AMIRAJ
COLLEGE OF ENGINEERING & TECHNOLOGY

LABORATORY MANUAL

ELECTRICAL CIRCUIT ANALYSIS

SUBJECT CODE: 3130906

ELECTRICAL ENGINEERING DEPARTMENT

B.E. 3RD SEMESTER

NAME:____

ENROLLMENT NO: ________________________________

BATCH NO: ____________________________________

YEAR: ______________________________________

Amiraj College of Engineering and Technology,
Nr.Tata Nano Plant, Khoraj, Sanand, Ahmedabad.

AMIRAJ

COLLEGE OF ENGINEERING & TECHNOLOGY

Amiraj College of Engineering and Technology,

Nr.Tata Nano Plant, Khoraj, Sanand, Ahmedabad.

CERTIFICATE

This is to certify that Mr. / Ms. ____ Of class____________________ Enrolment No ___________________________has Satisfactorily completed the course in ____________________________________as by the Gujarat Technological University for ____ Year (B.E.) semester___ of Electrical Engineering in the Academic year_________.

Date of Submission:-

Faculty Name and Signature

(Subject Teacher)

Head of Department

(Electrical)

AMIRAJ
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SUBJECT: ELECTRICAL CIRCUIT ANALYSIS

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List of Experiments

Sr. No.	Title	Date of Performance	Date of submission	Sign	Remarks
1	TO PERFORM THE OHMS LAW EXPERIMENT AND VERIFY THE VALUE OF RESISTOR.				
2	TO PERFORM SERIES & PARALLEL CONNECTION OF RESISTOR AND CAPACITOR.				
3	TO MEASURE AND CALCULATE CURRENTS AND VOLTAGES FOR A GIVEN RESISTIVE CIRCUIT AND VERIFY KCL AND KVL.				
4	TO PERFORM STAR TO DELTA CONNECTION OF RESISTOR.				
5	VERIFICATION OF SUPER POSITION THEOREM				
6	VERIFICATION OF THEVENIN’S THEOREM				
7	VERIFICATION OF NORTON’S THEOREM				
8	VERIFICATION OF MAXIMUM POWER TRANSFER THEOREM				
9	VERIFICATION OF RECIPROCITY THEOREM				
10	VERIFICATION OF TWO PORT PARAMETERS FOR DIFFERENT NETWORK				

PRACTICAL NO: - 1 DATE:

AIM: To perform the Ohms Law experiment and verify the value of Resistor.

APPARATUS :

1) Experimental training kit
2) DC Voltmeter (0-20Vdc)
3) Connecting wires
4) DC Ammeter (0-50mA)

THEORY :

Ohm's law is represented by following equation

$$R = V / I$$

Here, **"R"** is resistance (Ohm), **"V"** is voltage across resistor (Volt) and **"I"** is current flowing through the resistor (Amp.)

PROCEDURE :

1) Connect the (0-50mA) milliammeter & (0-20V) voltmeter as shown in figure.
2) Keep voltage adjust potentiometer to its minimum position.
3) Switch on the trainer.
4) Connect any of one resistor "R" (0.5KΩ / 1 KΩ / 2.2KΩ), which is provided on the kit itself.
5) Now, take the different readings of Voltage "V" and current "I" by varying DC variable supply from 2Vdc on wards insteps of 3Vdc.
6) Repeat above step 5 for different value of resistor.
7) Calculate resistor R = V/I and compare it with its theoretical value.
8) Also plot the graph of Current "I" v/s Voltage "V". It is linear.
9) Calculate the slop of the line. It give resistor "R" value in ohm.

OBSERVATION TABLE :

R =_________KΩ

Voltage “V”	**Current “I”**	**R = V / I**
2 Vdc		
5 Vdc		
8 Vdc		
11 Vdc		
14 Vdc		
17 Vdc		

CONCLUSION :

PRACTICAL NO: - 2 DATE:

AIM: To perform the series and parallel connection of resistor and capacitor.

A) SERIES AND PARALLEL CONNECTION OF RESISTOR

APPARATUS :

1) Experimental training kit
2) DC MilliAmmeter (0-50mAdc)
3) Connecting wires
4) DC Voltmeter (0-15Vdc)

PROCEDURE :

Part – 1 : Only one Resistor

a. Connect the circuit as shown in **Figure. 1.**

b. Select any one resistor.

c. Switch on the trainer.

d. Note the readings of DC voltmeter (Vdc) and DC ammeter (Idc).

e. Calculate Resistance ***R = Vdc/Idc.***

OBSERVATION TABLE - 1 :

DC voltage (Vdc)	DC Current (Idc)	Calculated "R" (KΩ)	Actual "R" (KΩ)

Part – 2 : Two Resistors are in Parallel

f. Connect the circuit as shown in **Figure. 2.**

g. Switch on the trainer.

h. Note the readings of DC voltmeter (Vdc) and DC ammeter (Idc).

i. Calculate equivalent Resistance ***Rp = Vdc/Idc.***

j. Equivalent Parallel Resistance ***Rp = R1*R2 / (R1+R2) .***

Part – 3 : Two Resistors are in Series

k. Connect the circuit as shown in **Figure. 3.**

l. Switch on the trainer.

m. Note the readings of DC voltmeter (Vdc) and DC ammeter (Idc).

n. Calculate equivalent Resistance ***Rs = Vdc/Idc.***

o. Equivalent Series Resistance ***Rs = R1+R2.***

Calculation :

- From Series and parallel connected Resistors (Refer Part – 2 and Part – 3) Voltage and current readings, calculate equivalent parallel resistance **Rp** and equivalent series Resistance **Rs**.
- Solve these two equations of **Rp & Rs** for calculating values of **R1** and **R2**.
- Compare these calculated values of Resistance with its actual value.

CONCLUSION :

B) SERIES AND PARALLEL CONNECTION OF CAPACITOR

APPARATUS :

1) Experimental training kit
2)AC MilliAmmeter (0-50mAdc)
3) Connecting wires
4) AC Voltmeter (0-15Vac)

PROCEDURE :

Part – 1 : Only one Capacitor

p. Connect the circuit as shown in **Figure. 1.**

q. Select capacitor either 2.2µF or 1µF or 0.47µF.

r. Switch on the trainer.

s. Note the readings of AC voltmeter (Vac) and AC ammeter (Iac).

t. Calculate Capacitance Impedance ***Xc = Vac/Iac.***

u. Calculate capacitance value from the ***Xc = 1/(2ΠfC).*** Here frequency ***f = 50Hz.***

Hence, **C = [(Iac/Vac)*** ***1/(2Πf)]***

OBSERVATION TABLE - 1 :

AC voltage (Vac)	AC Current (Iac)	Calculated "C" (µF)	Actual "C" (µF)

Part – 2 : Two Capacitors are in Parallel

v. Connect the circuit as shown in **Figure. 2.**

w. Switch on the trainer.

x. Note the readings of AC voltmeter (Vac) and AC ammeter (Iac).

y. Calculate equivalent Capacitance Impedance ***Xcp = Vac/Iac.***

z. Calculate capacitance value from the Xcp = 1/(2ΠfCp). Frequency f = 50Hz.

aa. Equivalent Parallel Capacitance ***Cp = C1+C2.***

Part – 3 : Two Capacitors are in Series

bb. Connect the circuit as shown in **Figure. 3.**

cc. Switch on the trainer.

dd. Note the readings of AC voltmeter (Vac) and AC ammeter (Iac).

ee. Calculate equivalent Capacitance Impedance ***Xcs = Vac/Iac.***

ff. Calculate capacitance value from the Xcp = 1/(2ΠfCs). Frequency f = 50Hz.

gg. Equivalent Series Capacitance ***Cs = C1*C2 / (C1+C2) .***

Calculation :

- From Series and parallel connected capacitors (Refer Part – 2 and Part – 3) Voltage and current readings, calculate equivalent parallel capacitance **Cp** and equivalent series Capacitance **Cs**.
- Solve these two equations of **Cp & Cs** for calculating values of **C1** and **C2**.
- Compare these calculated values of capacitance with its actual value.

CONCLUSION :

PRACTICAL NO: - 3 DATE:

AIM: To measure and calculate currents and voltages for a given resistive circuit and verify KCL and KVL.

APPARATUS :

1) Experimental training kit
2) Digital multimeter
3) Connecting wires

THEORY :

Kirchoff's Voltage Law (KVL) : For any closed path in a network, the algebraic sum of voltages is zero.

Kirchoff's Current Law (KCL) : The algebraic sum of currents at a node is zero.

PROCEDURE :

1. Make the Connect for any of the above network.
2. Keep voltage adjust potentiometer to its minimum position.
3. Switch on the trainer and adjust the voltage to any value (i.e. 10Vdc).
4. Measure the voltage drop across each resistor and current supplied from voltage source.
5. Calculate current flowing through each resistor.
6. Solve the same network, theoretical and verify the results with measured values.
7. Verify the KVL for any closed path and KCL for any node of the network.

Observation Table :

Type of network : ___________

V =_______Vdc

Total current, I (mA)	Measured voltage across resistors	Theoritical voltage across resistors

Readings for Figure. 1

	Measured voltage across resistors

Readings for Figure. 2

	Measured voltage across resistors

CONCLUSION :

PRACTICAL NO: - 4 DATE:

AIM: To perform star to delta connection of Resistors.

APPARATUS :

1) Experimental training kit
2) Digital multimeters (Vac & Iac measurement)
3) Connecting wires

THEORY :

Star Connection : Refer figure 1 for the same.

For Star connection line current and phase current are same.

For Star connection line voltages are equal to 3 times phase voltage.

Delta Connection : Refer figure 2 for the same.

For Delta connection line currents are equal to 3 times phase current.

For Delta connection line voltage and phase voltage are same.

PROCEDURE :

1. Connect 3 phase, 4 wire, 415Vac, 50Hz supply to trainer.
2. Make the Star connection as per figure 1.
3. Switch on 3 phase supply.
4. Measure the line voltages and phase voltages. Verify the relation between same.
5. Measure the line current, it same as of phase current.
6. Make the Delta connection as per figure 2.
7. Measure the line voltages and phase voltages. Verify the relation between same, both are same.
8. Measure the line current and calculate phase current from phase voltage (Vph/R). Verify the relation between line current and phase current.

Observation Table :

Type of network : Star connection

Line Voltage	Phase Voltage	Line current = Phase current

Type of network : Delta connection

Line Current	Phase Current = Vph/1K	Line Voltage = Phase Voltage

CONCLUSION :

PRACTICAL NO: - 5 DATE:

AIM: Verification of Superposition Theorem.

APPARATUS :

3) Experimental training kit
4) Digital multimeters

3) Connecting wires

THEORY :

The superposition theorem states that the response in any element of a linear bilateral network containing two or more sources is the algebraic sum of the responses obtained by each source acting separately at a time and with all the other sources set equal to zero, leaving behind their internal resistance in the network.

According to this theorem, if there are a number of e.m.fs acting simultaneously in any linear bilateral network, each e.m.f acts independently of the others i.e as if the other e.m.fs doesn't exist. The value of current in any element of the netwrok is the algebraic sum of the currents due to each e.m.f. Similarly voltage across any element/branch is the algebraic sum of the voltages which each e.m.f would have produced while acting separately at a time. In other words, current through or voltage across any conductor of the network is obtained by superimposing the currents and voltages due to each e.m.f. in the network .It is important to note that this theorem is applicable only to linear networks.

The superposition theorem is applied to determine currents and voltages which are linearly related to the sources acting on the network. Power can not be determined by superposition principle since the relationship between power and current or voltage is quadratic.

In Fig(a) I_1, I_2 and I_3 represent values of currents due to simultaneous action of the two sources of e.m.fs in the network. In fig(b) I_1', I_2' and I' represent values of currents due to source of e.m.f E_1 alone. In fig (c) I_1'', I_2'' and I'' represent values of currents due to source of e.m.f E_2 alone. By superimposing the current values of fig (b) and fig (c) the actual values of currents due to both the sources can be obtained as under:

Obviously : $I_1 = I_1' + I_1''$ (algebraic)

$I_2 = I_2'' + I_2'$ (algebraic)

$I = I' + I''$ (algebraic)

PROCEDURE :

1. Make the Connect for any of the above network. Use two DC power supplies.
2. Keep voltage adjust potentiometer to its minimum position.
3. Switch on the trainer and adjust the voltages to any value (i.e. 10Vdc).
4. Measure the voltage drop across each resistor and current supplied from voltage source.
5. Calculate current flowing through each resistor.
6. Solve the same network, theoretical and verify the results with measured values.
7. Now, connect only one voltage source at a time and repeat the steps 4, 5 & 6.
8. Repeat the same for connecting only second voltage source at a time and repeat the steps 4, 5 & 6.
9. Algebraic sum of readings taken by steps 7 & 8 will be same as of reading taken in step 4 by connecting two sources simultaneously.

CALCULATION :

CONCLUSION :

PRACTICAL NO: - 6 DATE:

AIM: Verification of Thevenin's Theorem.

APPARATUS :

1. Experimental training kit
2. Connecting wires
3. DC Voltmeter (0-20Vdc)
4. Ohm-meter

THEORY :

Thevenin’s theorem is useful when voltage across only single resistance / impedance or current flowing through only single resistance / impedance is to be calculated or to be measured.

For a linear network voltage across any resistance / impedance or current flowing through that resistance / impedance is equal to the voltage across same resistance / impedance or current flowing through that resistance / impedance when it is connected to Thevenin’s equivalent voltage source.

Any linear network can be represented by actual voltage source, i.e. voltage source V_{TH} and series connected resistance R_{TH} / impedance Z_{TH}.

For solving any network by Thevenin’s theorem follow the steps as given below

1) Measure or calculate the open circuit voltage between two given points “A & B”, where the load is to be connected. This voltage is known as open circuit Thevenin’s equivalent voltage V_{TH} **or** V_{OC}.

2) Measure or calculate the equivalent impedance between two given points “A & B”, by making source is zero. This impedance is known as Thevenin’s equivalent impedance R_{TH} **or** Z_{TH}.

Here, we have used “Bridge T” network of having all resistors of 3.3KΩ each and load resistance R_L of 10KΩ.

R_{TH} = (R1//R3 + R2)//R4 = (3.3K//3.3K + 3.3K)//3.3K = 4.95k//3.3K = 1.98 KΩ

PROCEDURE :

1. Make the connection as shown in **Figure 1.**
2. Switch on the trainer.
3. Set variable DC voltage V_S to 10Vdc and Measure open circuit Thevenin's equivalent voltage between points "A & B", it known as V_{TH} **or** V_{OC}.
4. Now connect the Load resistor R_L of 10KΩ between points "A & B" and measure the load voltage V_L. Calculate the load current.
5. For measurement of Thevenin's equivalent impedance R_{TH} **or** Z_{TH} make the connection as shown in **Figure 2.**
6. Measure the resistance between points "A & B" by Ohm-meter.
7. Calculate the Theoretical value of Thevenin's equivalent impedance R_{TH} **or** Z_{TH}. Here it is 1.98 KΩ.
8. To verify the load voltage V_L by Thevenin's theorem. Set the variable potentiometer ohmic value is equal to R_{TH} and voltage source V_S to is equal V_{TH} **or** V_{OC}. Connect the circuit as shown in **Figure 3**.
9. Measure the load voltage V_L and compare with measured voltage as per step no. 3. You will get same readings.
10. Repeat the all above steps for different value of V_S i.e. 15Vdc or 5Vdc or so and verify the load voltage by Thevenin's theorem.
11. Also solve the given network theoretical and match the theoretical result with the practical or measured result.

OBSERVATION TABLE :

Measured Rth =_________KΩ, VS =_____Vdc

VS (Vdc)	**Open circuit voltage "Vth"**	**Load voltage "VL"**	**Load voltage by Thevenin's Network "VL"**
10Vdc			
15Vdc			

THEORITICAL TABLE :

Rth = 1.98 KΩ,

VS (Vdc)	Open circuit voltage “Vth”	Load voltage “VL”	Load voltage by Thevenin’s Network “VL”

CALCULATION :

CONCLUSION :

PRACTICAL NO: - 7 DATE:

AIM: Verification of Norton's Theorem.

APPARATUS :

1. Experimental training kit
2. DC Voltmeter (0-20Vdc)
3. DC milliammeter (0-20mAdc)
4. Connecting wires
5. Ohm-meter

THEORY :

Norton's theorem is useful when voltage across only single resistance / impedance or current flowing through only single resistance / impedance is to be calculated or to be measured.

For a linear network voltage across any resistance / impedance or current flowing through that resistance / impedance is equal to the voltage across same resistance / impedance or current flowing through that resistance / impedance when it is connected to Norton's equivalent current source.

Any linear network can be represented by actual current source, i.e. current source $\mathbf{I_{SC}}$ and parallel connected resistance $\mathbf{R_{TH}}$ / impedance $\mathbf{Z_{TH}}$.

For solving any network by Norton's theorem follow the steps as given below

1. Measure or calculate the short circuit current between two given points "A & B", where the load is to be connected. This current is known as short circuit Norton's equivalent current $\mathbf{I_{SC}}$.
2. Measure or calculate the equivalent impedance between two given points "A & B", by making source is zero. This impedance is known as Thevenin's equivalent impedance $\mathbf{R_{TH}}$ **or** $\mathbf{Z_{TH}}$.

Here, we have used "Bridge T" network of having all resistors of 3.3KΩ each and load resistance $\mathbf{R_L}$ of 4.7 KΩ.

$$\mathbf{R_{TH} = (R1//R3 + R2)//R4 = (3.3K//3.3K + 3.3K)//3.3K = 4.95k//3.3K = 1.98\ K\Omega}$$

PROCEDURE :

1. Make the connection as shown in **Figure 1.**
2. Switch on the trainer.
3. Set variable DC voltage to 10Vdc and Measure short circuit Norton's equivalent current flowing through points "A & B", it known as I_{SC}.
4. Now connect the Load resistor R_L of 4.7KΩ between points "A & B" and measure the load current I_L. Calculate the load current.
5. For measurement of Norton's equivalent impedance **R_{TH} or Z_{TH}** make the connection as shown in **Figure 2.**
6. Measure the resistance between points "A & B" by Ohm-meter.
7. Calculate the Theoretical value of Thevenin's equivalent impedance **R_{TH} or Z_{TH}.** Here it is 1.98 KΩ.
8. To verify the load current I_L by Norton's theorem. Set the variable potentiometer ohmic value is equal to R_{TH} and current source **I** to be equal I_{SC}. Connect the circuit as shown in **Figure 3**.
9. Measure the load current I_L and compare with measured voltage as per step no. 3. You will get same readings.
10. Repeat the all above steps for different value of V_S i.e. 15Vdc or 5Vdc or so and verify the load current by Norton's theorem.
11. Also solve the given network theoretical and match the theoretical result with the practical or measured result.

OBSERVATION TABLE :

Measured Rth =_________KΩ, VS =_____Vdc

VS (Vdc)	Short circuit current "Isc"	Load current "IL"	Load current by Norton's Network "IL"

THEORITICAL TABLE :

Rth = 1.98 KΩ,

VS (Vdc)	Short circuit current "Isc"	Load current "IL"	Load current by Norton's Network "IL"

CALCULATION :

CONCLUSION :

PRACTICAL NO: - 8 DATE:

AIM: Verification of Maximum Power Transfer Theorem.

APPARATUS :

1. Experimental training kit
2. Connecting wires
3. DC Voltmeter (0-20Vdc)
4. DC milli-ammeter (0-20mAdc)

THEORY :

It is very important to determine the value of load impedance which will allow the maximum power to be transferred to the load from generating source. This maximum power transfer theorem is particularly useful for analyzing communication networks where the goal is transfer of maximum power from source to load and not the efficiency.

Any network can be replaced by single voltage source in series with a resistance/impedance. i.e. any linear network can be represented by Thevenin's equivalent circuit (voltage source $\mathbf{V_{TH}}$ and series connected resistance $\mathbf{R_{TH}}$ / impedance $\mathbf{Z_{TH}}$).

As shown in **Figure 1,** $\mathbf{V_S}$ is the voltage source or Thevenin's equivalent voltage and $\mathbf{R_S}$ is the internal resistance of the source or the Thevenin's equivalent resistance. Now calculate the load resistance $\mathbf{R_L}$ in terms of $\mathbf{R_S}$, so that power delivered to the load resistance $\mathbf{R_L}$ is maximum.

The load current $\mathbf{I_L = V_S / (R_S + R_L)}$

Power transferred $\mathbf{P = I_L^2 R_L = V_S^2 R_L / (R_S + R_L)^2}$

For maximum power to be transfer, the necessary condition is $\mathbf{dP/dR_L = 0}$

$$\mathbf{dP/dR_L = V_S^2 / (R_S + R_L)^4\{(R_S + R_L)^2 -- R_L\ 2\ (R_S + R_L)\} = 0}$$

$\therefore$ **$R_L = R_S$**

$\therefore$ **Pmax. = $V_S^2 / 4R_S$**

PROCEDURE :

1. Make the connection as shown in **Figure 1.**
2. Switch on the trainer.
3. Connect the series resistance **R_S** to 0.5KΩ.
4. Now select the load resistance **R_L** from 0.5KΩ / 1KΩ / 2.2KΩ / 3.3KΩ by proper connections. Every time measure **V_L** and **I_L**. Calculate power **"P = V_L I_L"** consumed by the load resistance **R_L**.
5. See that maximum power transfer takes place when **$R_L = R_S$**.
6. Repeat the all above steps for different value of value of series resistance **R_S**.
7. Also calculate the theoretical maximum power transfer "**Pmax. = $V_S^2 / 4R_S$**" and compare with the practical or measured result.

OBSERVATION TABLE :

Series Resistance Rs =_________KΩ, Vs = 15Vdc

Load Resistance "R_L"	Load Voltage "V_L"	Load Current "I_L"	Power transferred to Load "P = V_L I_L"

Theoretical maximum power **Pmax. = $V_S^2 / 4R_S$ =_________mW**

Measured maximum power from the observation table **Pmax. =_________mW**

CALCULATION :

CONCLUSION :

PRACTICAL NO: - 9 DATE:

AIM: Verification of Reciprocity Theorem.

APPARATUS :

1. Experimental training kit
2. Connecting wires
3. Digital Multimeter (DC voltmeter & DC mAmmeter)

THEORY :

The Reciprocity theorem states that in a linear, bilateral, single source network the ratio of excitation to response is constant when positions of excitation and response are interchanged.

In other words "If source **V** is located at one point in a network produces current **I** at a second point in the network, the source **V** acting at the second point of the network will produce the current **I** at the first point of the network.

Here, you can make "T" network, Bridge "T" network or ladder network.

PROCEDURE :

1. Make the connection as shown in **Figure 1.**
2. Switch on the trainer.
3. Set variable DC voltage **V** to 20Vdc and measure the load current **IL.**
4. Now interchange the voltage source and connected branch and set the DC voltage **V** to 20Vdc. Refer **Figure 2.** Measure the equivalent branch current **IJ.**
5. Verify that above measured currents **IL** and **IJ** both are same, i.e. **IL = IJ.**
6. Repeat the all above steps for different types of network
7. Also solve the given network theoretical and match the theoretical result with the practical or measured result.

OBSERVATION TABLE :

VS (Vdc)	Load current "IL"	Branch current "IJ"	Theoritical current "Ith"

CALCULATION :

CONCLUSION :

PRACTICAL NO: -10 DATE:

AIM: Verification of Two Port Parameters for different Network.

APPARATUS :

1. Experimental training kit
2. DC Voltmeter (0-20Vdc)
3. Connecting wires
4. DC Ammeter (0-20mA)

THEORY :

Open circuit impedance parameters (Z – Parameters) :

The two port network can be characterized by the following Z – parameters equations.

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

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

For calculation of Z – parameters, the condition $I_1 = 0$ **or** $I_2 = 0$ is accomplished by open circuiting either port 1 or port 2. Thus,

$Z_{11} = V_1 / I_1$, $I_2 = 0$ $Z_{21} = V_2 / I_1$, $I_2 = 0$

$Z_{12} = V_1 / I_2$, $I_1 = 0$ $Z_{22} = V_2 / I_2$, $I_1 = 0$

Short circuit admittance parameters (Y – Parameters) :

The two port network can be characterized by the following Y – parameters equations.

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

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

For calculation of Y – parameters, the condition $V_1 = 0$ **or** $V_2 = 0$ is accomplished by short circuiting either port 1 or port 2. Thus,

$Y_{11} = I_1 / V_1$, $V_2 = 0$ $Y_{21} = I_2 / V_1$, $V_2 = 0$

$Y_{12} = I_1 / V_2$, $V_1 = 0$ **$Y_{22} = I_2 / V_2$, $V_1 = 0$**

Hybrid parameters (H– Parameters)

The two port network can be characterized by the following H– parameters equations.

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

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

For calculation of H – parameters, the condition **$I_1 = 0$ or $V_2 = 0$** is accomplished by open circuiting port 1 or short circuiting port 2. Thus,

$H_{11} = V_1 / I_1$, $V_2 = 0$ **$H_{21} = I_2 / I_1$, $V_2 = 0$**

$H_{12} = V_1 / V_2$, $I_1 = 0$ **$H_{22} = I_2 / V_2$, $I_1 = 0$**

Refer the general circuit diagram as shown in **Figure 1.**

We can make the different networks like “T” network, “π” network, Bridge “T” network, ladder network etc. from the given circuit diagram.

PROCEDURE :

1. Make the connection as shown per required network, like “T” network or “π” network or Bridge “T” network or ladder network etc. from the given circuit diagram as shown in **Figure 1.**
2. Switch on the trainer.
3. Set variable DC voltages **V_1** to 10Vdc and **V_2** to 5Vdc.
4. Depending upon which parameters we would like to calculate, measure the appropriate readings as per required as per given theory.
5. Repeat the all above steps for different values of **V_1** and **V_2**.
6. Also repeat the all above steps for different parameters calculation and measurements.
7. Also solve the given network theoretical and match the theoretical result with the practical or measured result.

OBSERVATION TABLE :

Z - Parameters :

V_1 =_________Vdc, $I_2 = 0$.

Open circuit voltage "V_2"	Input Current "I_1"	$Z_{11} = V_1 / I_1$	$Z_{21} = V_2 / I_1$

V_2 =_________Vdc, $I_1 = 0$.

Open circuit voltage "V_1"	Input Current "I_2"	$Z_{12} = V_1 / I_2$	$Z_{22} = V_2 / I_2$

THEORITICAL TABLE :

$Z_{11} = V_1 / I_1$	$Z_{21} = V_2 / I_1$	$Z_{12} = V_1 / I_2$	$Z_{22} = V_2 / I_2$

Y - Parameters :

V_1 =_________Vdc, $V_2 = 0$.

Short circuit current "I_2"	Input Current "I_1"	$Y_{11} = I_1 / V_1$	$Y_{21} = I_2 / V_1$

V_2 =_________Vdc, $V_1 = 0$.

Short circuit current "I_1"	Input Current "I_2"	$Y_{12} = I_1 / V_2$	$Y_{22} = I_2 / V_2$

THEORITICAL TABLE :

$Y_{11} = I_1 / V_1$	$Y_{21} = I_2 / V_1$	$Y_{12} = I_1 / V_2$	$Y_{22} = I_2 / V_2$

H - Parameters :

V_1 =_________Vdc, $V_2 = 0$.

Short circuit current "I_2"	Input Current "I_1"	$H_{11} = V_1 / I_1$	$H_{21} = I_2 / I_1$

V_2 =________Vdc, I_1 = 0.

Open circuit voltage "V_1"	**Input Current "I_2"**	**$H_{12} = V_1 / V_2$**	**$H_{22} = I_2 / V_2$**

THEORITICAL TABLE :

$H_{11} = V_1 / I_1$	**$H_{21} = I_2 / I_1$**	**$H_{12} = V_1 / V_2$**	**$H_{22} = I_2 / V_2$**

CALCULATION :

CONCLUSION :