

DEMONSTRATION

on

**Electrical Circuit Analysis Lab (II-I)
(20A02601P)**

By

Mr. S.Guru Prasad

Associate Professor

**DEPT. OF E.E.E, VEMU IT
CHITTOOR**

Vision of the institute

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

Mission of the institute

Mission_1: 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.

Mission_2: To facilitate the learners to foster innovative ideas, inculcate competent research and consultancy skills through Industry-Institute Interaction.

Mission_3: 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

Mission_1: To produce competent Electrical and Electronics Engineers with strong core knowledge, design experience & exposure to research by providing quality teaching and learning environment..

Mission_2: To train the students in emerging technologies through state - of - the art laboratories and thus bridge the gap between Industry and academia.

Mission_3: 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

Programme Educational Objectives

(PEOs)

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.

Programme Outcome (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.

Programme Specific Outcome(PSOs)

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)

(20A02601P) ELECTRICAL CIRCUIT ANALYSIS LABORATORY

DEPT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Course Outcomes:

CO1. Analyze & Experimentally verify various resonance phenomenon.

CO2. Apply and experimentally analyze two port network parameters

CO3. Analysis of R, RL and RLC circuits with different excitations

List of Experiments:

1. Series Resonance
2. Parallel Resonance
3. Determination of Z Parameters
4. Determination of Y Parameters
5. Transmission Parameters
6. Hybrid Parameters
7. Determination of Coefficient of coupling
8. Response Analysis of R, RL and RLC circuits with sinusoidal and non-sinusoidal excitations.

Additional experients

10. Simulation of DC Circuits
11. Simulation of AC Circuits

S.No	Name of the experiment
1	Series Resonance
2	Parallel Resonance
3	Z Parameters
4	Y Parameters
5	ABCD Parameters
6	Hybrid parameters
7	Determination of Coefficient of Coupling
8	Response Analysis of R, RL and RLC circuits with sinusoidal and non-sinusoidal excitations
9	Simulation of DC Circuits
10	Simulation of AC Circuits

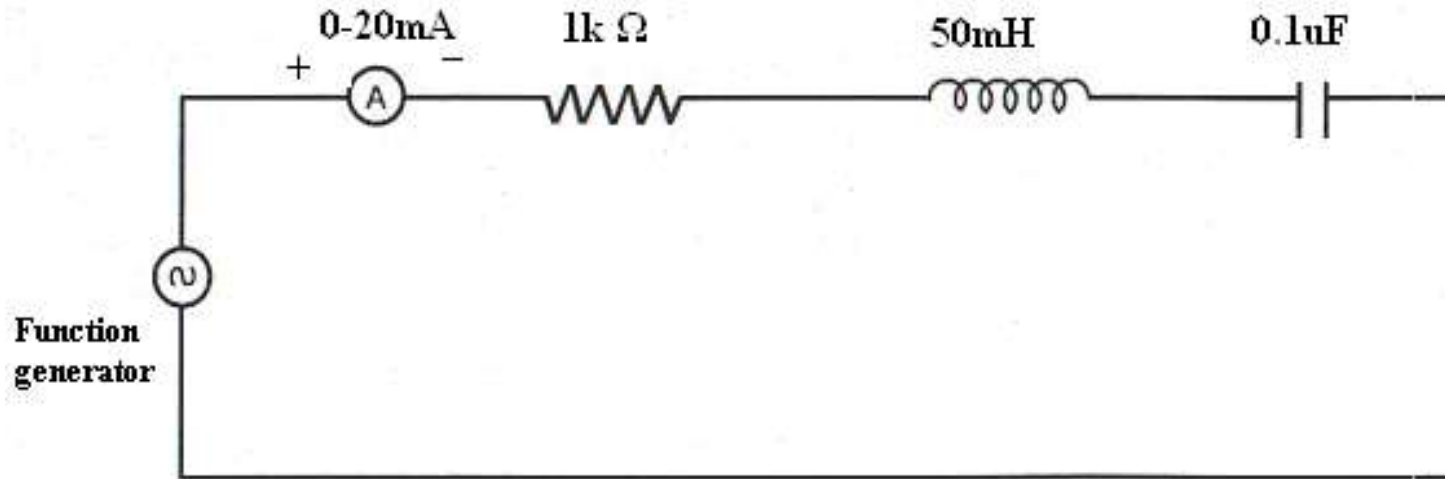
Ex.No. 1. SERIES RESONANCE

AIM: To find the resonant frequency, quality factor and bandwidth of a given series resonant circuits.

APPARATUS REQUIRED:

S.No	Name Of The Equipment	Range	Type	Quantity
1	Bread board	-	-	1 NO
2	Resistor	1k Ω	-	1 NO
3	Inductor	50 mH	-	1 NO
4	Capacitors	0.1 μ F	-	1 NO
5	CRO	20MHz.Dual CH	-	1 NO
6	Function generator	100-10MHz	-	1 NO
7	Ammeter	0-20mA	Digital	1 NO
8	Connecting wires			Required number

CIRCUIT DIAGRAM: SERIES RESONANCE:



THEORY:

Resonance is a particular type of phenomenon inherently found normally in every kind of system, electrical, mechanical, optical, Acoustical and even atomic. There are several definitions of resonance. But, the most frequently used definition of resonance in electrical system is studied state operation of a circuit or system at that frequency for which the resultant response is in time phase with the forcing function.

SERIES RESONANCE:

A circuit is said to be under resonance, when the applied voltage „V“ and current are in phase. Thus a series RLC circuit, under resonance behaves like a pure resistance network and the reactance of the circuit should be zero. Since V & I are in phase, the power factor is unity at resonance.

The frequency at which the resonance will occur is known as resonant frequency. Resonant frequency,

Thus at resonance the impedance Z is minimum. Since $I = V/Z$. The current is maximum So that current amplification takes place. Quality factor is the ratio of reactance power inductor(or) capacitor to its resistance.

THEORITICAL CALCULATIONS:

For Series Resonance circuit

1. Resonant frequency $f_r = \frac{1}{2\pi\sqrt{LC}}$
2. Lower Cut off Frequency $f_1 = f_r - (R/4\pi L)$
3. Upper Cut off Frequency $f_2 = f_r + (R/4\pi L)$
4. Band width = $f_2 - f_1$:
5. Quality factor $Q = \frac{\omega_0 L}{R} = \frac{2\pi f_r L}{R}$
6. Current at Resonance $I_o = V_{R0}/R$

PROCEDURE:

- ❑ Connect the circuit as shown in fig.1 for series resonant circuit & fig.2 for parallel resonant circuit.
- ❑ Set the voltage of the signal from function generator to 5V.
- ❑ Vary the frequency of the signal over a wide range in steps and note down the corresponding ammeter readings.
- ❑ Observe that the current first increases & then decreases in case of series resonant circuit & the value of frequency corresponding to maximum current is equal to resonant frequency.
- ❑ Observe that the current first decreases & then increases in case of parallel resonant circuit & the value of frequency corresponding to minimum current is equal to resonant frequency.
- ❑ Draw a graph between frequency and current & calculate the values of bandwidth & quality factor.

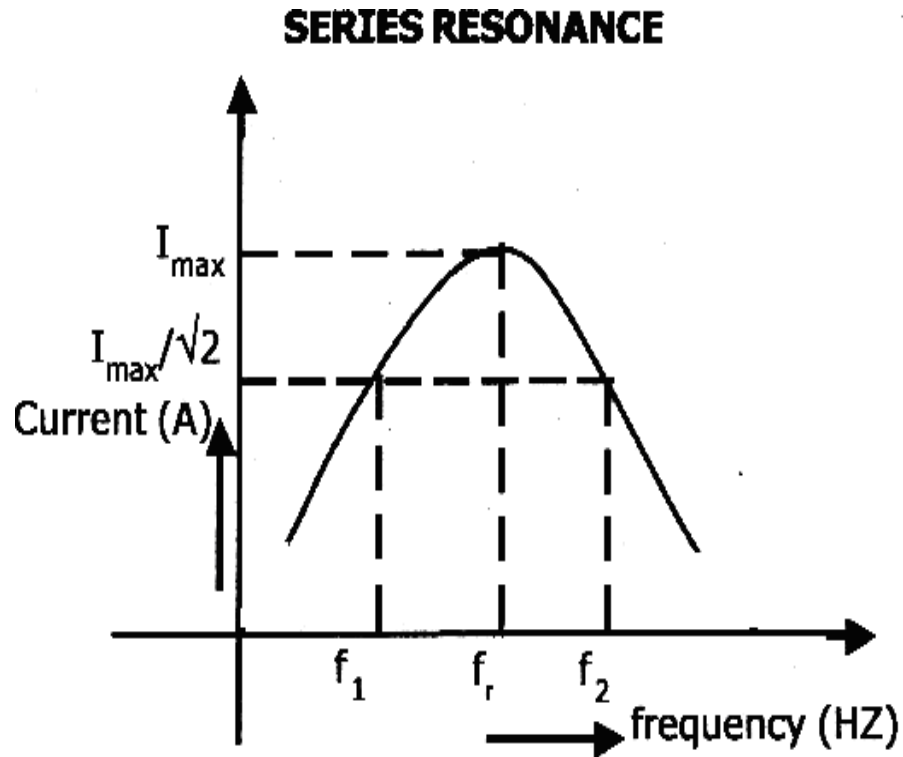
OBSERVATION TABLE:
Series Resonance:

S. No.	Frequency (Hz)	Current (mA)

TABULAR COLUMN:

S.NO	PARAMETER	Series resonant circuit	
		Theoretical	Practical
1	Resonant Frequency(f_r)		
2	Band width		
3	Quality factor		

MODEL GRAPHS:



f_1 = lower cutoff frequency

f_2 = upper cutoff frequency

f_r = Resonant frequency

RESULT:

VIVA QUESTIONS:

- 1) What is resonance of circuit?
- 2) What is series resonance?
- 3) What is parallel resonance?
- 4) What is cut-off frequency?
- 5) Define bandwidth and Quality factor?

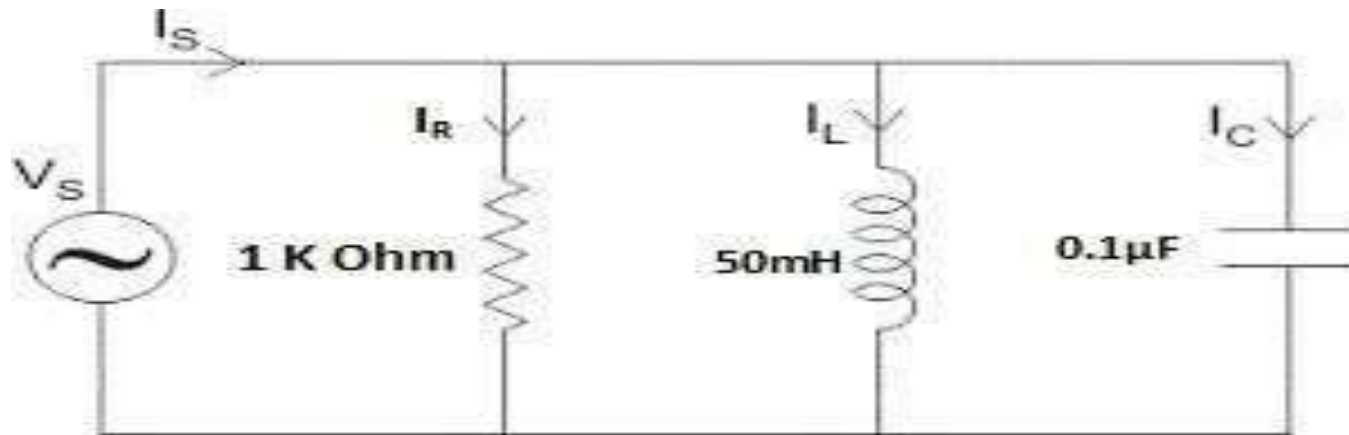
Ex.No. 2. PARALLEL RESONANCE

AIM: To find the resonant frequency, quality factor and bandwidth of a given parallel resonant circuits.

APPARATUS REQUIRED:

S.No	Name Of The Equipment	Range	Type	Quantity
1	Bread board	-	-	1 NO
2	Resistor	1k Ω	-	1 NO
3	Inductor	50 mH	-	1 NO
4	Capacitors	0.1 μ F	-	1 NO
5	CRO	20MHz.Dual CH	-	1 NO
6	Function generator	100-10MHz	-	1 NO
7	Ammeter	0-20mA	Digital	1 NO
8	Connecting wires			Required number

CIRCUIT DIAGRAM: PARALLEL RESONANCE:



THEORY:

Resonance is a particular type of phenomenon inherently found normally in every kind of system, electrical, mechanical, optical, Acoustical and even atomic. There are several definitions of resonance. But, the most frequently used definition of resonance in electrical system is studied state operation of a circuit or system at that frequency for which the resultant response is in time phase with the forcing function.

PARALLEL RESONANCE:

In the circuit (parallel RLC circuit) shown in figure.2, the condition for resonance occurs when the susceptance part is zero. The frequency at which the resonance will occur is known as resonant frequency.

Thus at resonance the admittance(Y) is Minimum and voltage is Maximum. However the performance of such a circuit is of interest in the general subject of resonance. Lower cut-off frequency is above the resonant frequency at which the current is reduced to 1 by root two times of its minimum value. Upper cut-off frequency is above. Quality factor is the ratio of resistance to reactance of inductor (or) capacitor. Selectivity is the reciprocal of the quality factors.

THEORITICAL CALCULATIONS:

For Parallel Resonance circuit

1. Resonant frequency $f_r = \frac{1}{2\pi\sqrt{LC}}$
2. Lower Cut off Frequency $f_1 = \{1/2\pi\} \{(-1/2RC) + ((1/2RC)^2 + (1/LC))^{0.5}\}$
3. Upper Cut off Frequency $f_2 = \{1/2\pi\} \{(1/2RC) + ((1/2RC)^2 + (1/LC))^{0.5}\}$
4. Band width = $f_2 - f_1$:
5. Quality factor $Q = \frac{\omega_0 L}{R} = \frac{2\pi f_r L}{R}$
6. Current at Resonance $I_o = V_{R0}/R$

PROCEDURE:

- ❑ Connect the circuit as shown in fig.1 for series resonant circuit & fig.2 for parallel resonant circuit.
- ❑ Set the voltage of the signal from function generator to 5V.
- ❑ Vary the frequency of the signal over a wide range in steps and note down the corresponding ammeter readings.
- ❑ Observe that the current first increases & then decreases in case of series resonant circuit & the value of frequency corresponding to maximum current is equal to resonant frequency.
- ❑ Observe that the current first decreases & then increases in case of parallel resonant circuit & the value of frequency corresponding to minimum current is equal to resonant frequency.
- ❑ Draw a graph between frequency and current & calculate the values of bandwidth & quality factor.

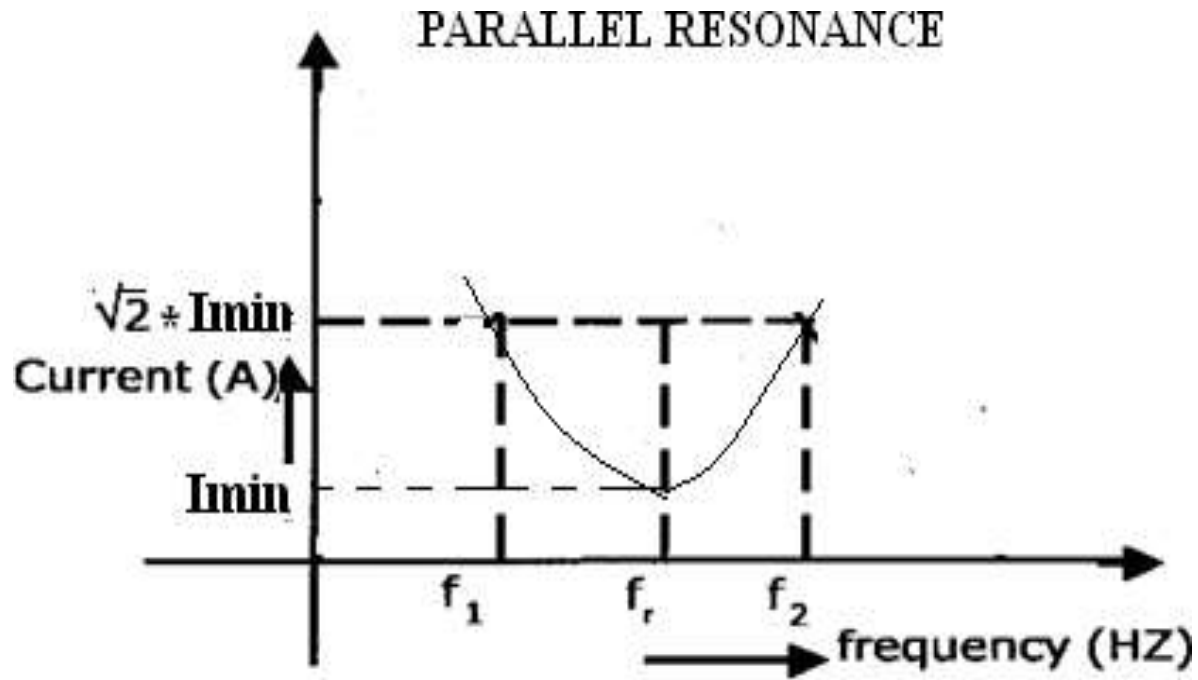
OBSERVATION TABLE:
Parallel Resonance:

S. No.	Frequency (Hz)	Current (mA)

TABULAR COLUMN:

S.NO	PARAMETER	Parallel resonant circuit	
		Theoretical	Practical
1	Resonant Frequency(f_r)		
2	Band width		
3	Quality factor		

MODEL GRAPHS:



f_1 = lower cutoff frequency

f_2 = upper cutoff frequency

f_r = Resonant frequency

RESULT:

VIVA QUESTIONS:

- 1) What is resonance of circuit?
- 2) What is series resonance?
- 3) What is parallel resonance?
- 4) What is cut-off frequency?
- 5) Define bandwidth and Quality factor?

Ex.No. 3. Z PARAMETERS

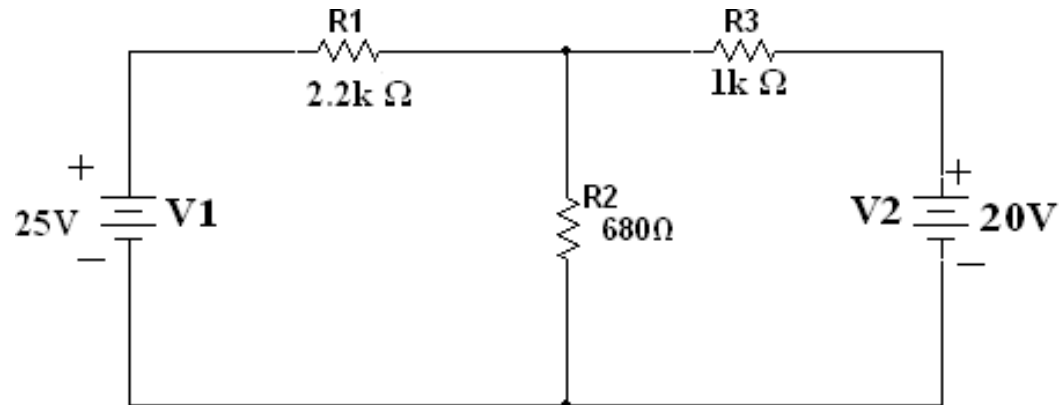
AIM: To determine the Impedance (Z) and admittance (Y) parameters of a two port network.

APPARATUS REQUIRED:

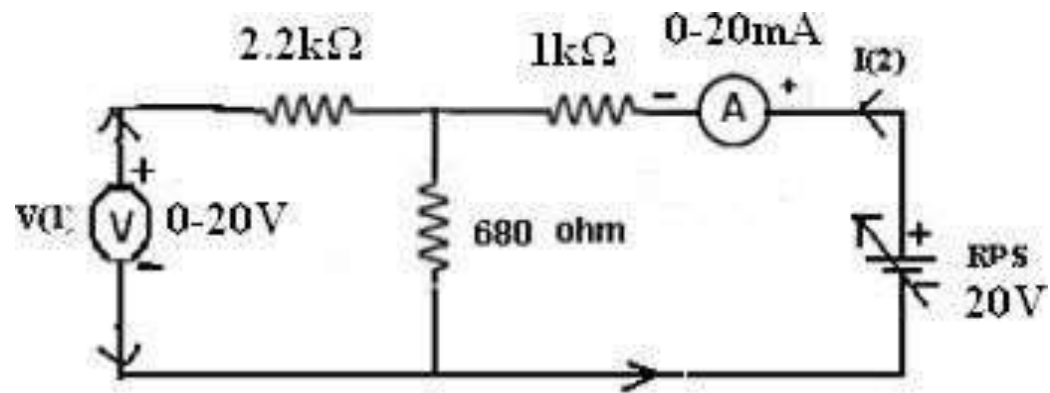
S.No	Name Of The Equipment	Range	Type	Quantity
1	Voltmeter	(0-20)V	Digital	1 NO
2	Ammeter	(0-20)Ma	Digital	1 NO
3	RPS	0-30V	Digital	1 NO
4	Resistors	2.2k Ω	-	1 NO
		1k Ω	-	1 NO
		680 Ω	-	1 NO

CIRCUIT DIAGRAMS:

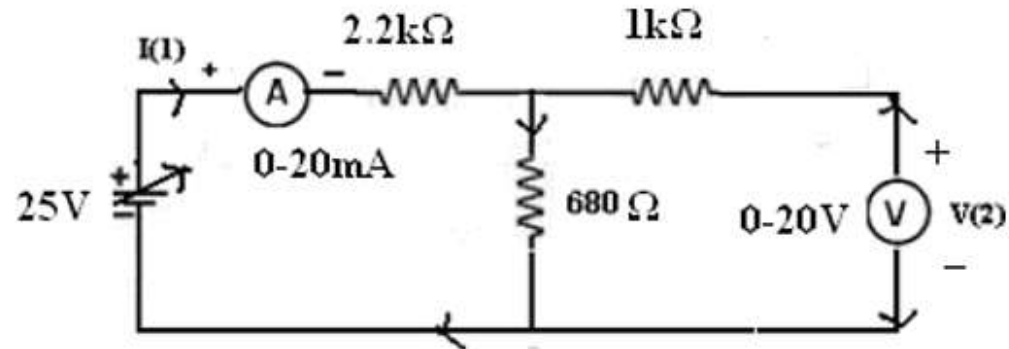
GIVEN CIRCUIT:



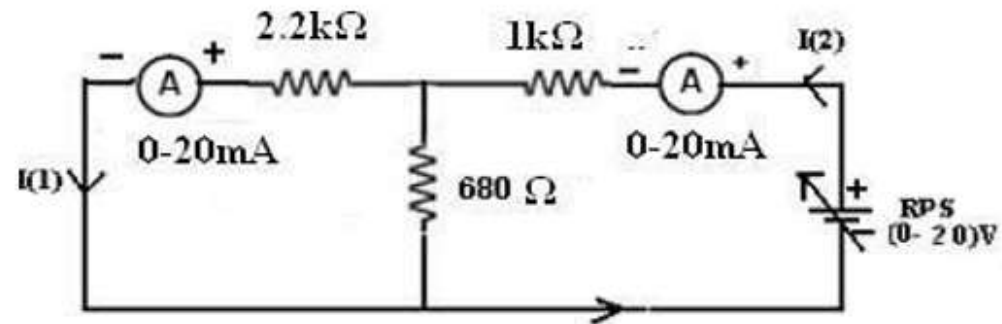
PRACTICAL CIRCUITS:



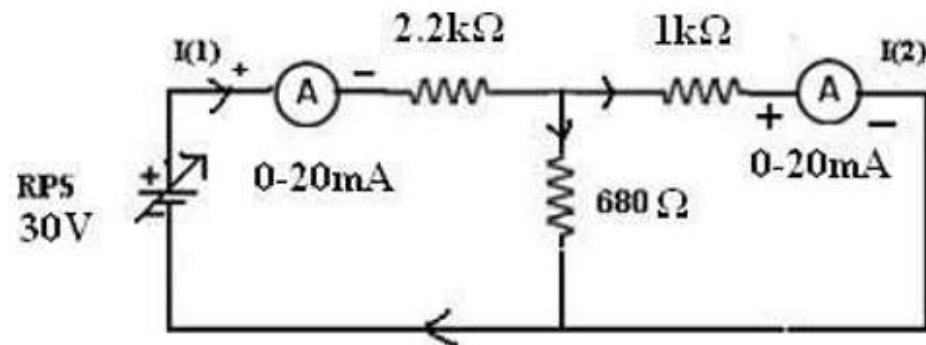
3. When $I_2 = 0$:



4. When $V_1 = 0$:



5. When $V_2 = 0$:



THEORY:

A pair of terminals between which a signal may enter or leave the network is known as port. If a network has one such type pair of terminals it is known as One-Port Network and that have two such type of ports is known as Two-Port Network.

If we relate the voltage of one port to the current of the same port, we get driving point admittance. On the other hand, if we relate the voltage of one port to the current at another port, we get transfer admittance. Admittance is a general term used to represent either the impedance or the admittance of a network. We will consider a general two-port network composed of linear, bilateral elements and no independent sources. The voltage and current at port -1 are V_1 and I_1 and at port -2 are V_2 and I_2 . The position of V_1 and V_2 and the directions of I_1 and I_2 are customarily selected. Out of four variables only two are independent. The other two are expressed in terms of the independent variable of network parameters. The relation between the voltages and currents in terms of Z and Y parameters are as follows.

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

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

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

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

Z PARAMETERS:

$$Z_{11} = V_1 / I_1 \text{ } I_2 = 0$$

$$Z_{12} = V_1 / I_2 \text{ } I_1 = 0$$

$$Z_{21} = V_2 / I_1 \text{ } I_2 = 0$$

$$Z_{22} = V_2 / I_2 \text{ } I_1 = 0$$

PROCEDURE:

1. Connections are made as per the circuit diagram.
 2. Open circuit the port – 1 i.e., $I_1=0$, find the values of V_1 , I_2 and V_2 .
 3. Short circuit the port-1 i.e. $V_1 =0$, find the values of V_2 , I_1 and I_2 .
 4. Open circuit the port – 2 i.e., $I_2=0$, find the values of V_1 , I_1 and V_2 .
 5. Short circuit the port-2 i.e. $V_2 =0$, find the values of V_1 , I_1 and I_2 .
5. Find the Z and Y parameters of the given two port network.

Z-PARAMETERS

Z-parameters	Theoretical	Practical
$Z_{11} = \frac{V_1}{I_1} \bigg _{I_2=0}$		
$Z_{12} = \frac{V_1}{I_2} \bigg _{I_1=0}$		
$Z_{21} = \frac{V_2}{I_1} \bigg _{I_2=0}$		
$Z_{22} = \frac{V_2}{I_2} \bigg _{I_1=0}$		

PRECAUTIONS:

1. Initially keep the RPS output voltage knob in zero volt position.
2. Avoid loose connections.
3. Avoid short circuit of RPS output terminals.

RESULT:

VIVA QUESTIONS:

1. Define Port?
2. Define Z parameters?
3. What is the condition for symmetry in case Z parameters?
4. Define characteristic impedance?
5. What is the condition for reciprocity in case Z parameters?

Ex.No. 4. Y PARAMETERS

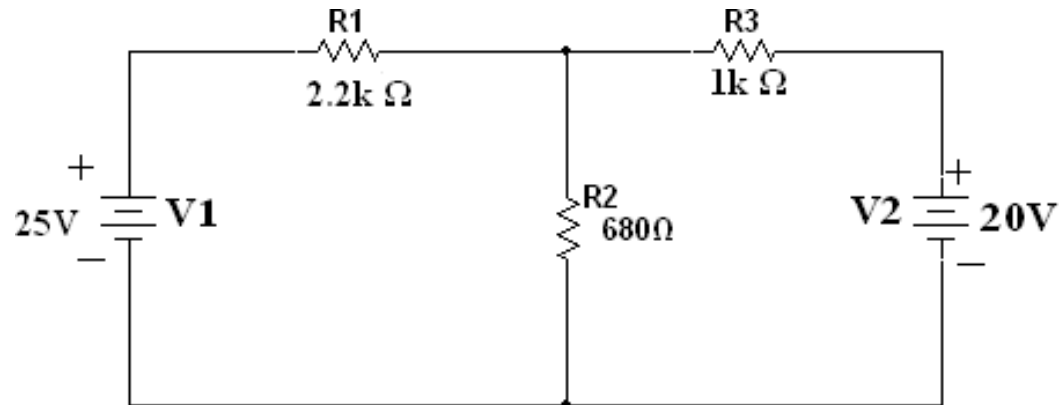
AIM: To determine the Impedance (Z) and admittance (Y) parameters of a two port network.

APPARATUS REQUIRED:

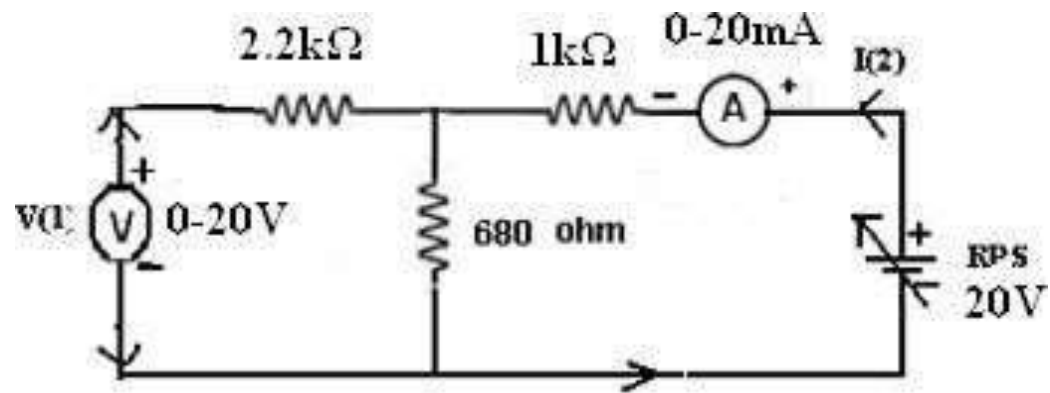
S.No	Name Of The Equipment	Range	Type	Quantity
1	Voltmeter	(0-20)V	Digital	1 NO
2	Ammeter	(0-20)Ma	Digital	1 NO
3	RPS	0-30V	Digital	1 NO
4	Resistors	2.2k Ω	-	1 NO
		1k Ω	-	1 NO
		680 Ω	-	1 NO

CIRCUIT DIAGRAMS:

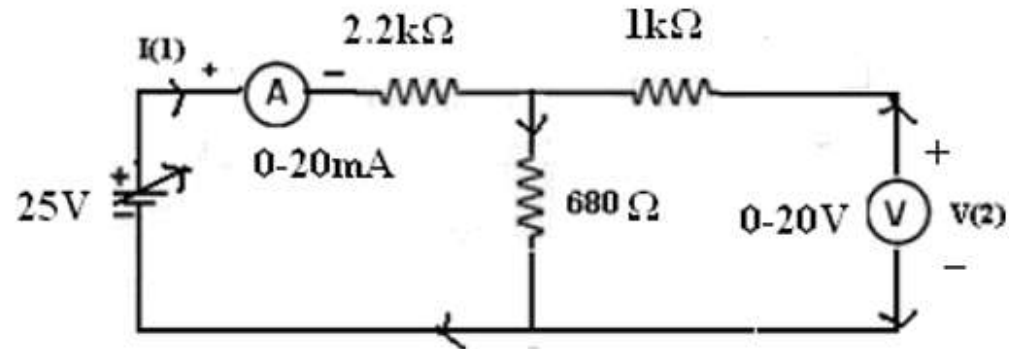
GIVEN CIRCUIT:



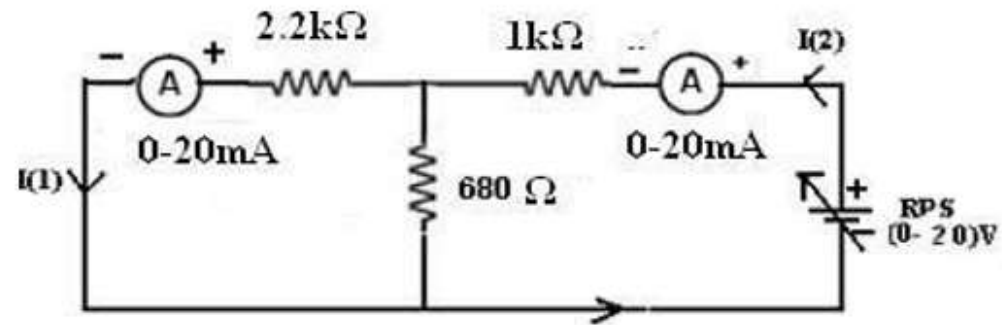
PRACTICAL CIRCUITS:



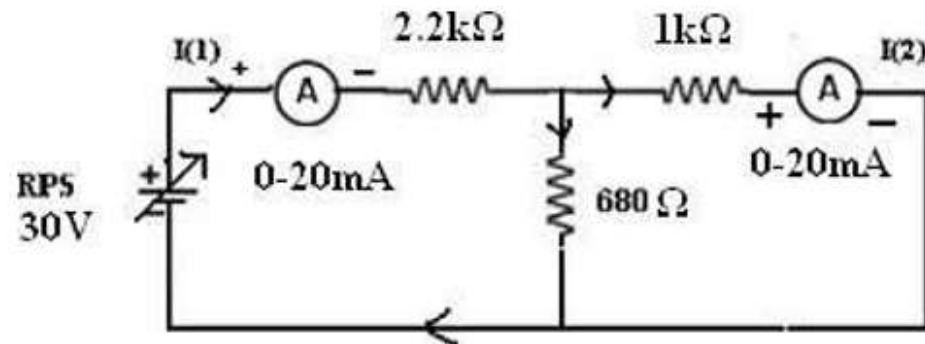
3. When $I_2 = 0$:



4. When $V_1 = 0$:



5. When $V_2 = 0$:



THEORY:

A pair of terminals between which a signal may enter or leave the network is known as port. If a network has one such type pair of terminals it is known as One-Port Network and that have two such type of ports is known as Two-Port Network.

If we relate the voltage of one port to the current of the same port, we get driving point admittance. On the other hand, if we relate the voltage of one port to the current at another port, we get transfer admittance. Admittance is a general term used to represent either the impedance or the admittance of a network. We will consider a general two-port network composed of linear, bilateral elements and no independent sources. The voltage and current at port -1 are V_1 and I_1 and at port -2 are V_2 and I_2 . The position of V_1 and V_2 and the directions of I_1 and I_2 are customarily selected. Out of four variables only two are independent. The other two are expressed in terms of the independent variable of network parameters. The relation between the voltages and currents in terms of Z and Y parameters are as follows.

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

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

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

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

Y-PARAMETERS:

$$Y_{11} = \frac{I_1}{V_1} / V_2 = 0$$

$$Y_{12} = \frac{I_2}{V_1} / V_1 = 0$$

$$Y_{21} = \frac{I_1}{V_2} / V_2 = 0$$

$$Y_{22} = \frac{I_2}{V_2} / V_1 = 0$$

PROCEDURE:

1. Connections are made as per the circuit diagram.
2. Open circuit the port – 1 i.e., $I_1=0$, find the values of V_1 , I_2 and V_2 .
3. Short circuit the port-1 i.e. $V_1 = 0$, find the values of V_2 , I_1 and I_2 .
4. Open circuit the port – 2 i.e., $I_2=0$, find the values of V_1 , I_1 and V_2 .
5. Short circuit the port-2 i.e. $V_2 = 0$, find the values of V_1 , I_1 and I_2 .
5. Find the Z and Y parameters of the given two port network.

Y-PARAMETERS

Y-Parameters	Theoretical	Practical
I_1 $Y_{11} = I_1 / V_1 \text{ at } V_2 = 0$		
I_2 $Y_{12} = I_2 / V_1 \text{ at } V_2 = 0$		
I_2 $Y_{21} = I_2 / V_2 \text{ at } V_1 = 0$		
I_2 $Y_{22} = I_2 / V_2 \text{ at } V_1 = 0$		

PRECAUTIONS:

1. Initially keep the RPS output voltage knob in zero volt position.
2. Avoid loose connections.
3. Avoid short circuit of RPS output terminals.

RESULT:

VIVA QUESTIONS:

1. Define Port?
2. Define Y parameters?
3. What is the condition for symmetry in case Y parameters?
4. Define characteristic impedance?
5. What is the condition for reciprocity in case Y parameters?

Ex.No. 5. ABCD PARAMETERS

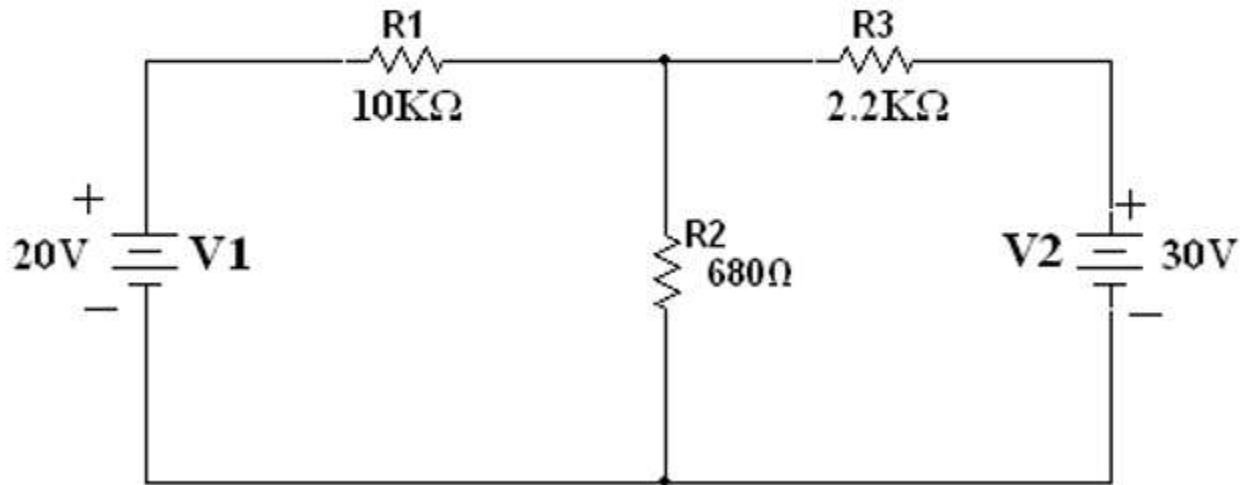
AIM: To determine the ABCD parameters of a two port network.

APPARATUS REQUIRED:

S.No	Name Of The Equipment	Range	Type	Quantity
1	Voltmeter	(0-20)V	Digital	1 NO
2	Ammeter	(0-20)mA	Digital	1 NO
3	RPS	0-30V	Digital	1 NO
4	Resistors	10K Ω		1 NO
		2.2 Ω		1 NO
		680 Ω		1 NO
5	Breadboard	-	-	1 NO
6	Connecting wires			Required number

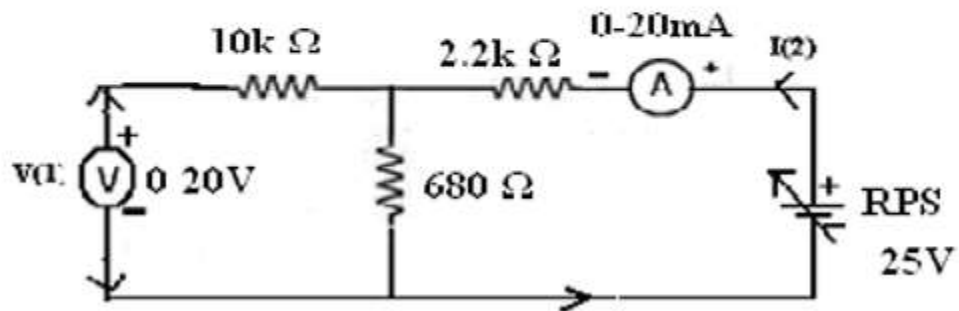
CIRCUIT DIAGRAMS:

GIVEN CIRCUIT:

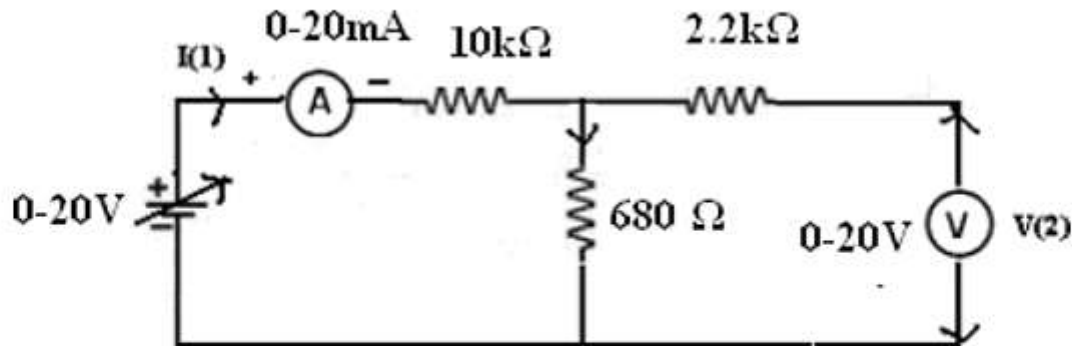


PRACTICAL CIRCUITS:

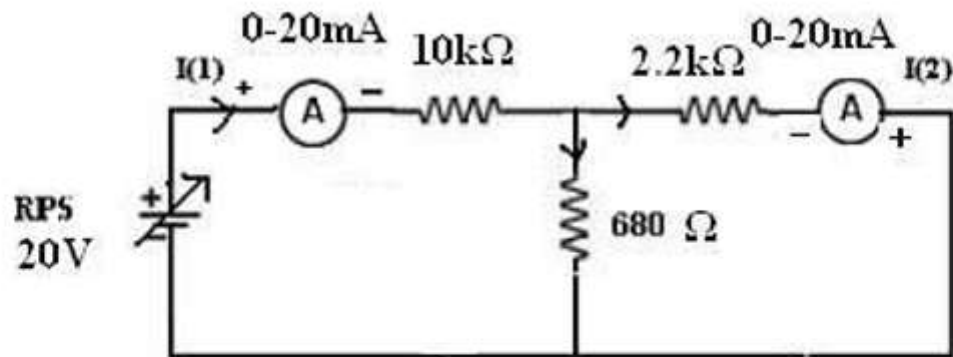
1. When $I_1 = 0$:



2. When $I_2 = 0$:



3. When $V_2 = 0$:



THEORY:

The relation between the voltages and currents of a two port network in terms of ABCD and h-parameters is given as follows.

ABCD PARAMETERS:

$$V_1 = AV_2 - BI_2$$

$$I_1 = CV_2 - DI_2$$

H-PARAMETERS

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

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

ABCD PARAMETERS:

$$A = \frac{V_1}{V_2} \Big|_{I_2 = 0}$$

$$B = \frac{V_1}{I_2} \Big|_{V_2 = 0}$$

$$C = \frac{I_1}{V_2} \Big|_{I_2 = 0}$$

$$D = \frac{I_1}{I_2} \Big|_{V_2 = 0}$$

H-PARAMETERS:

$$h_{11} = \frac{v_1}{I_1} \bigg|_{V_2 = 0}$$

$$h_{12} = \frac{v_1}{I_2} \bigg|_{I_1 = 0}$$

$$h_{21} = \frac{V_2}{I_1} \bigg|_{V_2 = 0}$$

$$h_{22} = \frac{V_2}{I_2} \bigg|_{I_1 = 0}$$

PROCEDURE:

1. Connections are made as per the circuit diagram.
2. Open circuit the port – 1 i.e., $I_1=0$ find the values of V_1 , I_2 and V_2 .
3. Short circuit the port-1 $V_1 =0$ find the values of V_2 , I_1 and I_2 .
4. Open circuit the port – 2 i.e., $I_2=0$ find the values of V_1 , I_1 and V_2 .
5. Short circuit the port-2 i.e. $V_2 =0$ find the values of V_1 , I_1 and I_2
5. Find the ABCD and h-parameters of the given two port network from the above data.

THEORITICAL VALUES:

$V_2 = 0$	$V_1 =$	$I_1 =$	$I_2 =$
$I_1 = 0$	$V_1 =$	$V_2 =$	$I_2 =$
$I_2 = 0$	$V_1 =$	$V_2 =$	$I_1 =$

PRACTICAL VALUES:

$V_2 = 0$	$V_1 =$	$I_1 =$	$I_2 =$
$I_1 = 0$	$V_1 =$	$V_2 =$	$I_2 =$
$I_2 = 0$	$V_1 =$	$V_2 =$	$I_1 =$

ABCD-PARAMETERS:

T-Parameters	Theoretical	Practical
$A = \frac{V_1}{V_2} \Big I_2 = 0$		
$B = \frac{V_1}{I_2} \Big V_2 = 0$		
$C = \frac{I_1}{V_2} \Big I_2 = 0$		
$D = \frac{I_1}{I_2} \Big V_2 = 0$		

**H- PARAMETERS:**

H-Parameters	Theoretical	Practical
$h_{11} = \frac{V_1}{I_1} \Big V_2 = 0$		
$h_{12} = \frac{V_1}{V_2} \Big I_1 = 0$		
$h_{21} = \frac{I_2}{I_1} \Big V_2 = 0$		
$h_{22} = \frac{I_2}{V_2} \Big I_1 = 0$		

RESULT:

VIVA QUESTIONS

Define Port?

What is the condition for symmetry in case ABCD (T) parameters?

Define characteristic impedance?

What is the condition for reciprocity in case ABCD (T) parameters?

Ex.No. 6. H PARAMETERS

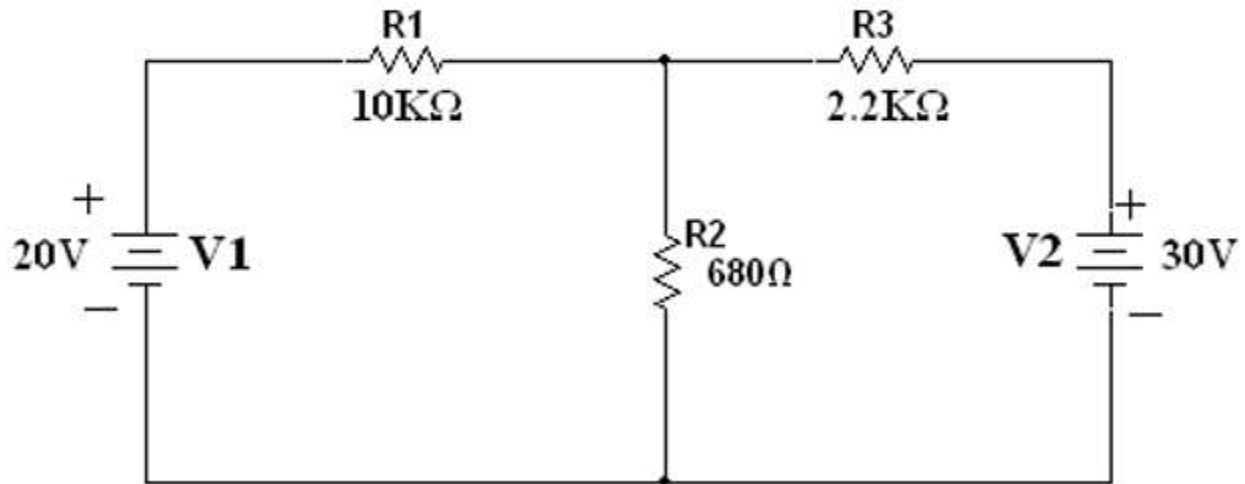
AIM: To determine the ABCD parameters of a two port network.

APPARATUS REQUIRED:

S.No	Name Of The Equipment	Range	Type	Quantity
1	Voltmeter	(0-20)V	Digital	1 NO
2	Ammeter	(0-20)mA	Digital	1 NO
3	RPS	0-30V	Digital	1 NO
4	Resistors	10K Ω		1 NO
		2.2 Ω		1 NO
		680 Ω		1 NO
5	Breadboard	-	-	1 NO
6	Connecting wires			Required number

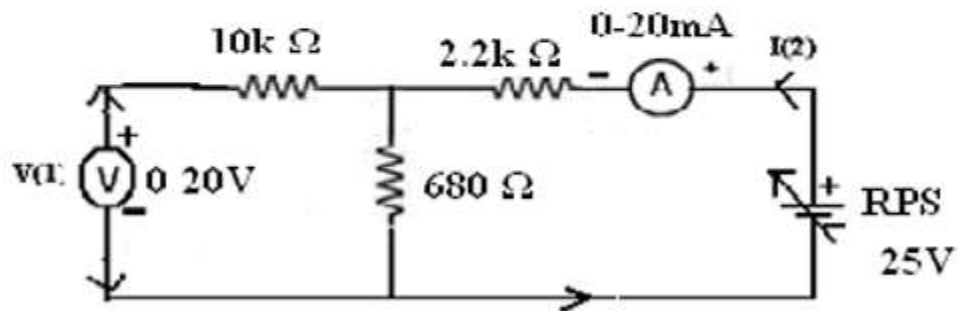
CIRCUIT DIAGRAMS:

GIVEN CIRCUIT:

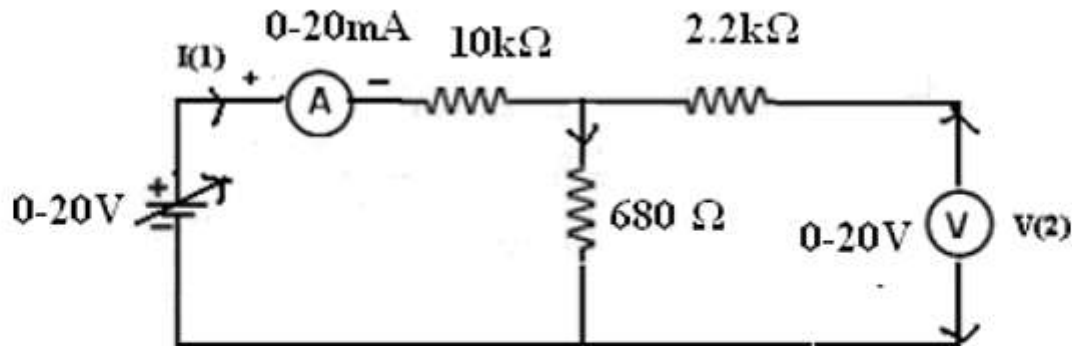


PRACTICAL CIRCUITS:

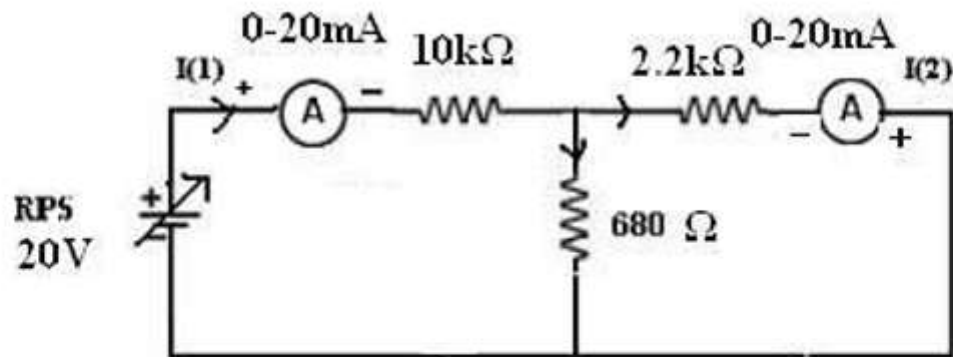
1. When $I_1 = 0$:



2. When $I_2 = 0$:



3. When $V_2 = 0$:



THEORY:

The relation between the voltages and currents of a two port network in terms of ABCD and h-parameters is given as follows.

ABCD PARAMETERS:

$$V_1 = AV_2 - BI_2$$

$$I_1 = CV_2 - DI_2$$

H-PARAMETERS

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

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

ABCD PARAMETERS:

$$A = \frac{V_1}{V_2} \Big|_{I_2 = 0}$$

$$B = \frac{V_1}{I_2} \Big|_{V_2 = 0}$$

$$C = \frac{I_1}{V_2} \Big|_{I_2 = 0}$$

$$D = \frac{I_1}{I_2} \Big|_{V_2 = 0}$$

H-PARAMETERS:

$$h_{11} = \frac{v_1}{I_1} \Big|_{V_2 = 0}$$

$$h_{12} = \frac{v_1}{I_2} \Big|_{I_1 = 0}$$

$$h_{21} = \frac{V_2}{I_1} \Big|_{V_2 = 0}$$

$$h_{22} = \frac{V_2}{I_2} \Big|_{I_1 = 0}$$

PROCEDURE:

1. Connections are made as per the circuit diagram.
2. Open circuit the port – 1 i.e., $I_1=0$ find the values of V_1 , I_2 and V_2 .
3. Short circuit the port-1 $V_1 =0$ find the values of V_2 , I_1 and I_2 .
4. Open circuit the port – 2 i.e., $I_2=0$ find the values of V_1 , I_1 and V_2 .
5. Short circuit the port-2 i.e. $V_2 =0$ find the values of V_1 , I_1 and I_2
5. Find the ABCD and h-parameters of the given two port network from the above data.

THEORITICAL VALUES:

$V_2 = 0$	$V_1 =$	$I_1 =$	$I_2 =$
$I_1 = 0$	$V_1 =$	$V_2 =$	$I_2 =$
$I_2 = 0$	$V_1 =$	$V_2 =$	$I_1 =$

PRACTICAL VALUES:

$V_2 = 0$	$V_1 =$	$I_1 =$	$I_2 =$
$I_1 = 0$	$V_1 =$	$V_2 =$	$I_2 =$
$I_2 = 0$	$V_1 =$	$V_2 =$	$I_1 =$

ABCD-PARAMETERS:

T-Parameters	Theoretical	Practical
$A = \frac{V_1}{V_2} \Big I_2 = 0$		
$B = \frac{V_1}{I_2} \Big V_2 = 0$		
$C = \frac{I_1}{V_2} \Big I_2 = 0$		
$D = \frac{I_1}{I_2} \Big V_2 = 0$		

**H- PARAMETERS:**

H-Parameters	Theoretical	Practical
$h_{11} = \frac{V_1}{I_1} \Big V_2 = 0$		
$h_{12} = \frac{V_1}{V_2} \Big I_1 = 0$		
$h_{21} = \frac{I_2}{I_1} \Big V_2 = 0$		
$h_{22} = \frac{I_2}{V_2} \Big I_1 = 0$		

RESULT:

VIVA QUESTIONS

Define Port?

What is the condition for symmetry in case H-parameters parameters?

Define characteristic impedance?

What is the condition for reciprocity in case Hybrid (h) parameters?

Ex.No. 7. DETERMINATION OF COEFFICIENT OF COUPLING

Ex.No. 8. RESPONSE ANALYSIS OF R, RL AND RLC CIRCUITS WITH SINUSOIDAL AND NON-SINUSOIDAL EXCITATIONS

THANK YOU

