRAM OUTCOMES (POs)

PO-1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO-2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO-3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO-4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO-5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO-6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO-7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO-8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO-9	**Individual and team work:** Function effectively as an individual, and as a member or leader

	in diverse teams, and in multidisciplinary settings.
PO-10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO-11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO-12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

On completion of the B.Tech. (Electrical and Electronics Engineering) degree, the graduates will be able to

PSO-1: Higher Education: Apply the fundamental knowledge of Mathematics, Science, Electrical and Electronics Engineering to pursue higher education in the areas of Electrical Circuits, Electrical Machines, Electrical Drives, Power Electronics, Control Systems and Power Systems.

PSO-2: Employment: Get employed in Public/Private sectors by applying the knowledge in the domains of design and operation of Electronic Systems, Microprocessor based control systems, Power systems, Energy auditing etc.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

II B.Tech. I-Sem (EEE)

ELECTRICAL CIRCUIT ANALYSIS LABORATORY(20A02301P)

COURSE OUTCOMES

C216.1	Analyze & Experimentally verify various resonance phenomenon
C216.2	Analyze various current locus diagrams.
C216.3	Apply and experimentally analyze two port network parameters
C216.4	Analysis of R, RL and RLC circuits with different excitations
C216.5	Simulate the DC & AC Circuits

Name: ______________________________

H.T.No: ______________________________

Year/Semester: ______________________________

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech II-I Sem. (EEE) **L T P C**
0 0 3 1.5

(20A02301P) ELECTRICAL CIRCUIT ANALYSIS LABORATORY

The following experiments are required to be conducted as compulsory experiments:

1. Locus Diagram of RL Series Circuits:
   a) Variable 'R' and Fixed 'L' b) Variable 'L' and Fixed 'R'
2. Locus Diagram of RC Series Circuits:
   a) Variable 'R' and Fixed 'C' b) Variable 'C' and Fixed 'R'
3. Series Resonance
4. Parallel Resonance
5. Determination of Z Parameters
6. Determination of Y Parameters
7. Transmission Parameters
8. Hybrid Parameters
9. Determination of Coefficient of coupling
10. Response Analysis of R, RL and RLC circuits with sinusoidal and non-sinusoidal excitations.

ADDITIONAL EXPERIENTS

11. Simulation of DC Circuits
12. Simulation of AC Circuits

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List of Experiments to be conducted

ELECTRICAL CIRCUIT ANALYSIS LABORATORY

S.NO.	NAME OF THE EXPERIMENT
1	Locus Diagram of RL Series Circuits: a) Variable ‘R’ and Fixed ‘L’ b) Variable ‘L’ and Fixed ‘R’
2	Locus Diagram of RC Series Circuits: a) Variable ‘R’ and Fixed ‘C’ b) Variable ‘C’ and Fixed ‘R’
3	Series Resonance
4	Parallel Resonance
5	Determination of Z Parameters
6	Determination of Y Parameters
7	Transmission Parameters
8	Hybrid Parameters
9	Determination of Coefficient of coupling
10	Response Analysis of R, RL and RLC circuits with sinusoidal and non-sinusoidal excitations
Additional Experiments	
11	Simulation of DC Circuits
12	Simulation of AC Circuits

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List of Experiments to be conducted

CONTENTS

ELECTRICAL CIRCUIT ANALYSIS LABORATORY

GENERAL INSTRUCTIONS FOR LABORATORY CLASSES

DO‘S

1. Without Prior permission do not enter into the Laboratory.
2. While entering into the LAB students should wear their ID cards.
3. The Students should come with proper uniform.
4. Students should sign in the LOGIN REGISTER before entering into the laboratory.
5. Students should come with observation and record note book to the laboratory.
6. Students should maintain silence inside the laboratory.
7. Circuit connections must be checked by the lab-in charge before switching the supply

DONT‘S

8. Students bringing the bags inside the laboratory..
9. Students wearing slippers/shoes insides the laboratory.
10. Students scribbling on the desk and mishandling the chairs.
11. Students using mobile phones inside the laboratory.
12. Students making noise inside the laboratory.
13. Students mishandle the devices.
14. Students write anything on the devices

ELECTRICAL CIRCUIT ANALYSIS LABORATORY

SCHEME OF EVALUATION

S.No	Experiment Name	Date	Marks Awarded				Total 30(M)
			Record (10M)	Observation (10M)	Viva Voce (5M)	Attendance (5M)	
1	Locus Diagram of RL Series Circuits: a) Variable ‘R’ and Fixed ‘L’ b) Variable ‘L’ and Fixed ‘R’						
2	Locus Diagram of RC Series Circuits: a) Variable ‘R’ and Fixed ‘C’ b) Variable ‘C’ and Fixed ‘R’						
3	Series Resonance						
4	Parallel Resonance						
5	Determination of Z Parameters						
6	Determination of Y Parameters						
7	Transmission Parameters						
8	Hybrid Parameters						
9	Determination of Coefficient of coupling						
10	Response Analysis of R, RL and RLC circuits with sinusoidal and non-sinusoidal excitations						
ADDITIONAL EXPERIENTS							
11	Simulation of DC Circuits						
12	Simulation of AC Circuits						

Signature of Lab In-charge

EXP.NO:1 **DATE:**

01.Locus Diagram of RL Series Circuits:

a) Variable ‘R’ and Fixed ‘L’ b) Variable ‘L’ and Fixed ‘R’

AIM: To design the Locus Diagram of RL Series Circuits for the given circuit.

AIM: To draw the current locus diagrams for series RL and RC circuits by varying resistance and for series RC circuit by varying capacitance.

APPARATUS:

S. No	Name of the apparatus	Range	Type	Quantity
1	Signal generator	(0 – 3M)Hz, (0-20)V_{PP}	-	1No
2	Decade Resistance Box	(0-111.11K)Ω	-	1No
3	Decade inductance Box	(0-1.11)H	-	1No
4	Decade Capacitance Box	(0-1.11)F	-	1No
5	Ammeter	(0-10m)A	MC	1No
6	Connecting wires	-	-	Required number

PROCEDURE:

Series RL circuit(Varying resistance (R) and Fixed Inductance L)

1. Set the signal generator to be in sine wave mode and adjust the output voltage to 20V peak to peak,frequency to 200 Hzs.

2. Connect the circuit as per fig.

3. Vary the resistance in the circuit using DRB in steps and note down the current through the circuit for each step(ammeter reading).

4. Calculate phase angle ϕ using to formula $\phi = \tan^{-1}\left(\frac{X_L}{R}\right)$ for each step.

5. Disconnect the circuit.
6. Plot the current locus diagram by taking current on x axis and voltage on Y – axis.

Series RL circuit(Varying Inductance (L) and Fixed Resistance R)

1. Set the signal generator to be in sine wave mode and adjust the output voltage to 20V peak to peak,frequency to 200 Hzs.

2. Connect the circuit as per fig.

3. Vary the Inductance in the circuit using DLB in steps and note down the current through the circuit for each step (ammeter reading).
4. Calculate phase angle ϕ using to formula $\phi = \tan^{-1}$for each step.
5. Disconnect the circuit.
6. Plot the current locus diagram by taking current on x axis and voltage on Y – axis.

PRECAUTIONS:

1. Set the ammeter pointer at zero position.

2.Take the readings with out parallax error.

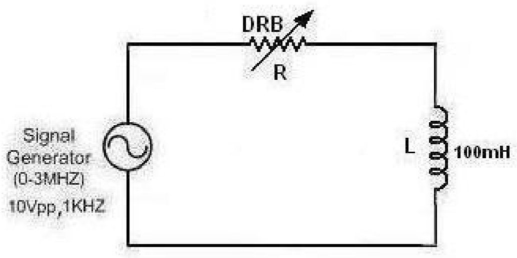
3. Avoid loose connections.

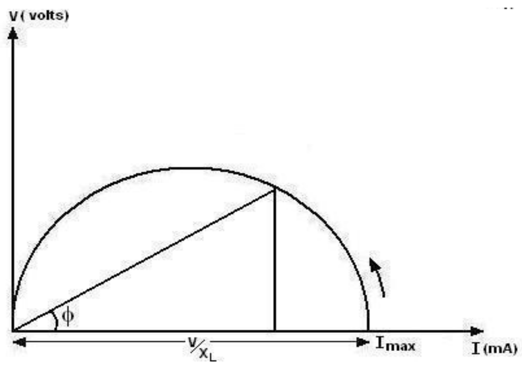
CURRENT LOCUS DIAGRAMS

GIVEN CIRCUIT

MODEL GRAPH

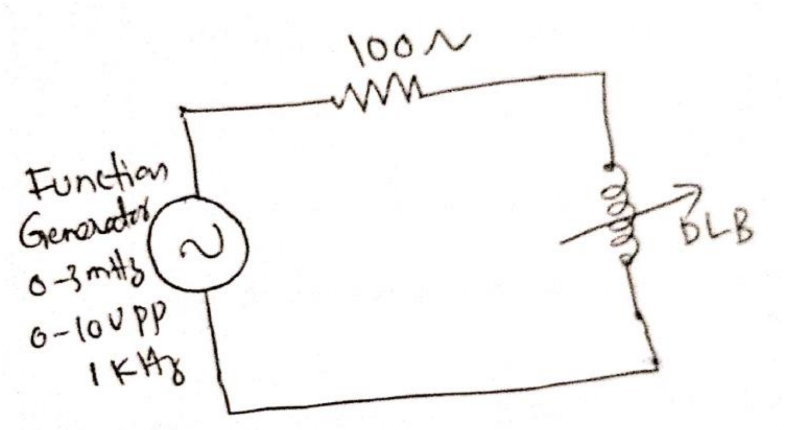
Series RL circuit (R Varying)





S.NO	R(ohms)	I(mA)	Φ= $\tan^{-1}\left(\frac{X_L}{R}\right)$

Series RL circuit (L Varying& R Fixed)



S.NO	R (ohms)	L	I(mA)	Φ= $\tan^{-1}\left(\frac{X_L}{R}\right)$

Theoretical Circuit diagram:

Practical circuit diagram:

Fig

RESULT:

The current locus diagrams for series RL circuits by varying resistance and by varying Capacitance are drawn.

CONCLUSION:

The current locus diagrams of series RL and RC circuits with resistance varying and for series RC circuit with capacitance varying are semi-circles.

EXP.NO:02 **DATE:**

02.Locus Diagram of RC Series Circuits:

a) Variable ‘R’ and Fixed ‘C’ b) Variable ‘C’ and Fixed ‘R’

AIM: To draw the current locus diagrams for series RC circuits by varying resistance and for series RC circuit by varying capacitance.

APPARATUS:

S. No	Name of the apparatus	Range	Type	Quantity
1	Signal generator	(0 – 3M)Hz, (0-20)V_{PP}	-	1No
2	Decade Resistance Box	(0-111.11K)Ω	-	1No
3	Decade inductance Box	(0-1.11)H	-	1No
4	Decade Capacitance Box	(0-1.11)F	-	1No
5	Ammeter	(0-10m)A	MC	1No
6	Connecting wires	-	-	Required number

PROCEDURE:

Series RC circuit(varying resistance)

1. Set the signal generator to be in sine wave mode and adjust the output voltage to 20Vpeak to peak,frequency to 200 Hzs.
2. Connect the circuit as per fig.
3. Vary the resistance in the circuit using DRB in steps and note down the current through the circuit for each step(ammeter reading).
4. Calculate phase angle ϕ using to formula $\phi = \tan^{-1}\left(\frac{X_C}{R}\right)$ for each step.
5. Disconnect the circuit.
6. Plot the current locus diagram by taking current on Y axis and voltage on X – axis.

Series RC circuit(varying capacitance)

1. Set the signal generator to be in sine wave mode and adjust the output voltage to 20V peak to peak,frequency to 200 Hzs.
2. Connect the circuit as per fig.
3. Vary the Capacitance in the circuit using DCB in steps and note down the current through the circuit for each step(ammeter reading).

4. Calculate phase angle ϕ using to formula $\phi = \tan^{-1}\left(\frac{X_C}{R}\right)$ for each step.

5. Disconnect the circuit.
6. Plot the current locus diagram by taking current on Y axis and voltage on X – axis.

PRECAUTIONS:

1. Set the ammeter pointer at zero position.

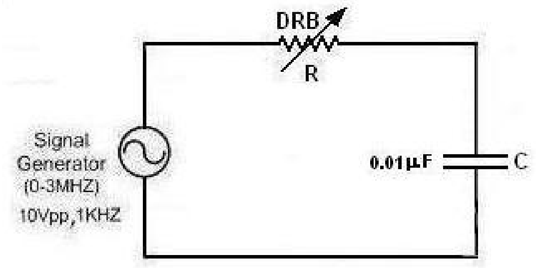
2.Take the readings with out parallax error.

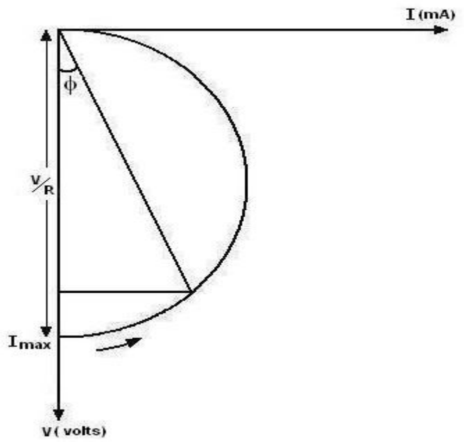
3. Avoid loose connections.

CURRENT LOCUS DIAGRAMS

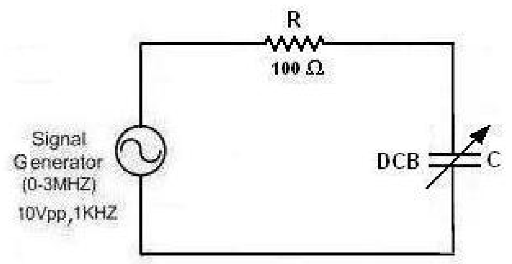
GIVEN CIRCUIT MODEL GRAPH

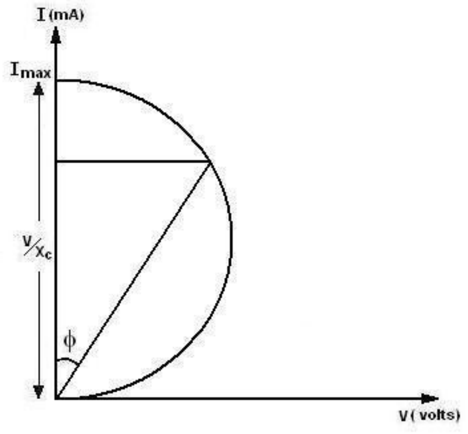
Series RC circuit (C Varying)





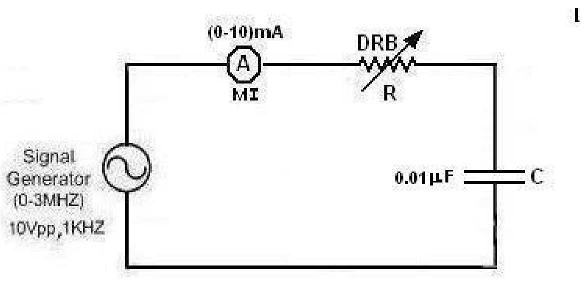
Series RC circuit (C Varying)





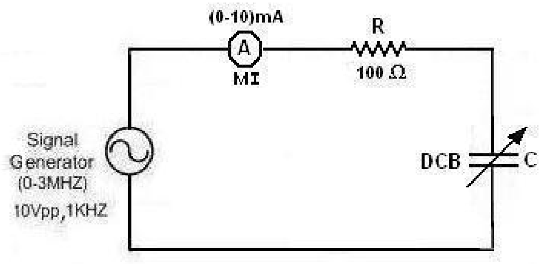
Theoretical Circuit diagram:	**Practical circuit diagram:**

Practical circuit diagram:



Fig

S.NO	R(ohms)	I(mA)	Φ= $\tan^{-1}\left(\frac{X_C}{R}\right)$



Fig

S.NO	C(µF)	I(mA)	Φ= $\tan^{-1}\left(\frac{X_C}{R}\right)$

RESULT:

The current locus diagrams for series RC circuits by varying resistance and for series RC circuit by varying capacitance are drawn.

CONCLUSION:

The current locus diagrams of series RC circuits with resistance varying and for series RC circuit with capacitance varying are semi-circles.

CIRCUIT DIAGRAM OF SERIES RESONANCE:

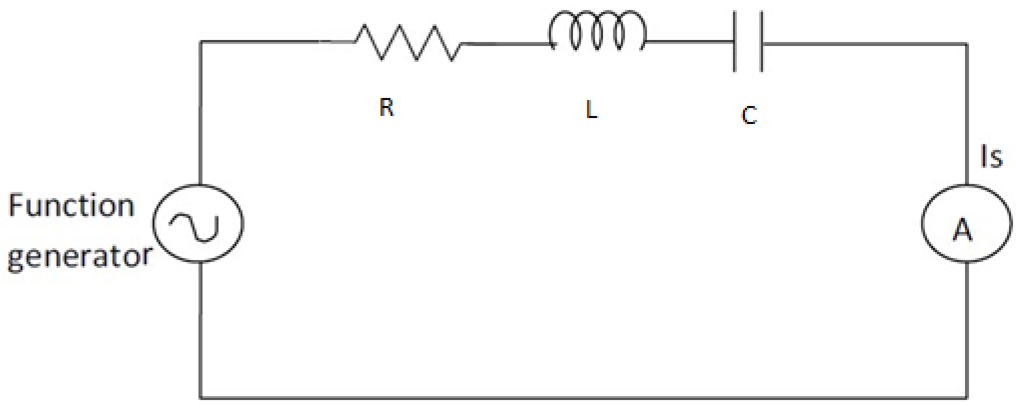
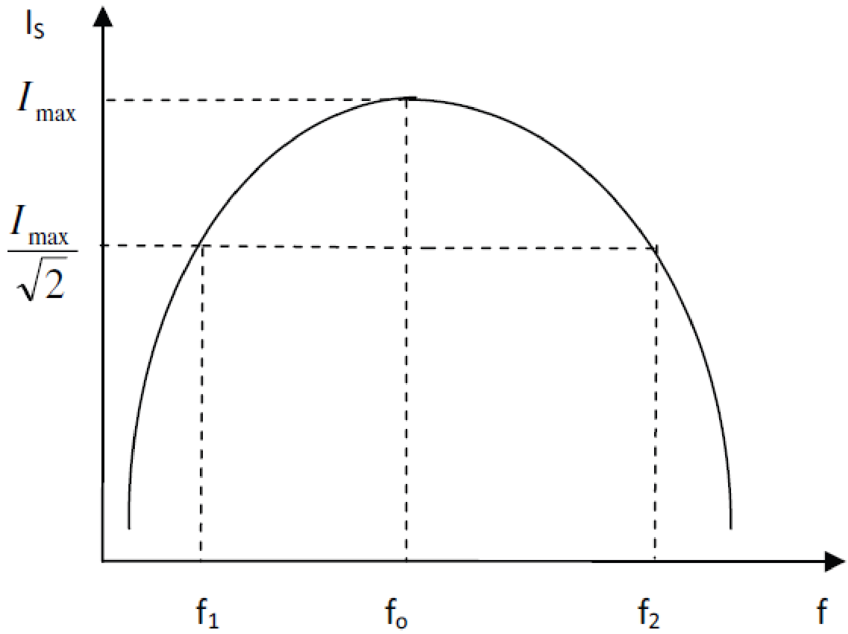


Fig-1

MODEL GRAPH:



EXP.NO:03 **DATE:**

FREQUENCY RESPONSE OF SERIES RESONANCE CIRCUIT

AIM: To verify resonant frequency, bandwidth & quality factor of RLC series Resonant circuits.

APPARATUS:

S. No	Name of the apparatus	Range	Type	Quantity
1	Signal generator	(0 – 3M)Hz, (0-20) V_{PP}	-	1No
2	Decade inductance Box	(0-1.11H)	-	1No
3	Decade Capacitance Box	(0-1.11F)	-	1No
4	Decade Resistance Box	(0-111.11K)Ω	-	1No
5	Resistors	1k Ω	Carbon Composition	2No
6	Ammeter	(0-10m) A	MI	1No
7	Bread board	-	-	1No
8	Connecting wires	-	-	Required Number

PROCEDURE:

Series Resonant circuit

1. Set the signal generator in sine wave mode.
2. Using C.R.O set the output voltage of the signal generator to an appropriate value (Say 20 V peak to peak).
3. Connect the circuit as per fig (1.1).
4. Vary the frequency of the input signal in steps and note down the corresponding current through the circuit and tabulate the readings.

5. Reduce the frequency to zero.
6. Now decrease the resistance to 500 Ω and repeat the steps 4 and 5.
7. Reduce the signal generator voltage to 0V and switch off the supply.
8. Disconnect the circuit and plot the graph by relating dependent and independent variables.
9. The frequency corresponding to maximum current will be the resonant frequency.
10. Draw a line parallel to X-axis, corresponding to 0.707 I_{max}, which cuts the curve at two points.
11. The frequencies corresponding to those points are called as cut-off frequencies.
12. The difference between lower and upper cut-off frequencies gives the bandwidth.

PRECAUTIONS:

1. Keep the output voltage of the signal generator in zero volt position.

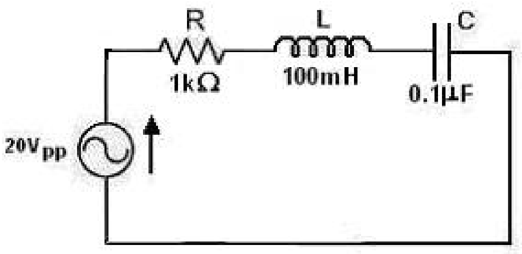
2. Set the ammeter pointer at zero position.

3. Take the readings with out parallax error.

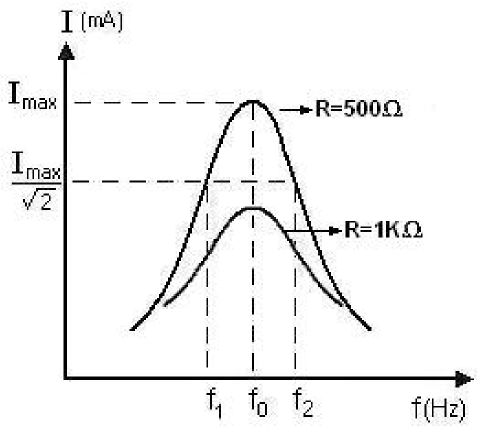
4. Avoid loose connections.

SERIES RESONANCE

GIVEN CIRCUIT



MODEL GRAPH



Theoretical Circuit diagram:

Practical circuit diagram:

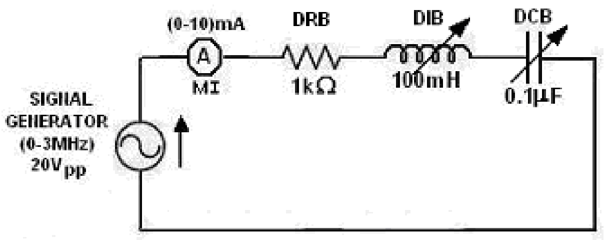


Fig (1.1)

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

Quality factor, $Q = \frac{\omega L}{R} = \frac{1}{\omega CR} = \frac{1}{R}\sqrt{\frac{L}{C}} = 1$

Band width =

Resonant frequency, f_0 =

Lower cut-off frequency, f_1 =

Upper cut-off frequency, f_2 =

Band width = $f_2 - f_1$ =

Quality factor, $Q = \frac{f_o}{f_2 - f_1}$

Tabular Column:

When R = 1KΩ

S. No	**Frequency, f (Hz)**	**Current, I (mA)**

When R = 500Ω

S. No	**Frequency, f (Hz)**	**Current, I (mA)**

RESULT:

The resonant frequency, bandwidth and quality factor of the given series and parallel resonant circuits are determined and compared with the theoretical values.

S.No	Parameter	Series Resonant circuit	
		Theoretical Values	Practical Values
1	Resonant Frequency, f_o		
2	Band width		
3	Quality factor		

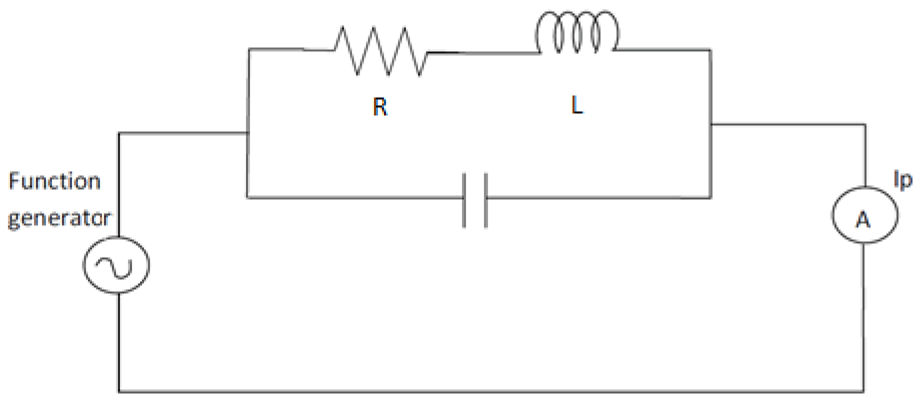
CONCLUSIONS:

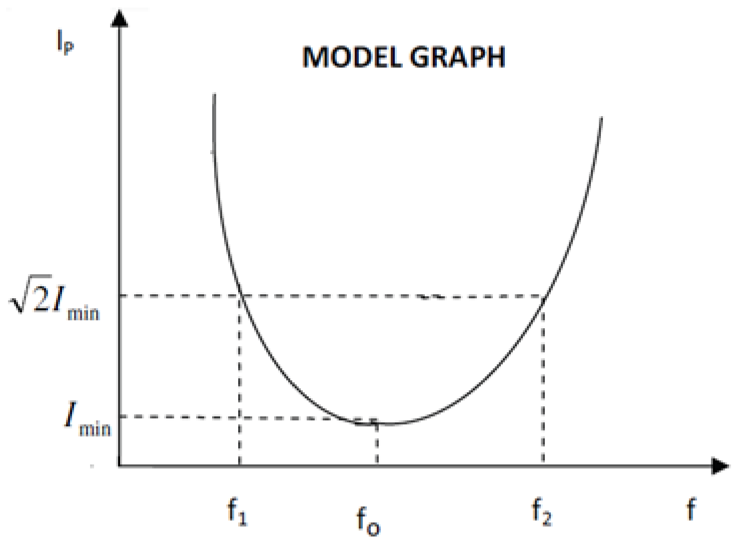
1. Since the current at resonance is maximum, the series resonant circuit is called as acceptor circuit.
2. As the resistance of the circuit decreases, the Q-factor increases and selectivity of the circuit will be better.
3. Since the current at resonance is minimum, the parallel resonant circuit is called as rejector circuit.
4. The variation of the resistance does not affect the resonant frequency.

VIVA QUESTIONS:-

1) Define Resonance?
2) Define bandwidth?
3) What is resonant condition in series RLC circuit?
4) Define quality factor?
5) What is half power frequencies?
6) What is the resonance frequency of series RLC circuit?
7) What is the band width of series RLC circuit?
8) What are the half power frequencies of series RLC circuit?

Circuit Diagram:





EXP.NO:04 **DATE:**

ANALYSIS OF PARALLEL RESONANCE CIRCUIT

AIM: To verify resonant frequency, bandwidth & quality factor of RLC parallel Resonant circuits.

APPARATUS:

S. No	Name of the apparatus	Range	Type	Quantity
1	Signal generator	(0 – 3M)Hz, (0-20) V_{PP}	-	1No
2	Decade inductance Box	(0-1.11H)	-	1No
3	Decade Capacitance Box	(0-1.11F)	-	1No
4	Decade Resistance Box	(0-111.11K)Ω	-	1No
5	Resistors	1k Ω	Carbon Composition	2No
6	Ammeter	(0-10m) A	MI	1No
7	Bread board	-	-	1No
8	Connecting wires	-	-	Required Number

PROCEDURE:

Resonance in parallel RLC circuit

1. Connect the circuit as per fig .
2. Vary the frequency of the input signal in steps and note down the corresponding current through the circuit and tabulate the readings.
3. Reduce the frequency to zero.
4. Now decrease the resistance to 500 Ω and repeat the steps 4 and 5.
5. Reduce the signal generator voltage to 0V and switch off the supply.
6. The frequency corresponding to minimum current will be the resonant frequency.

7. Draw a line parallel to X-axis, corresponding to 1.414 I_{min}, which cuts the curve at two points.
8. The difference between lower and upper cut-off frequencies gives the bandwidth.

PRECAUTIONS:

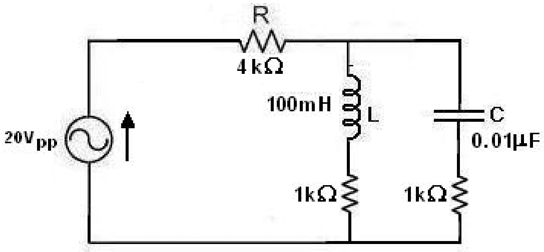
1. Keep the output voltage of the signal generator in zero volt position.
2. Set the ammeter pointer at zero position.
3. Take the readings with out parallax error.
4. Avoid loose connections.

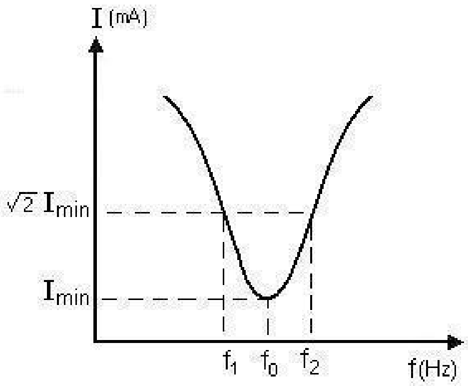
SERIES RESONANCE

GIVEN CIRCUIT MODEL GRAPH

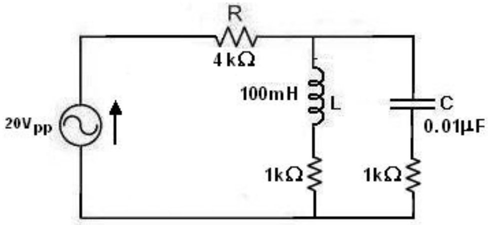
PARALLEL RESONANCE

GIVEN CIRCUIT: **MODEL GRAPH:**





Theoretical Circuit diagram: **Practical circuit diagram**:



Resonant frequency, f_0 ,

$$f_0 = \frac{1}{2\pi\sqrt{LC}}\sqrt{\frac{CR_L^2 - L}{CR_C^2 - L}}.$$

$$\because R_L = R_C,\ f_0 = \frac{1}{2\pi\sqrt{LC}} = .$$

Quality factor, Q =.

Band width =.

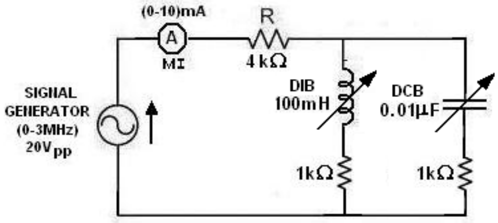


Fig (1.2)

Tabular Column:

S. No	Frequency, f (Hz)	Current, I(mA)

f_0 = f_1= f_2=

Band width = $f_2 - f_1$ =

$$Q = \frac{f_o}{f_2 - f_1} =$$

RESULT:

S.No	Parameter	Parallel Resonant circuit

The resonant frequency, bandwidth and quality factor of the given series and parallel resonant circuits are determined and compared with the theoretical values.

		Theoretical Values	Practical Values
1	Resonant Frequency, f_o		
2	Band width		
3	Quality factor		

CONCLUSIONS:

1. Since the current at resonance is maximum, the series resonant circuit is called as acceptor circuit.
2. As the resistance of the circuit decreases, the Q-factor increases and selectivity of the circuit will be better.
3. Since the current at resonance is minimum, the parallel resonant circuit is called as rejector circuit.
4. The variation of the resistance does not affect the resonant frequency.

VIVA QUESTIONS:-

1) Define Resonance?

2) What is the quality factor of parallel RLC circuit?

3) What is Resonant condition in series RLC circuit?

4) Define quality factor?

5) What is half power frequencies?

6) What is the resonance frequency of parallel RLC circuit?

7) What is the band width of parallel RLC circuit?

8) What are the half power frequencies of parallel RLC circuit?

EXPT NO: 05 **DATE:**

DETERMINATION OF Z PARAMETERS

AIM: To determine open circuit impedance parameters (Z) of the given two port network.

BRIEF THEORY: In Z parameters of a two-port, the input & output voltages V1 & V2 can be expressed in terms of input & output currents I1 & I2. Out of four variables (i.e V1, V2, I1, I2) V1& V2 are dependent variables whereas I1 & I2 are independent variables. Thus,

$V_1 = Z_{11}I_1 + Z_{12} I_2$ (1)

$V_2 = Z_{21}I_1 + Z_{22} I_2$ (2)

Here Z_{11}& Z_{22} are the input & output driving point impedances while Z_{12}& Z_{21} are the reverse & forward transfer impedances.

APPARATUS:

S. No	**Name of the apparatus**	**Range**	**Type**	**Quantity**
1	Dual channel Regulated power supply	(0 – 30)V	-	1
2	Voltmeters	(0-10) V	MC	2
3	Ammeters	(0-10m) A	MC	2

4	Resistors	1k Ω 2.2 KΩ 470Ω	Carbon Composition	2 1 1
5	Bread board	-	-	1
6	Connecting wires	-	-	Required Number

PRECAUTIONS:

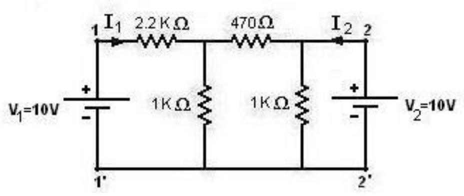
1. Initially keep the RPS output voltage knob in zero volt position.
2. Set the ammeter pointer to zero position.
3. Take the readings without parallax error.
4. Avoid loose connections.
5. Do not short-circuit the RPS output terminals.

PROCEDURE:

1. Connect the circuit as per the fig.
2. Adjust the output voltage of the regulated power supply to an appropriate value (Say 10V).
3. Note down the corresponding current (I_1) through the input port, $1\text{-}1^1$ and voltage (V_2) across the output port, $2\text{-}2^1$.
4. Reduce the voltage to zero, disconnect the circuit and calculate Z_{11} and Z_{21} using the formulae, $Z_{11}=V_1/I_1$ and $Z_{21}=V_2/I_1$.
5. Connect the circuit as per the fig .
6. Vary the R.P.S. output voltage to 5V, 10Vand 15V
7. Reduce the voltage to zero, disconnect the circuit and calculate Z_{22} and Z_{12} using the formulae, $Z_{22}=V_2/I_2$ and $Z_{12}=V_1/I_2$

DETERMINATION OF Z PARAMETERS

GIVEN CIRCUIT:



Theoretical circuit diagrams:

a) To find Z_{11}&Z_{21}:

Practical circuit diagrams:

a) To find Z_{11}&Z_{21}:

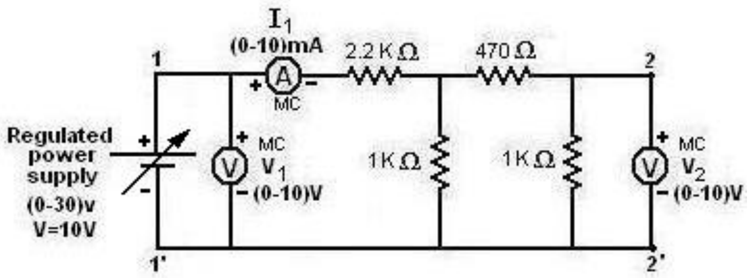


Fig.

Tabular Column:

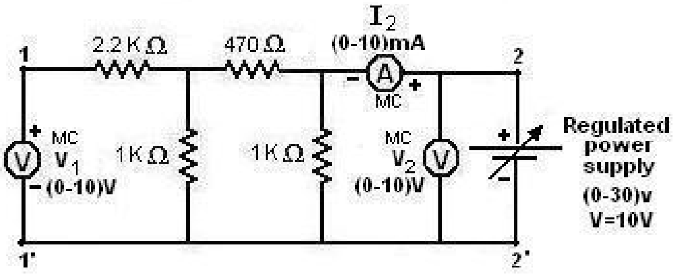
S. No	V_1 (Volts)	V_2 (Volts)	I_1 (mA)	$Z_{11} = \frac{V_1}{I_1}$ kΩ	$Z_{21} = \frac{V_2}{I_1}$ kΩ

Theoretical circuit diagrams:

b) To find Z_{22}&Z_{12}:

Practical circuit diagrams:

b) To find Z_{22}&Z_{12}:



S. No	V_1 (volts)	V_2 (volts)	I_2 (mA)	$z_{22} = \frac{V_2}{I_2} k\Omega$	$z_{12} = \frac{V_1}{I_2} k\Omega$

RESULT:

Open circuited impedance parameters are determined and are compared with theoretical values.

S.No	Parameter	Theoretical Values	Practical Values
1	Z_{11}		
2	Z_{12}		
3	Z_{21}		
4	Z_{22}		

CONCLUSIONS:

1. Since $Z_{12} = Z_{21}$ the given circuit is reciprocal.
2. Since $Z_{11} = Z_{22}$ the given circuit is symmetrical.
3. There is a small deviation between theoretical and practical values because internal resistances of source and meters are not considered.

EXPT NO:06 **DATE:**

DETERMINATION OF Y PARAMETERS

AIM: To determine Short circuit admittance parameters (Y) of the given two port network.

BRIEF THEORY : In Y parameters of a two-port , the input & output currents I_1&I_2can be expressed in terms of input & output voltages V_1& V_2 . Out of four variables (i.e I_1, I_2, V, V_2) I_1&$I_2$are dependent variables whereas V_1& V_2 are independentvariables.

$$I_1= Y_{11}V_1+Y_{12}V_2 \text{------------------------------------} (1)$$

$$I_2 = Y_{21}V_1+Y_{22}V_2 \text{----------------------------------} (2)$$

Here Y_{11}& Y_{22} are the input & output driving point admittances while Y_{12}& $Y_{21}$are the reverse & forward transfer admittances.

APPARATUS:

S. No	Name of the apparatus	Range	Type	Quantity
1	Dual channel Regulated power supply	(0 – 30)V	-	1
2	Voltmeters	(0-10) V	MC	2
3	Ammeters	(0-10m) A	MC	2
4	Resistors	1k Ω 2.2 KΩ 470Ω	Carbon Composition	2 1 1
5	Bread board	-	-	1
6	Connecting wires	-	-	Required Number

PRECAUTIONS:

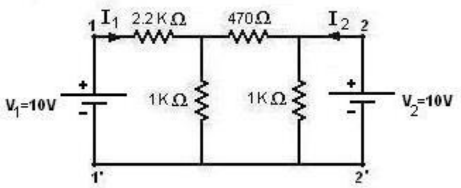
1. Initially keep the RPS output voltage knob in zero volt position.
2. Set the ammeter pointer to zero position.
3. Take the readings without parallax error.

4. Avoid loose connections.
5. Do not short-circuit the RPS output terminals.

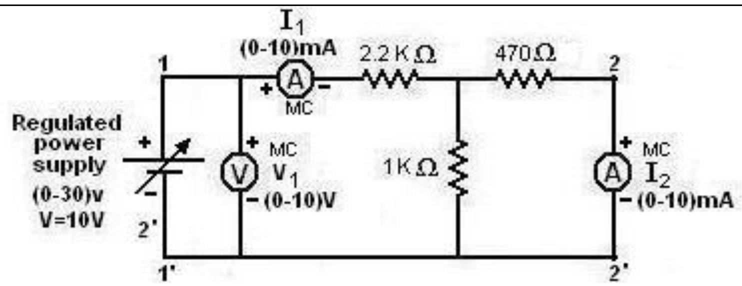
PROCEDURE:

1. Connect the circuit as per the fig.
2. Vary the R.P.S. output voltage to 5V, 10V and 15V.
3. Note down the corresponding currents through the input port I_1 and output port I_2.
4. Reduce the voltage to zero, disconnect the circuit and calculate Y_{11} and Y_{21} using the formulae,$Y_{11}=I_1/V_1$ and $Y_{21}=I_2/V_1$.
5. Connect the circuit as per the fig.
6. Vary the R.P.S. output voltage to 5V, 10V and 15V..
7. Note down the corresponding currents through the input port I_1 and output port I_2.
8. Reduce the voltage to zero, disconnect the circuit and calculate Y_{11} and Y_{21} using the formulae,$Y_{12}=I_1/V_2$ and $Y_{22}=I_2/V_2$.

GIVEN CIRCUIT:



Theoretical circuit diagrams:	**Practical circuit diagrams:**
A) <u>To find Y_{11}&Y_{21}</u>:	**B) <u>To find Y_{11}&Y_{21}</u>:**

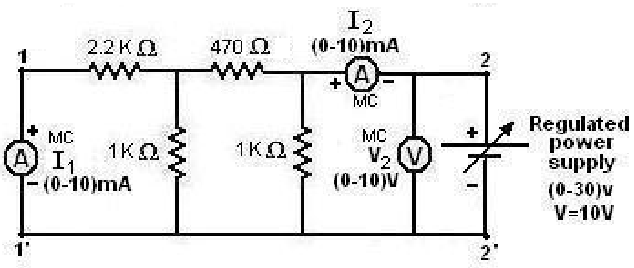


Tabular Column:

S. No	V_1 (volts)	I_2 (mA)	I_1 (mA)	$Y_{11} = \frac{I_1}{V_1}$ (mho)	$y_{21} = \frac{I_2}{V_1}$ (mho)

Theoretical circuit diagrams:	Practical circuit diagrams:
b)T**o find y_{22}&y_{12}:**	b) **To find y_{22}&y_{12}:**

.



S. No	V_2 (volts)	I_2 (mA)	I_1 (mA)	$y_{22} = \frac{I_2}{V_2}$ (mho)	$Y_{12} = \frac{I_1}{V_2}$ (mho)

RESULT:

Open circuited impedance and short circuit admittance parameters are determined and are compared with theoretical values.

S.No	Parameter	Theoretical Values	Practical Values

1	Y_{11}		
2	Y_{12}		
3	Y_{21}		
4	Y_{22}		

CONCLUSIONS:

4. Since $Y_{12} = Y_{21}$ the given circuit is reciprocal.
5. Since $Y_{11} = Y_{22}$ the given circuit is symmetrical.
6. There is a small deviation between theoretical and practical values because internal resistances of source and meters are not considered.

Expt. No.: 07 **Date:**

DETERMINATION OF ABCD PARAMETERS

AIM: To determine transmission parameters (ABCD) of the given two port network.

BRIEF THEORY: ABCD parameters are widely used in analysis of power transmission engineering where they are termed as "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,

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

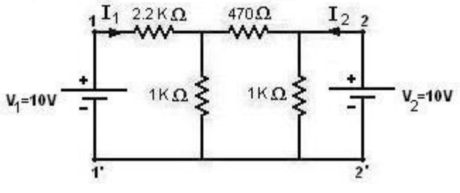
$$I_1 = CV_2 + D(-I_2)$$

Here "A" is called reverse voltage ratio, "B" is called transfer impedance "C" is called transfer admittance & "D" is called reverse currentratio.

APPARATUS:

S. No	Name of the apparatus	Range	Type	Quantity
1	Dual channel Regulated power supply	(0 – 30)V	-	1
2	Voltmeters	(0-10) V	MC	2
3	Ammeters	(0-10m) A	MC	2
4	Resistors	1k Ω 2.2 KΩ 470Ω	Carbon Composition	2 1 1
5	Bread board	-	-	1
6	Connecting wires	-	-	Required Number

Given Circuit



Theoretical circuit diagrams:

b) To find B&D:

Practical circuit diagrams:

b) To find B&D:

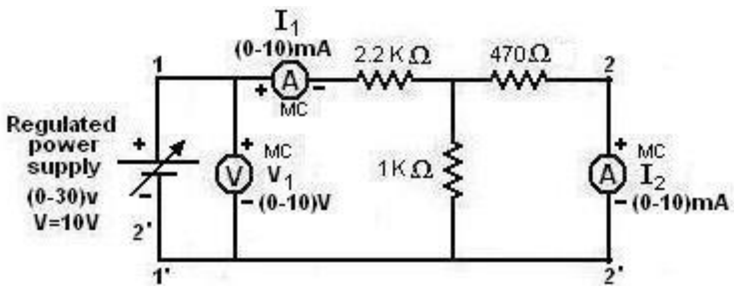


Fig.

Tabular Column:

S. No	V_1 (volts)	I_2 (mA)	I_1 (mA)	$B = \frac{V_1}{I_2}$ (kΩ)	$D = \frac{I_1}{I_2}$

Theoretical circuit diagrams:

b) To find A&C:

Practical circuit diagrams:

b) To find A & C:

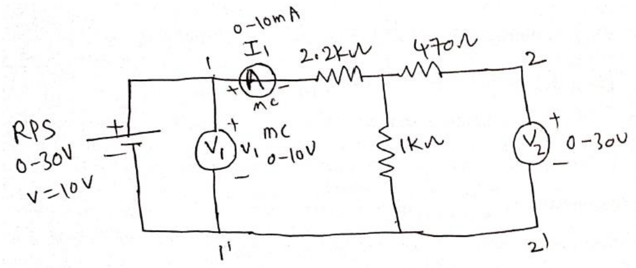


Fig.

Tabular Column:

S. No	V_1 (Volts)	V_2 (Volts)	I_1 (mA)	**A**=$\frac{V1}{V2}$	**C**=$\frac{I1}{V2}$

PROCEDURE:

1. Connect the circuit as per the fig.

2. Adjust the output voltage of the regulated power supply to an appropriate value (Say 10V).

3. Note down the corresponding current (I_1) through the input port, 1-1^1 and voltage (V_2) across the output port, 2-2^1.

4. Reduce the voltage to zero, disconnect the circuit and calculate A and C using the formulae, A=v1/v2 and C=I1/V2.

5. Connect the circuit as per the fig.

6. Vary the R.P.S. output voltage to 5V, 10Vand 15V

7. Note down the corresponding current (I_2) through the output port 2-2^1 and voltages (V_1& V_2) across the input port 1-1^1& output port 2.2^1resp'y.

8. Reduce the voltage to zero, disconnect the circuit and calculate B and D using the formulae, B=V1/I2and $D=I_1/I_2$

9. Connect the circuit as per the fig.

10. Vary the R.P.S. output voltage to 5V, 10V and 15V.

11. Note down the corresponding currents through the input port I_1 and output port I_2.

12. Reduce the voltage to zero, disconnect the circuit and calculate h_{11} and h_{21} using the formulae,$h_{11}=V_1/I_1$ and $h_{21}=I_2/I_1$.

13. Connect the circuit as per the fig.

14. Vary the R.P.S. output voltage to 5V, 10V and 15V..

15. Note down the corresponding currents through the input port I_1 and output port I_2.

16. Reduce the voltage to zero, disconnect the circuit and calculate h_{22} and h_{12} using the formulae,$h_{22}=I_2/V_2$ and $h_{12}=V_1/V_2$.

PRECAUTIONS:

1. Initially keep the RPS output voltage knob in zero volt position.

2. Set the ammeter pointer to zero position.

3. Take the readings without parallax error.

4. Avoid loose connections.

5. Do not short-circuit the RPS output terminals.

RESULT:

Transmission parameters are determined and are compared with theoretical values.

S.No	Parameter	Theoretical Values	Practical Values
1	A		
2	B		
3	C		
4	D		

CONCLUSIONS:

Expt. No.: 08 **Date:**

DETERMINATION OF H PARAMETERS

AIM: To determine hybrid parameters (h) of the given two port network.

BRIEF THEORY: In 'h' parameters of a two port network, voltage of the input port and the current of the output port are expressed in terms of the current of the input port and the voltage of the output port. Due to this reason, these parameters are called as 'hybrid' parameters, i.e. out of four variables (i.e. V_1, V2, I1, I2) V_1, I_2 are dependent variables.

Thus,

$V_1 = h_{11}I_1 + h_{12}V_2$ --(1)

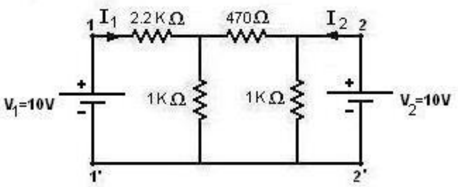
$I_2 = h_{21}I_1 + h_{22}V_{22}$ --(2)

H_{11} and H_{22} are input impedance and output admittance.

H_{21} and H12 are forward current gain and reverse voltage gain.

APPARATUS:

S. No	Name of the apparatus	Range	Type	Quantity
1	Dual channel Regulated power supply	(0 – 30)V	-	1
2	Voltmeters	(0-10) V	MC	2
3	Ammeters	(0-10m) A	MC	2
4	Resistors	1k Ω 2.2 KΩ 470Ω	Carbon Composition	2 1 1
5	Bread board	-	-	1
6	Connecting wires	-	-	Required Number



Theoretical circuit diagrams:

a) To find h_{11} & h_{21}:

$\because h11 = \frac{V_1}{I_1} =$

$\because h21 = \frac{I_2}{I_1} =$

Practical circuit diagrams:

a) To find h_{11} & h_{21}

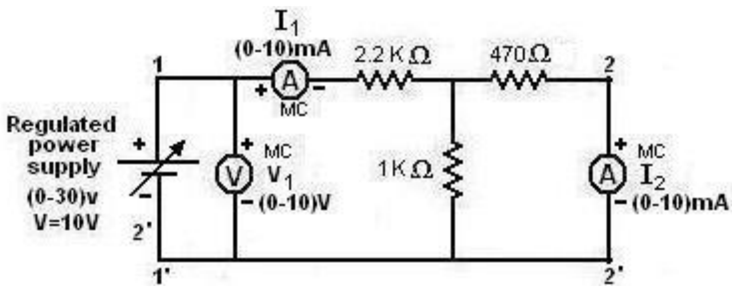


Fig.

Tabular Column:

S. No	V_1 (volts)	I_2 (mA)	I_1 (mA)	$h11 = \frac{V_1}{I_1}$ (kΩ)	$h21 = \frac{I_2}{I_1}$

)To find h_{12} & h_{22}:

$$h_{12} = \frac{V_1}{V_2}$$

$$h_{22} = \frac{I_2}{V_2}$$

) To find h_{12} & h_{22}:

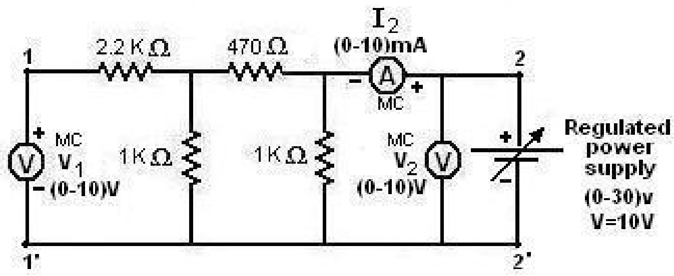


Fig. (3.4)

S. No	V_1 (volts)	V_2 (volts)	I_2 (mA)	$h12 = \frac{V_1}{V_2}$	$h22 = \frac{I_2}{V_2}$

PROCEDURE:

1. Connect the circuit as per the fig.

2. Vary the R.P.S. output voltage to 5V, 10V and 15V.

3. Note down the corresponding currents through the input port I_1 and output port I_2.

4. Reduce the voltage to zero, disconnect the circuit and calculate h_{11} and h_{21} using the formulae,$h_{11}=V_1/I_1$ and $h_{21}=I_2/I_1$.

5. Connect the circuit as per the fig.

6. Vary the R.P.S. output voltage to 5V, 10V and 15V..

7. Note down the corresponding currents through the input port I_1 and output port I_2.

8. Reduce the voltage to zero, disconnect the circuit and calculate h_{22} and h_{12} using the formulae,$h_{22}=I_2/V_2$ and $h_{12}=V_1/V_2$.

PRECAUTIONS:

1. Initially keep the RPS output voltage knob in zero volt position.

2. Set the ammeter pointer to zero position.

3. Take the readings without parallax error.

4. Avoid loose connections.

5. Do not short-circuit the RPS output terminals.

RESULT:

Hybrid parameters are determined and are compared with theoretical values.

S.No	Parameter	Theoretical Values	Practical Values
1	h_{11}		
2	h_{12}		
3	h_{21}		

4	h_{22}		

CONCLUSIONS:

1. Since $Z_{12} = Z_{21}$ and $Y_{12} = Y_{21}$ the given circuit is reciprocal.
2. Since $Z_{11} = Z_{22}$ and $Y_{11} = Y_{22}$ the given circuit is symmetrical.
3. There is a small deviation between theoretical and practical values because internal resistances of source and meters are not considered.
4.

Expt. No.: 09 **Date:**

DETERMINATION OF COEFFICIENT OF COUPLING

AIM: To determine the coefficient of coupling of the given 1-ϕtransformer.

APPARATUS:

S. No	Name of the apparatus	Range	Type	Quantity
1	Single phase transformer	230V / 115V, 2KVA	-	1No
2	1-ϕ auto transformer	230V / 0-270V,10A, 2.7 KVA	-	1No
3	Ammeter	(0-2) A	MI	1 No
4	Voltmeter	(0-600) / (0-300) V	MI	1No
5	Wattmeter	0-150 / 300 / 600V 2.5 / 5A, LPF	DM	1No
6	3-ϕ auto transformer	415 /0-470V, 10A, 4.7 KVA	-	1No
7	Connecting wires	-	-	Required number

PROCEDURE:

1. Connect the circuit as per the fig.
2. Apply 230V across the primary winding by varying the knob of autotransformer slowly.
3. Note down the corresponding voltmeter, ammeter, and wattmeter readings.
4. Calculate the self-inductance, L_1 of the primary coil with the help of above readings.
5. Disconnect the circuit and connect the circuit as per the fig.
6. Apply 115V across the secondary winding by varying the knob of autotransformer slowly.
7. Note down the corresponding voltmeter, ammeter, and wattmeter readings.
8. Calculate the self-inductance, L_2 of the secondary coil with the help of above readings.
9. Disconnect the circuit and connect the circuit as per the fig .
10. Apply 345V across the cumulatively coupled windings by varying the knob of 3-ϕautotransformer slowly.
11. Note down the corresponding voltmeter, ammeter, and wattmeter readings.
12. Calculate the equivalent inductance, L_A of the windings with the help of above readings.
13. Disconnect the circuit and connect the circuit as per the fig .

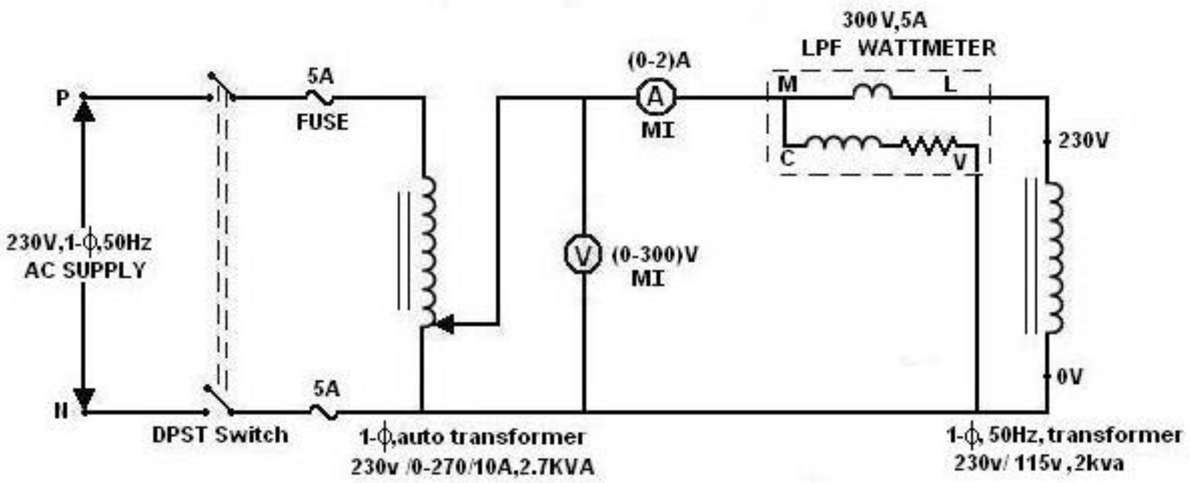
14. Apply 115V across the differentially coupled windings by varying the knob of 1-ϕautotransformer slowly.
15. Note down the corresponding voltmeter, ammeter, and wattmeter readings and disconnect the circuit.
16. Calculate the equivalent inductance, L_B of the windings with the help of above readings.
17. Calculate Mutual inductance M, and coefficient of coupling K, using the values of L_1, L_2, L_A, L_B.

PRECAUTIONS:

1. Ensure the minimum position of autotransformer during power on and off.
2. Set the ammeter pointer at zero position.
3. Take the readings with out parallax error.
4. Avoid loose connections.

CIRCUIT DIAGRAMS:

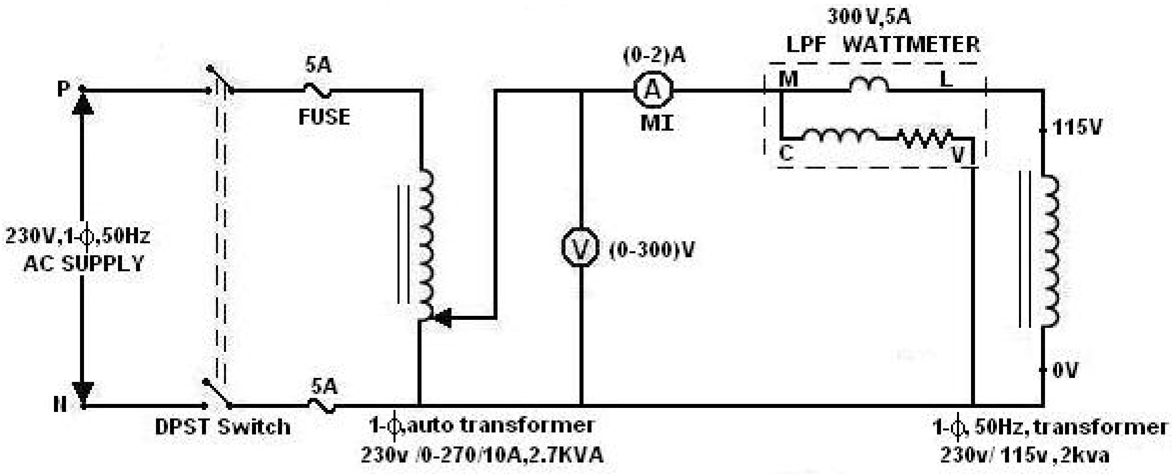
a) To determine the self inductance of coil 1:



Tabular column:

S.No	V_1 (Volts)	I_1 (amp)	W_1 (Watt)	$Z_1 = \frac{V_1}{I_1}\Omega$	$R_1 = \frac{W_1}{I_1^2}\Omega$	$X_{L_1} = \sqrt{Z_1^2 - R_1^2}\Omega$	$L_1 = \frac{X_{L_1}}{2\pi f}H$

b) To determine the self inductance of coil 2:



Tabular column:

S.No	V_2 (Volts)	I_2 (amp)	W2 (Watt)				

RESULT:

The coefficient of coupling K is determined for the given 1-ϕtransformer.

CONCLUSION:

The coefficient of coupling, K of the given 1-ϕ iron cored transformer is less than unity.

CIRCUIT DIAGRAM :

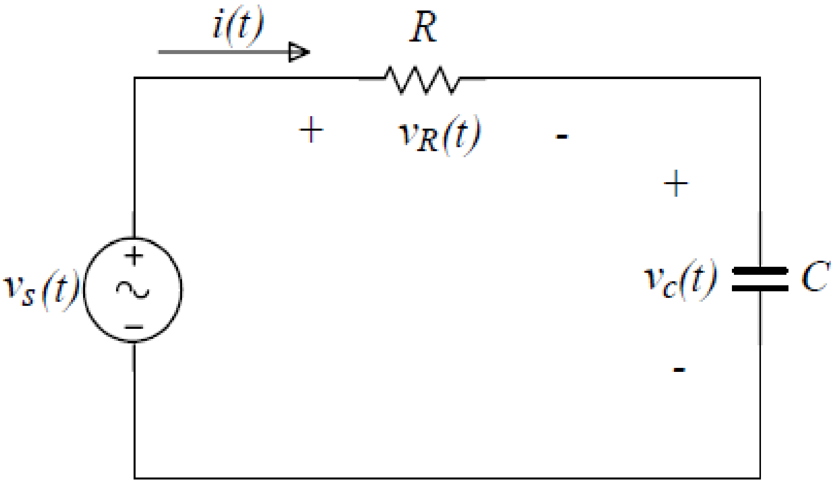


Figure 1. Series RC circuit driven by a sinusoidal forcing function

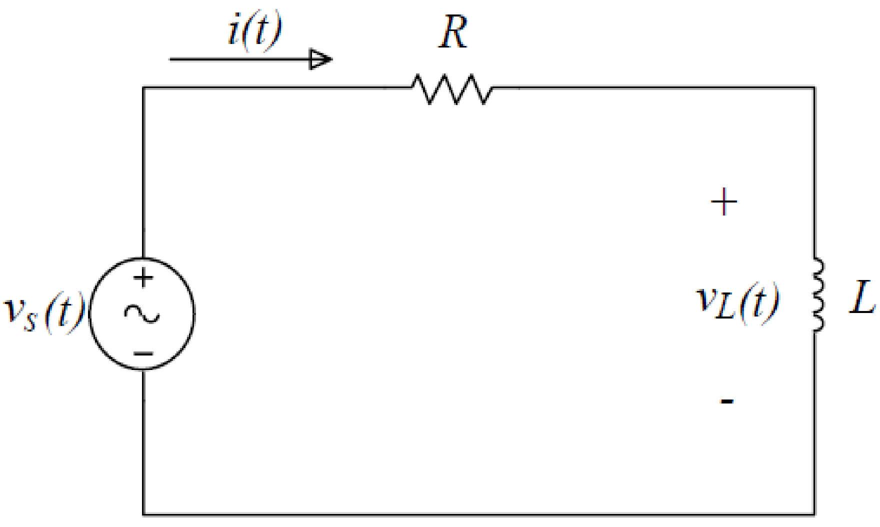


Figure 2: Series RL circuit driven by a sinusoidal forcing function

Expt. No.: 10 Date:

Exp. No.:	Response Analysis of R, RL and RLC circuits with sinusoidal excitations
Date:	

Aim:

To determine the sinusoidal response of series RL and RC circuit with sinusoidal excitations

Apparatus:

S. No.	Name of the Equipment	Range	Type	Quantity
1	Function generator			1
2	Bread Board			1
3	Resistor			1
4	Inductor			1
5	Capacitor			1
6	Connecting Wires			--

PROCEDURE :

(1) Connect the apparatus as per the circuit diagram.

(2) Apply a sinusoidal voltage using function generator.

(3) Note down current with different frequencies

(4) Switch off the supply and disconnect the circuit

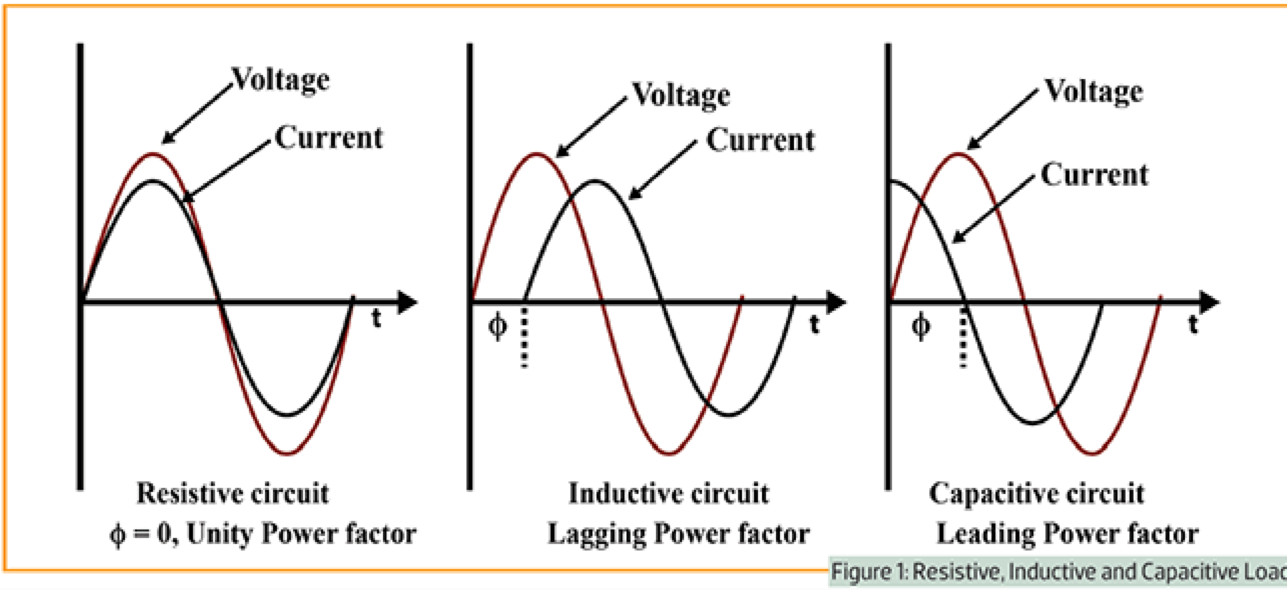


Figure 1: Resistive, Inductive and Capacitive Loads

Result:

SIMULATION EXPERIENTS

Exp. No.: 11 **Date:**

SIMULATION OF D.C. CIRCUIT

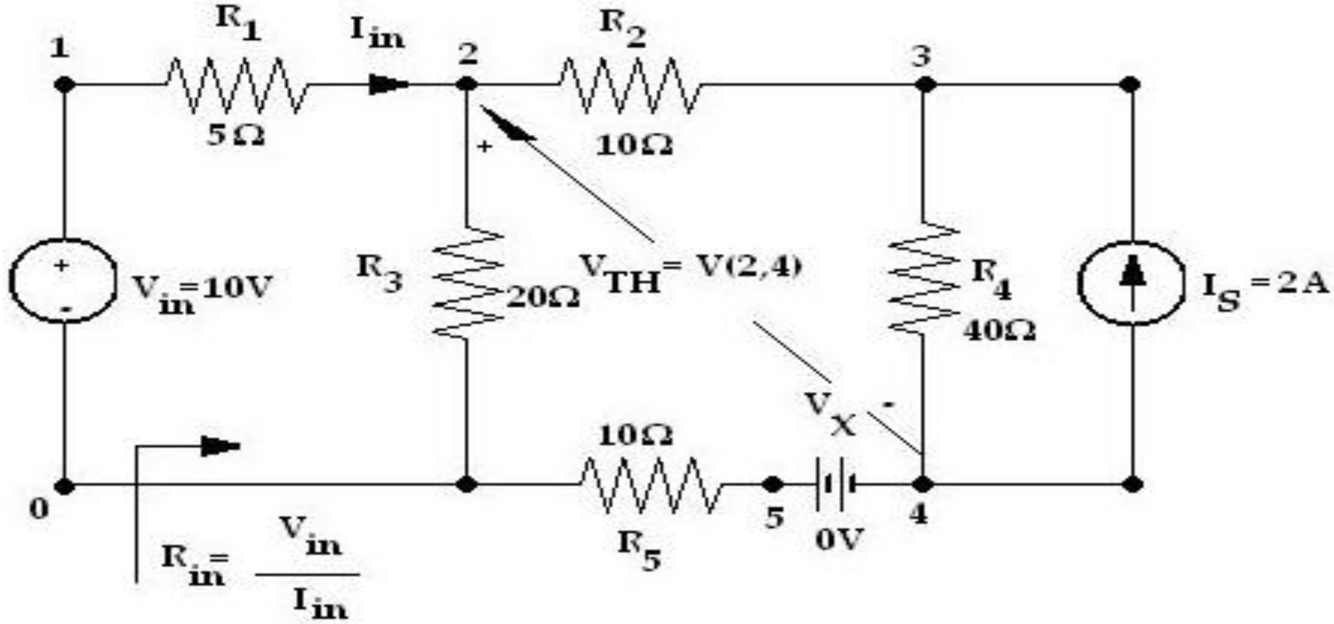
AIM: To Simulate the DC Circuit for determining the Thevenin's equivalent circuit using PSPICE.

SOFTWARE REQUIRED: **PSPICE – P**ersonal Computer **S**imulated **P**rogramwith **I**ntegrated **C**ircuit **E**mphasis.

DATA REQUIRED FOR DRAWING CIRCUIT DIAGRAM:

A DC Circuit is as shown in the figure. It Consists of Voltage Source whose Value is **10V;** the Current source has the Value of **2A.** It has the resistance values as **5Ω**, **10Ω, 20Ω, 40Ω, and10Ω** respectively. Use PSPICE to plot and calculate the Thevenin's Equivalent Circuit across thenodes **2** and **4.**Obtain the transfer function between the two nodes **2** and **4.**

CIRCUIT DIAGRAM:



PROCEDURE:

1. Open PSPICE A/D windows
2. Create a new circuit file
3. Enter the program representing the nodal interconnections of various components
4. Run the program
5. Observe the response through all the elements in the output file
6. Observe the voltage, current graph of any in probe window

PROGRAM

THEVENINS THEOREM:

V_{IN}1 0 dc 10V
I_S 4 3 2A
V_X 4 5 dc 0V
$R_1$1 2 5
R_2 2 3 10
$R_3$2 0 20
R_4 3 4 40
$R_5$5 0 10
.TF V(2,4) V_{IN}
.END

THEORETICAL CALCULATIONS

RESULT:

VIVA QUESTIONS:

1. What is V_{th} or Thevenin's voltage?
2. How equivalent impedance is calculated in Thevenin Theorem?
3. What are internal resistance of an ideal voltage source and an ideal current source?
4. State Thevenin's theorem?
5. What are active elements and passive elements?
6. What are non linear elements and give examples?
7. Can you find maximum power transferred to the load by using Thevenins theorem?
8. Write the formulae to convert a current source into voltage source?
9. Write the formulae to convert a voltage source into current source?
10. Define KVL and KCL?

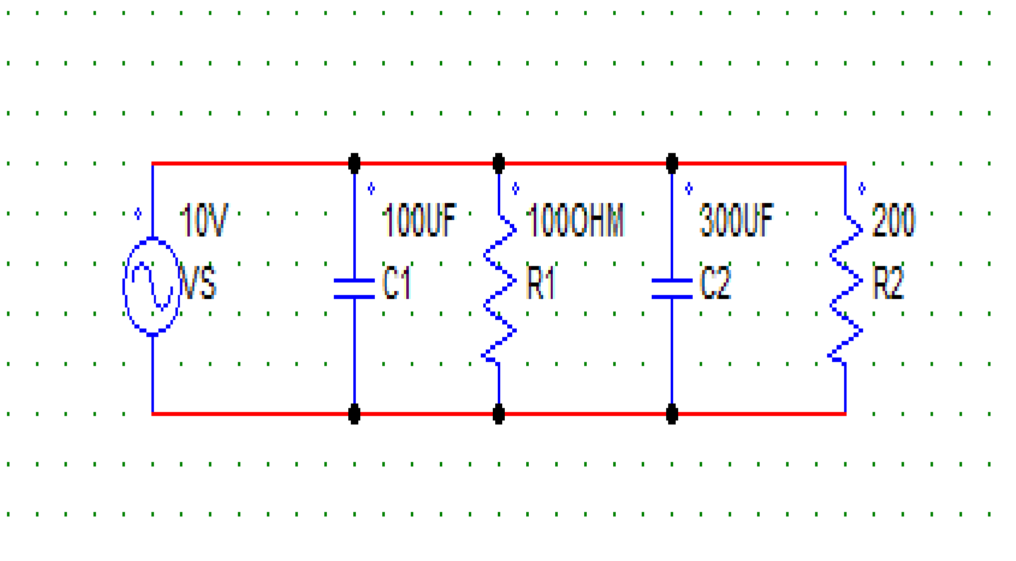
Exp. No.:12 **Date:**

SIMULATION OF AC CIRCUITS

AIM: **T**o calculate the responce for the ac circuits.

SOFTWARE REQUIRED: PSPICE – Personal Computer **S**imulated **P**rogramwith **I**ntegrated **C**ircuit **E**mphasis.

Circuit diagram:



Program:

VS 1 0 AC 10V

C1 1 0 100U

R1 1 0 100

C2 1 0 300U

R2 1 0 200

.AC LIN 1 50 100

.PRINT AC IM(VS) IP(VS) IM(C1) IP(C1)

.END

Output:

Result: