METHODIST

Estd:2008

COLLEGE OF ENGINEERING AND TECHNOLOGY

(Affiliated to Osmania University & Approved by AICTE, New Delhi)

LABORATORY MANUAL

CIRCUITS AND MEASUREMENTS LABORATORY

BE, V Semester (CBCS): 2020-21

NAME: ____

ROLL NO:__________________________________

BRANCH:__________________________________

SEM:______________________________

DEPARTMENT OF ELECTRICAL AND ELECTRONCS ENGINEERING

Empowering youth- Architects of Future World

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COLLEGE OF ENGINEERING AND TECHNOLOGY

Estd:2008

VISION

To produce ethical, socially conscious and innovative professionals who would contribute to sustainable technological development of the society.

MISSION

To impart quality engineering education with latest technological developments and interdisciplinary skills to make students succeed in professional practice.

To encourage research culture among faculty and students by establishing state of art laboratories and exposing them to modern industrial and organizational practices.

To inculcate humane qualities like environmental consciousness, leadership, social values, professional ethics and engage in independent and lifelong learning for sustainable contribution to the society.

DEPARTMENT
OF
ELECTRICAL AND ELECTRONICS ENGINEERING

LABORATORY MANUAL

CIRCUITS AND MEASUREMENTS LABORATORY

Prepared
By
Mr.N.NIREEKSHAN

Assistant Professor

Estd:2008

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COLLEGE OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

VISION

To become a reputed centre for imparting quality education in Electrical and Electronics Engineering with human values, ethics and social responsibility.

MISSION

- To impart fundamental knowledge of Electrical, Electronics and Computational Technology.
- To develop professional skills through hands-on experience aligned to industry needs.
- To undertake research in sunrise areas of Electrical and Electronics Engineering.
- To motivate and facilitate individual and team activities to enhance personality skills.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

PROGRAM EDUCATIONAL OBJECTIVES

BE-Electrical Engineering graduates shall be able to:

- **PEO1**. Utilize domain knowledge required for analyzing and resolving practical Electrical Engineering problems.
- **PEO2**.Willing to undertake inter-disciplinary projects, demonstrate the professional skills and flair for investigation.
- **PEO3**. Imbibe the state of the art technologies in the ever transforming technical scenario.
- **PEO4**. Exhibit social and professional ethics for sustainable development of the society.

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PROGRAM OUTCOMES

Engineering Graduates will have ability to:

- **PO1. Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of electrical and electronics engineering problems.
- **PO2. Problem analysis:** Identify, formulate, review research literature, and analyze complex electrical and electronics engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- **PO3. Design/development of solutions:** Design solutions for complex electrical and electronics 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.
- **PO4. 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.
- **PO5. Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex electrical and electronics engineering activities with an understanding of the limitations.
- **PO6. 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 electrical and electronics engineering practice.
- **PO7. 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 electrical and electronics engineering practice.
- **PO9. Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- **PO10. 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.
- **PO11. 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.
- **PO12. 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.

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PROGRAM SPECIFIC OUTCOMES

At the end of BE program Electrical and Electronics Engineering graduates will be able to:

- **PSO1**.Provide effective solutions in the fields of Power Electronics, Power Systems and Electrical Machines using MATLAB/MULTISIM.
- **PSO2.** Design and Develop various Electrical and Electronics Systems, particularly Renewable Energy Systems.
- **PSO3.** Demonstrate the overall knowledge and contribute for the betterment of the society.

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I. PREREQUISITE(S):

Level	Credits	Semester	Prerequisites
UG	1	1	Circuits and Measurements lab

II. SCHEME OF INSTRUCTIONS

Lectures	Tutorials	Practicals	Credits
0	0	2	1

III. SCHEME OF EVALUATION & GRADING

S. No	Component	Duration	Maximum Marks
	Continuous Internal Evaluation (CIE)		
1.	Internal Examination – I	1 hours	25
	CIE (Total)		**25**
2.	**Semester End Examination** (University Examination)	3 hours	**50**
		TOTAL	**75**

%Marks Range	>=90	80 to <90	70 to < 80	60 to < 70	50 to <60	40 to < 50	< 40	Absent
Grade	S	A	B	C	D	E	F	Ab
Grade Point	10	9	8	7	6	5	0	-

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COURSE OUTCOMES

After completing this course the student will be able to:

CO No.	Course Outcomes	Taxonomy Level
C553.1	Examine the KCL, KVL theorems for a given circuit theoretically and practically	Analyze
C553.2	Simplify the complicated circuits using Thevenin's, Norton's and Superposition theorems.	Analyze
C553.3	Formulate the current and voltage equations for two port networks.	Create
C553.4	Estimate the resistance, inductance and capacitance using various bridges.	Create
C53.5	Measure the energy, power and power factor of the given circuits using wattmeter, ammeter and voltmeter	Evaluate
C553.6	Make use of CRO for finding out the amplitude, frequency and phase of waveforms	Apply

Mapping of Cos with POs and PSOs (Correlation Level: High – 3; Medium – 2; Low – 1)

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
C553.1	3	3	1	-	1	-	-	-	2	-	-	-	3		-
C553.2	3	3	1	2	1	-	-	-	2	-	-	-	3	-	-
C533.3	3	3	3	1	3	-	-	-	3	-	-	-	3	3	-
C533.4	3	3	-	-	-	-	-	-	3	-	-	-	1	3	-
C533.5	3	-	-	-	-	3	-	3	3	-	-	3	1	3	-
C533.6	-	-	-	1	-	-	-	-	1	-	-	-	-	-	3
C533	3	3	1.6	1.3	1.6			3	2.3			3	2.2	3	3

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Code of Conduct

1. Students should report to the concerned labs as per the time tableschedule.
2. Studentswhoturnuplatetothelabswillinnocasebepermittedtoperformtheexperiment scheduled for theday.
3. Students should bring a note book of about 100 pages and should enter the readings/observations into the note book while performing theexperiment.
4. After completion of the experiment, certification of the concerned staff in-charge in the observation book isnecessary.
5. Staff in-charge shall award **25marks** for each experiment based on continuous evaluation and will be entered in thecontinuous internal evaluation sheet.
6. These 25 marks are divided as **10 marks** for **overall performance** of the student in conducting the experiment (which is further divided as 5marks for Viva voce and 5 marks execution of the experiment), **10 marks** for **observation** and **5marks** for **record**.
7. The record of observations along with the detailed experimental procedure of the experiment performed in the immediate last session should be submitted and certified by the staff memberin-charge.
8. The group-wise division made in the beginning should be adhered to, and no student is allowed to mix up with different groups later.
9. The components required pertaining to the experiment should be collected from lab assistant, only after duly filling in the requisitionform.
10. When the experiment is completed, students should disconnect the setup made by them, and should return all the components/instruments to lab assistant.
11. Any damage of the equipment or burn-out of components will be viewed seriously by either charging penalty or dismissing the total group of students from the lab for the semester/year.
12. Students are required to prepare thoroughly to perform the experiment before coming to Laboratory.

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Do's and Don'ts in the laboratory

Do's:-

1. Proper dress has to be maintained while entering in the Lab. (with apron & shoes)
2. Students should carry observation notes and record completed in all aspects.
3. Correct specifications of the equipment have to be mentioned in the circuit diagram.
4. Student should be aware of operating equipment.
5. Students should be at their concerned experiment table, unnecessary moment is restricted.
6. After completing the connections Students should verify the circuits by the Lab Instructor.
7. The reading must be shown to the Lecturer In-Charge for verification.
8. Students must ensure that all switches are in the OFF position, all the connections are removed.
9. All patch cords and stools should be placed at their original positions.

Don'ts:-

1. Don't come late to the Lab.
2. Don't enter into the Lab with Golden rings, bracelets and bangles.
3. Don't make or remove the connections with power ON.
4. Don't switch ON the supply without verifying by the Staff Member.
5. Don't switch OFF the machine with load.
6. Don't leave the lab without the permission of the Lecturer In-Charge.

Before Leaving Lab:

- Place the wooden stools under the lab bench.
- Turn off the power to all instruments.
- Return all the equipment to lab assistant.
- Turn off the main power switch to the lab bench.
- Please check the laboratory notice board regularly for updates.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

CIRCUITS AND MEASUREMENTS LAB

NAME: ROLL NO:
CLASS: SECTION:

<u>INDEX</u>

S.No.	NameoftheExperiment	Date of Expt. Conducted	Date of Submission	Grade/Marks	Signature	Remarks
-						

Experiment: 1 **Date:**

Verification of KCL & KVL using Mesh and Nodal analysis

AIM:

To verify Kirchhoff's Voltage Law (KVL) and Kirchhoff's Current Law (KCL) in a passive resistive network.

APPARATUS:

S. No	Apparatus Name	Range	Type	Quantity
1	Regulated Power Supply (RPS)			
2	Ammeter(A)			
3	Voltmeter (V)			
4	Resistors (R)			
5	Bread Board	-	-	01
6	Connecting Wires	-	-	As required

THEORY:

CIRCUITDIAGRAMS:

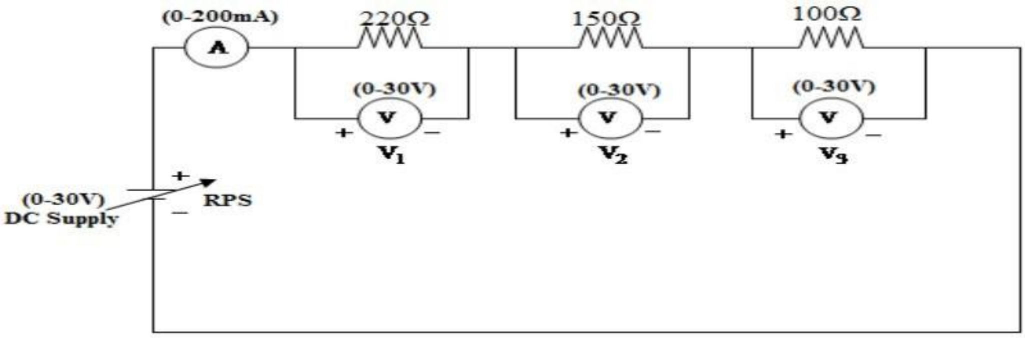


Figure – 1. Verification of KVL

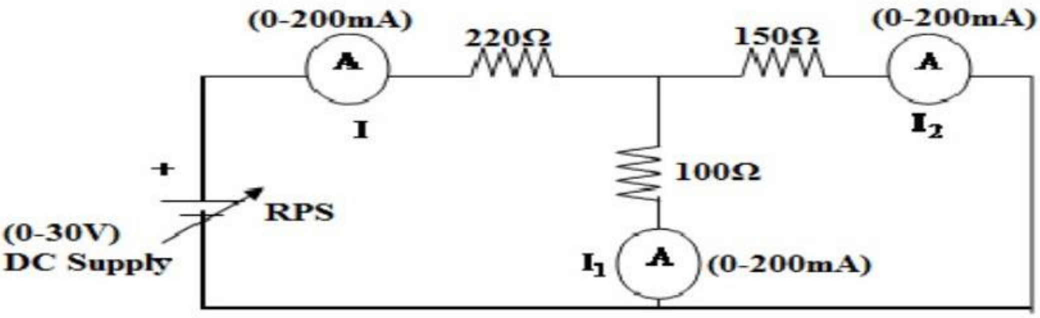


Figure – 2 Verification of KCL

PROCEDURE:

To Verify KVL

1. Connect the circuit diagram as shown in Figure1.
2. Switch ON the supply toRPS.
3. Apply the voltage (say 5v) and note the voltmeterreadings.
4. Gradually increase the supply voltage insteps of 5 V.
5. Note the corresponding readings ofthe voltmeters.
6. Sum up the voltmeter readings (voltage drops), that should be equal to applied voltage (Voltage rise).
7. Thus KVL is verifiedpractically.

To Verify KCL

1. Connect the circuit diagram as shown in Figure2.
2. Switch ON the supply toRPS.
3. Apply the voltage (say 5v) and note the Ammeterreadings.
4. Gradually increase the supply voltage insteps of 5 V.
5. Note the corresponding readings of the ammeters.
6. Sum up the Ammeter readings (I_1 and I_2)(currents leaving the node) , that should be equal to total current(I)(Current entering the node).
7. Thus KCL is Verifiedpractically

TABULAR FORM:

ForKVL

Applied Voltage V (volts)	V_1 (volts)		V_2 (volts)		V_3 (volts)		$V_1+V_2+V_3$ (volts)	
	Theoretical	**Practical**	**Theoretical**	**Practical**	**Theoretical**	**Practical**	**Theoretical**	**Practical**

ForKCL

Applied Voltage V (volts)	I (A)		I_1 (A)		I_2 (A)		I_1+I_2 (A)	
	Theoretical	**Practical**	**Theoretical**	**Practical**	**Theoretical**	**Practical**	**Theoretical**	**Practical**

PRECAUTIONS:

1. Check for proper connections before switching ON thesupply
2. Make sure of proper color coding ofresistors
3. The terminal of the resistance should be properlyconnected.

RESULT:

VIVAQUESTIONS:

1. Definecurrent.
2. Definevoltage.
3. What is resistance?
4. Define ohm’slaw.
5. State KCL andKVL
6. On which law is the mesh analysisbased?
7. What is meshanalysis?
8. When do we go for super meshanalysis?
9. What is the equation for determining the number of independent loop equations in mesh currentmethod?
10. On which law is the nodal analysisbased?
11. What is nodalanalysis?
12. When do we, go for super-nodeanalysis?

Experiment:2 Date:

Verification of

(a) Thevinen's Theorem **(b) Norton Theorem**

(c) Superposition Theorem **(d) Maximum power transfer theorem**

A.VERIFICATION OF THEVENIN'S THEOREM

AIM:

To Verify Thevinen's theorem.

APPARATUS:

S.No.	Equipment	Range	Type	Quantity
1	Ammeter			
2	Voltmeter			
3	R.P.S			
4	Bread Board			
5	Resistors			
6	Connecting Wires			As required

CIRCUITDIAGRAM:

Circuit - 1 : To find load current

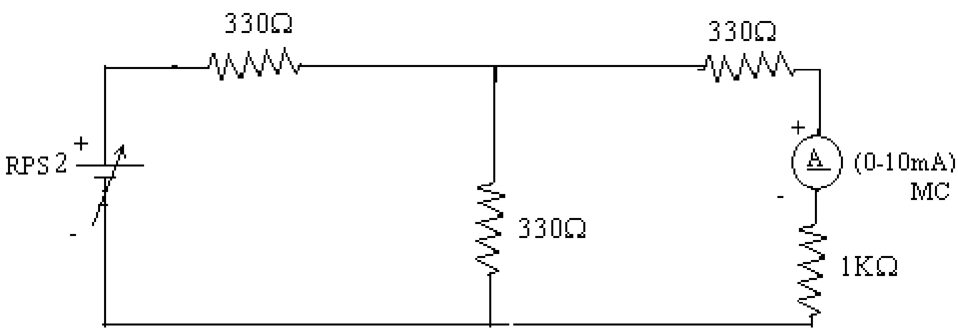


Figure.1 measurement of load current

To find V_{TH}

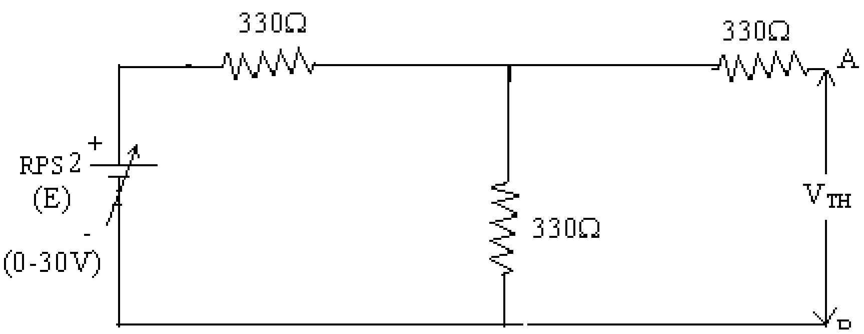


Figure.2 measurement of Vth

To find R_{TH}

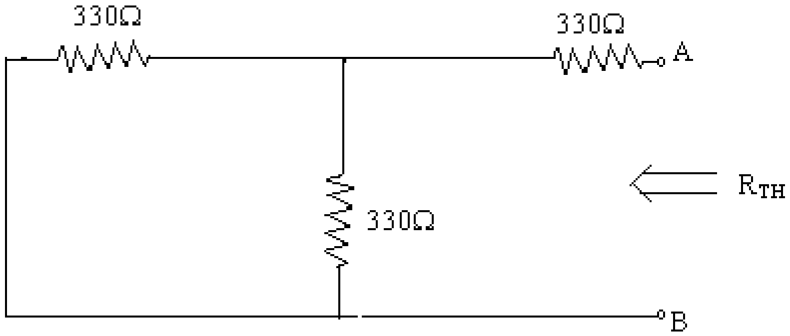


Figure.3 measurement of Rth

Thevinen's Equivalent circuit:

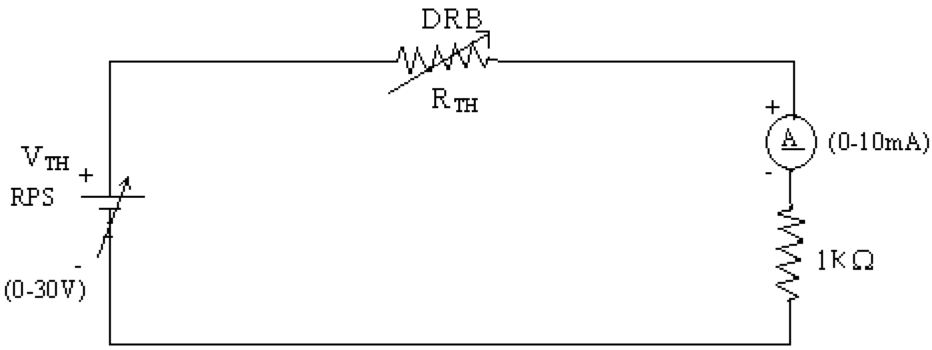
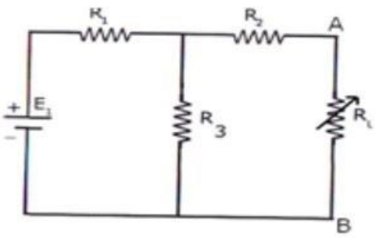
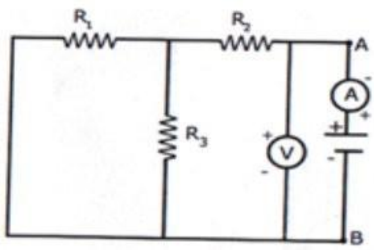


Figure.4 measurement of load current

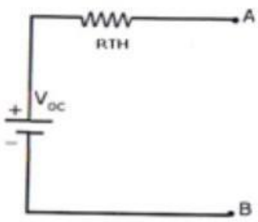
THEORY:

Any linear, bilateral network having a number of voltage, current sources and resistances can be replaced by a simple equivalent circuit consisting of a single voltage source in series with a resistance, where the value of the voltage source is equal to the open circuit voltage and the resistance is the equivalent resistance measured between the open circuit terminals with all energy sources replaced by their ideal internal resistances





Measurement of I_L&V_{TH}orV_{OC} Measurement ofR_{TH}



Measurement of I_L ($I_L = V_{TH}$ or $V_{OC}/ R_{TH} +R_L$)

PROCEDURE:

1. Connect the circuit diagram as shown infig..1
2. Measure current in R_L.
3. Connect the circuit as shown infig.2.
4. Measure open circuit voltage V_{oc} by open circuiting terminals i.e.,V_{TH}
5. Connect the circuit as shown infig.3,measure equivalent resistance i.e. R_{th}
6. Connect the Thevinen's equivalent circuit as shown infig.4
7. Measurement current inR_L

TABULARCOLUMN:

Parameters	Theoretical Values	Practical Values
V_{oc}		
R_{TH}		
I_L		

PRECAUTIONS:

1. Check for proper connections before switching ON thesupply
2. Make sure of proper color coding ofresistors
3. The terminal of the resistance should be properlyconnected.

RESULT:

VIVAQUESTIONS:

1. What is load resistance?
2. How will you calculate Thevinen's resistanceR_{TH}?
3. How will you calculate Thevinen's voltageV_{TH}?
4. How will you calculate load current I_L?

B.VERIFICATION OF NORTON 'S THEOREM

AIM:

To Verify Norton's theorem.

Apparatus Required

Sl.No.	Apparatus	Range	Quantity
1	RPS (regulated power supply)	(0-30V)	2
2	Ammeter	(0-10mA)	1
3	Resistors	1K□, 330□	3,1
4	Bread Board	--	Required
5	DRB	--	1

CIRCUITDIAGRAM:

Circuit - 1 : To find load current

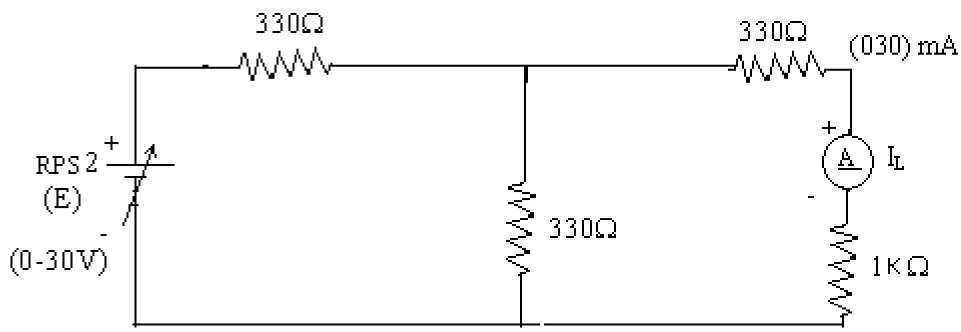


Figure.1 measurement of load current

To find I_N

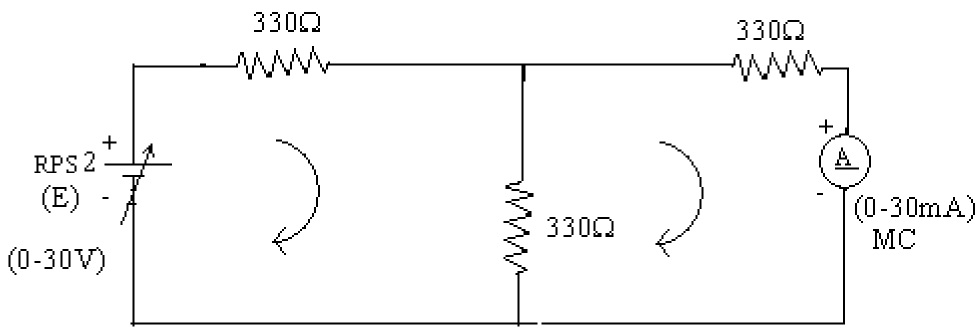


Figure.2 measurement of short circuit current

To find R_N

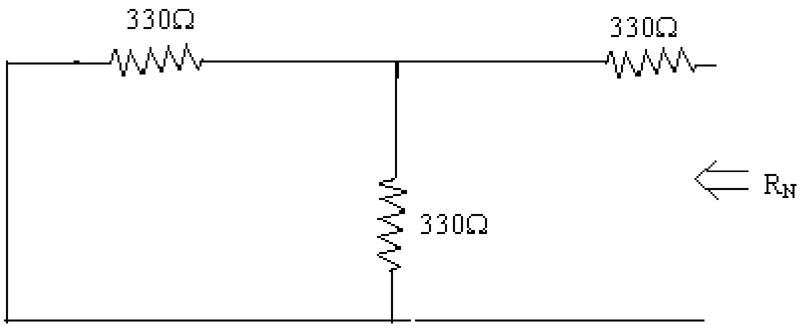


Figure.3 measurement of equivalent resistance

Norton's equivalent circuit

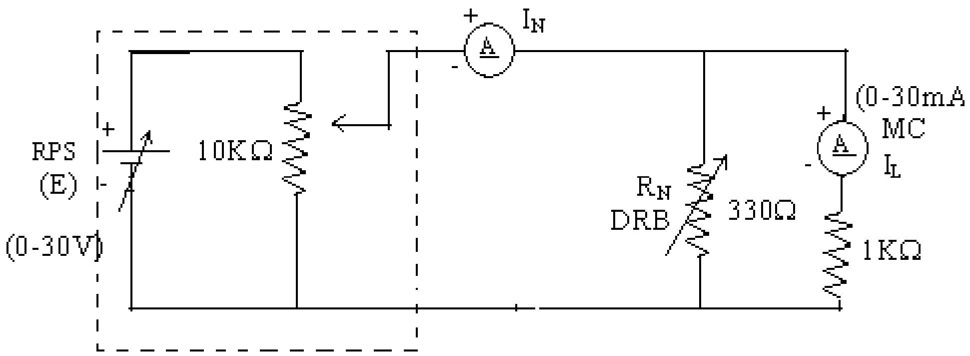
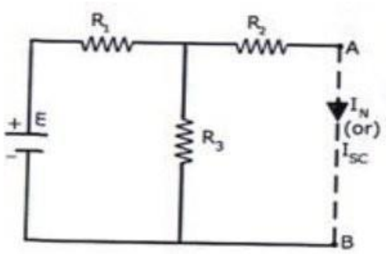
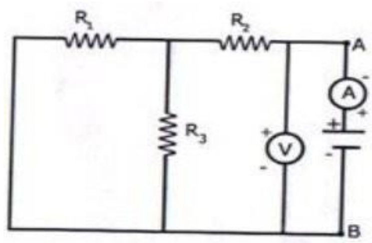


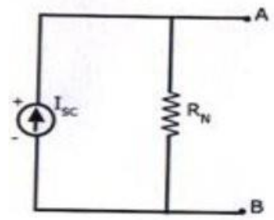
Figure.4 measurement of load current

STATEMENT

Any linear, bilateral network with current sources, voltage sources and resistances can be replaced by an equivalent circuit consisting of a current source in parallel with a resistance. The value of the current source is the current flowing through the short circuit terminals of the network and the resistance is the equivalent resistance measured between the open circuit terminals of the network with all the energy sources replaced by their internal resistances.







Norton's EquivalentResistancecircuit Norton's EquivalentCircuit Norton's Current

PROCEDURE:

1. Connect the circuit diagram as shown in fig.1.
2. Measure the current I_L
3. Connect the circuit diagram as shown in fig.2
4. Measure the current I_{SC} (or) I_N by short-circuiting load resistance
5. Connect the circuit diagram as shown in fig.3
6. Remove RPS and short circuit the terminal and remove the load and note down the resistance across the two terminals.

7.Connect Norton's equivalent circuit by connecting I_N & R_N in parallel as shown in fig.4 and find load current.

TABULARCOLUMN:

Parameters	Theoretical Values	Practical Values
I_{SC}/ I_N		
R_N		
I_L		

RESULT

VIVAQUESTIONS:

1. What is load resistance?
2. How will you calculate Norton’s resistanceR_N?
3. How will you calculate Norton’s currentI_{SC}?
4. How will you calculate load current I_L?

C.VERIFICATION OF SUPERPOSITIONTHEOREM

AIM:
ToVerify principle of Superposition theoretically and practically.
.
APPARATUS:

S.No.	Equipment	Range	Type	Quantity
1.	Resistors	-	-	
2.	Ammeter			
3.	R.P.S			
4.	Bread Board	-	-	
5.	Connecting Wires			required

CIRCUITDIAGRAM:

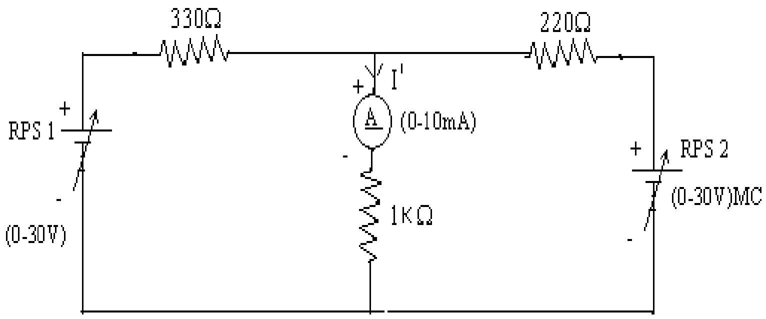


Fig- 1 Both Voltage Sources areacting($V_{1= RPS1}$&$V_{2= RPS2}$)

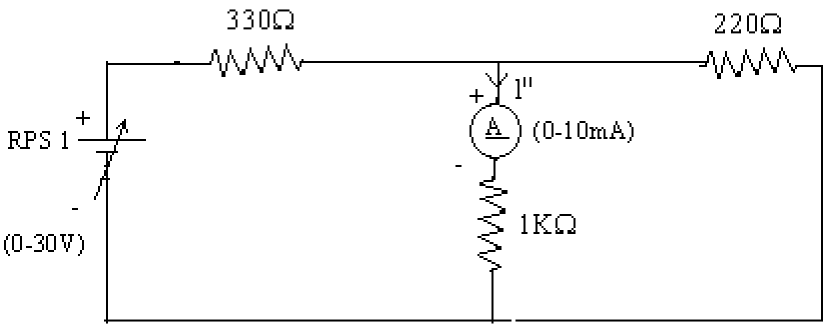


Fig - .2 Voltage Source V_1 is actingalone

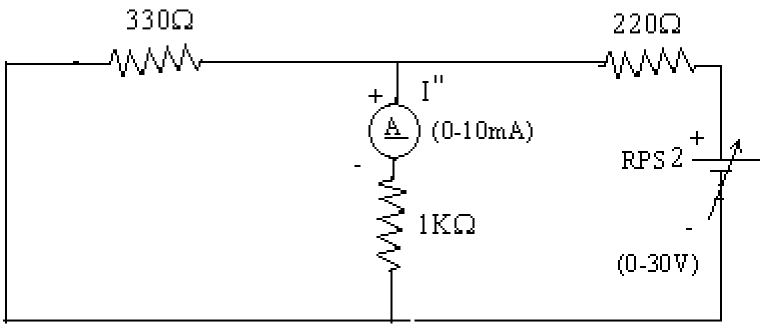
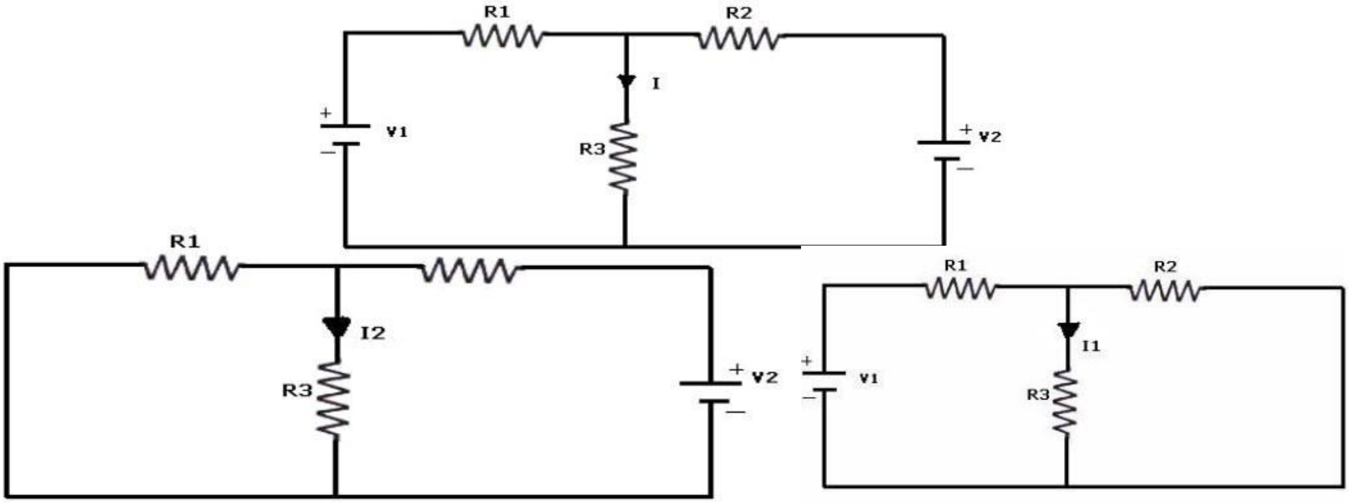


Fig - 3 Voltage Source V_2 is acting alone

STATEMENT:

In a linear, bilateral network the response in any element is equal to sum of individual responses with all other sources being non-operative.



PROCEDURE:

1. Connect the circuit as shown in figure (1) and note down the current flowing through 1KΩ and let it beI.
2. Connect the circuit as shown in figure 2 and note down the ammeter Reading, and let it beI_1.
3. Connect the circuit as shown in figure .3 and note down the ammeter reading, and let it beI_2.
4. Verify for $I=I_1+I_5$.
5. Compare the practical value of current observed with that of theoretically calculated.

TABULARCOLUMN:

PARAMETERS	WHEN BOTH V1 & V2≠0 (I)	WHEN V1≠0 & V2=0 (I1)	WHEN V1=0& V2≠0 (I2)
Current through R3 (Theoretical Values)			
Current through R3 (Practical Values)			

PRECAUTIONS:

1. Check for proper connections before switching ON thesupply
2. Make sure of proper color coding ofresistors
3. The terminal of the resistance should be properlyconnected

RESULT

VIVAQUESTIONS:

1. State Superpositiontheorem.
2. How to find power using Superpositiontheorem?
3. Write applications of super positiontheorem

D.VERIFICATION OF MAXIMUM POWER TRANSFERTHEOREM

AIM:

To design the load resistor this absorbs maximum power from source

Apparatus Required:

Sl.No.	Apparatus	Range	Quantity
1	RPS	(0-30V)	1
2	Voltmeter	(0-10V) MC	1
3	Resistor	1K Ώ, 1.3K Ώ, 3Ώ	3
4	DRB	--	1
5	Bread Board & wires	--	Required

CIRCUITDIAGRAM:

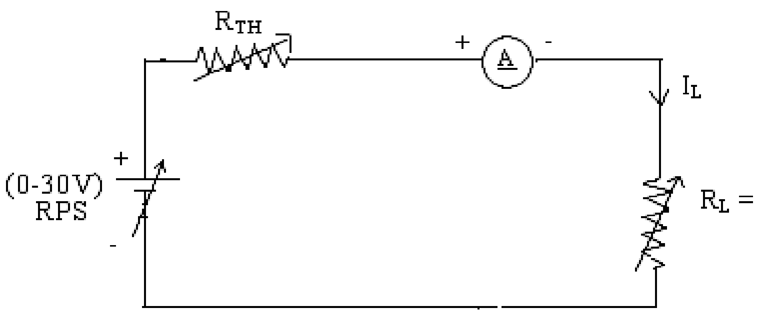
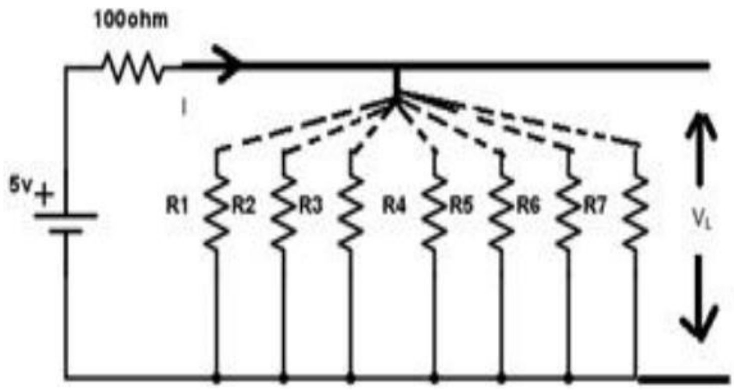


Fig –.1 Maximum Power Transfer Circuit

STATEMENT:

The maximum power transfer theorem states that maximum power is delivered from a source to an load resistance when the load resistance is equal to source resistance. (R_L = R_S is the condition required for maximum power transfer).



PROCEDURE:

1. Connect the circuit as shown infig..1
2. Vary the load resistance in steps and note down current flowing through thecircuit.
3. Calculate power delivered to the load
4. Draw the graph between resistance and power (resistance on X- axis and power onY-axis).
5. Verify the maximum power is delivered to the load when R_L = Rs forDC.

TABULARCOLUMN:

S. No	R_L	V	I	P=VI
1				
2				
3				
4				
5				

MODELGRAPH:

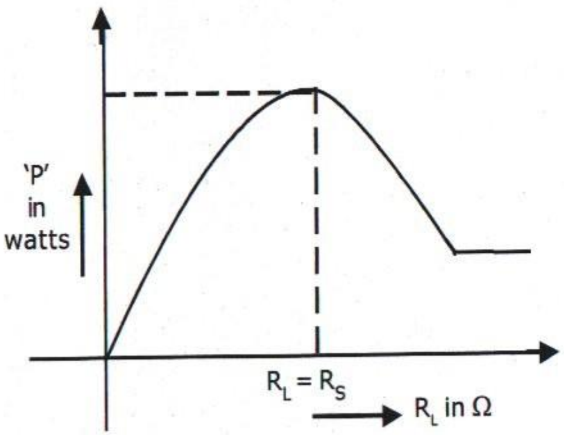


Fig –.2 Output Graph of Maximum Power Transfer Theorem

PRECAUTIONS:

1. Check for proper connections before switching ON thesupply
2. Make sure of proper color coding ofresistors
3. The terminal of the resistance should be properlyconnected

RESULT:

VIVAQUESTIONS:

1. State maximum power transfertheorem.
2. Is it possible to apply maximum power transfer theorem to ac as well as dccircuit?
3. How to find power using maximum power transfertheorem?
4. What are conditions for maximum power transfertheorem?
5. Is itpossible to apply maximumpower transfertheoremto nonlinearcircuit?

Experiment:3 Date:

Frequency and time response of 2nd order RLC circuits.

AIM:

To study frequency response of series RLC circuit and determine resonance frequency.

APPARATUS:

1. CRO,
2. Audio Frequency Generator,
3. Multimeter
4. Connecting Leads.
5. Decade resistance, inductance, capacitance boxes

THEORY:

In the series resonance circuit , the net reactance

$$X=X_L-X_C$$

So impedance of the circuit is

$$Z=\sqrt{(R^2+ (X_L-X_C)^2)}$$

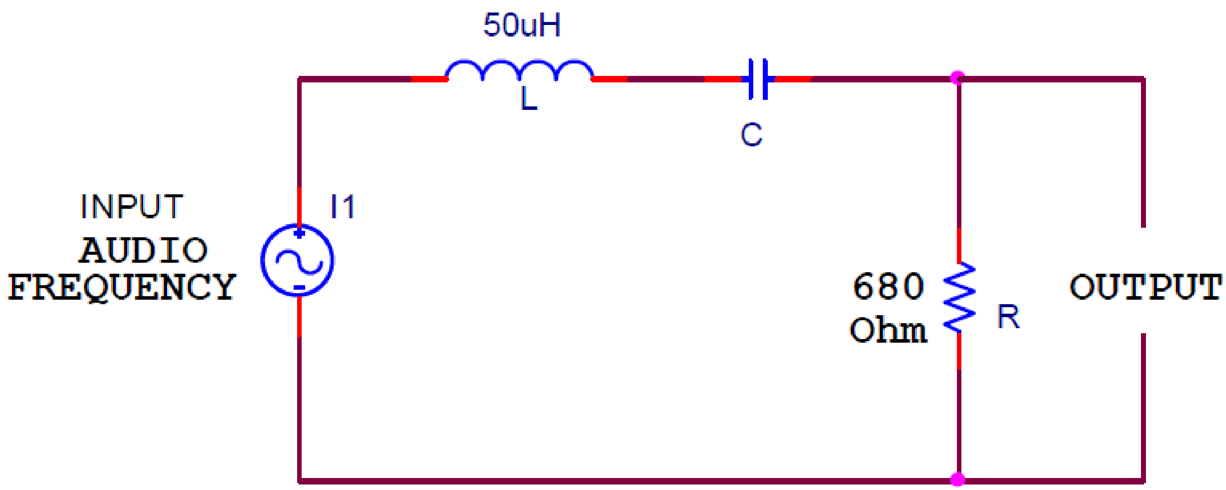
at the resonance frequency the capacitive reactance is equal to the inductive reactance.

$$X_L =X_C$$

$$\omega L=1/\omega C$$

$$f_0=1/2\pi\sqrt{LC}$$

CIRCUIT DIAGRAM:



PROCEDURE:

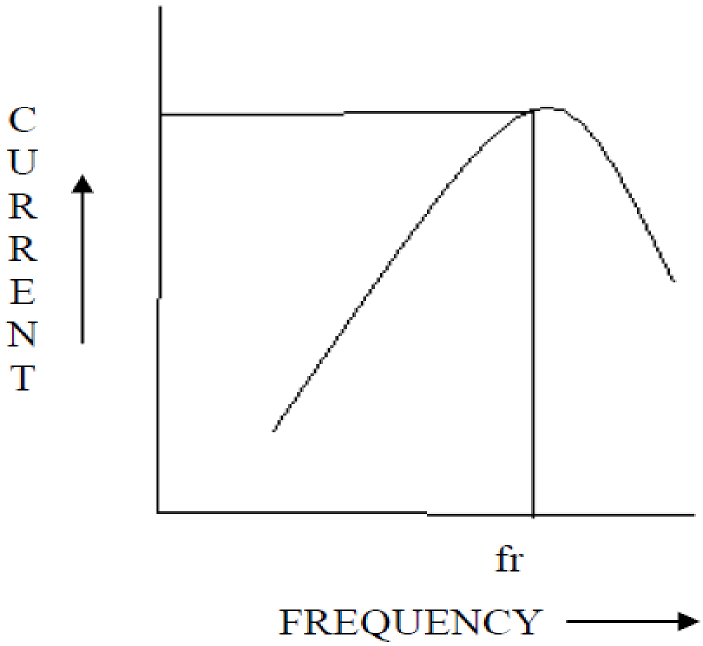
1. Make the connections as shown in circuit diagram.
2. Frequency is given by audio frequency generator.
3. Change the frequency and note thevoltage across the resistor carefully.
4. Plot the frequency Vs voltage graph to suitable scale. At certain frequency the voltage becomes maximum after which, the voltage decreases.
5. This is the resonance frequency.

OBSERVATION TABLE:

S.NO	FREQUENCY (KHz)	VOLTAGE (volts)	Current I = V / R (Amps)

1 2 3			

GRAPH:



RESULT:

The resonance frequency is found to be……kHz.

PRECAUTIONS:

1 All connections should be tight and correct.
2 Switch off the supply when not in use.
3 Reading should be taken carefully.

VIVA QUESTIONS

Q.1 If frequency is 50 Hz, what is the angular frequency?

A. $\omega=2\pi f=100\pi$

Q.2 If time period is 1/50 sec, what is the frequency?

A. f=1/T=50Hz

Q.3 If I=200sin 100πt, at which time it will have the value of 100A?

A. $100=200\sin 100\pi t$

$1/2=\sin 100\pi t$

$100\pi t=\pi/6$

t=1/600sec

Q.4 What is the average value of a square wave of peak value 200V?

A. 200V

Q.5 What is the relation between the max value and the average value of the square wave?

A. Both are same

Q.6 What is the form factor?

A. RMS/average

Q.7 What is the form factor for a sine wave?
A. 1.11
Q.8 What is the impedance for a series resonance circuit?
A. R
Q.9 What is the condition for resonance in a series RLC circuit?
A. $X_L=X_C$
Q.10 What is the quality factor?
A. Quality factor **=** fr/B.W.

Experiment:4 Date:

4.A. Open circuit, Short circuit parameters of two port parameters

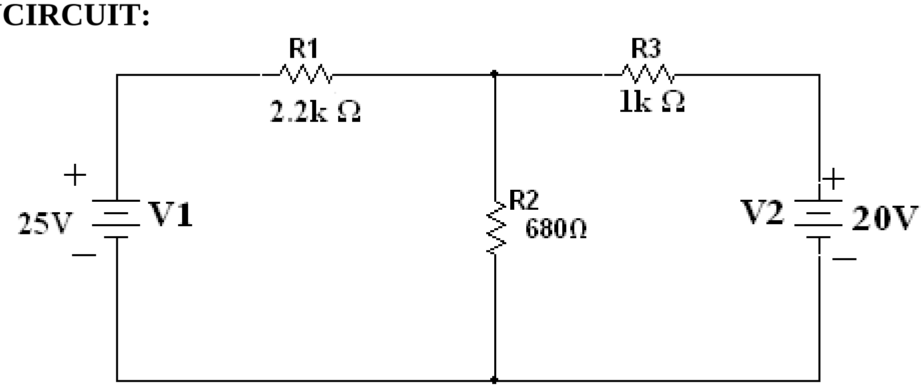
AIM: To determine the Impedance (Z) and admittance (Y) parameters of a two portnetwork.

APPARATUS REQUIRED:

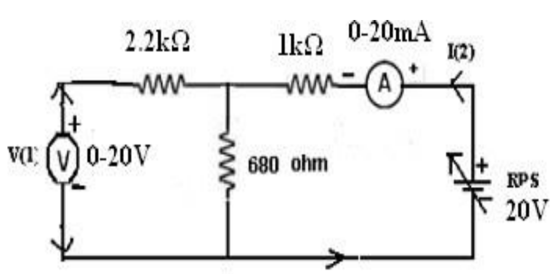
S.No	Name Of The Equipment	Range	Type	Quantity
1	Voltmeter	(0-20)V	Digital	1 NO
2	Ammeter	(0-20)mA	Digital	1 NO
3	RPS	0-30V	Digital	1 NO
4	Resistors	2.2k Ω	-	1 NO
		1k Ω	-	1 NO
		680 Ω	-	1 NO

CIRCUIT DIAGRAMS:

GIVENCIRCUIT:



PRACTICAL CIRCUITS:



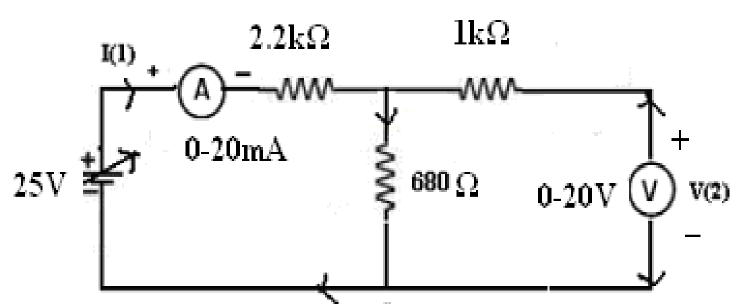
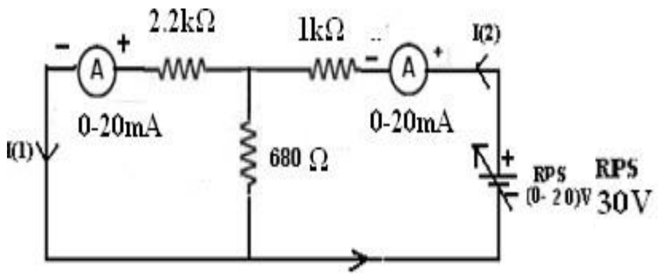


Fig.1. When $I_1 = 0$: fig.2. When $I_2 = 0$:



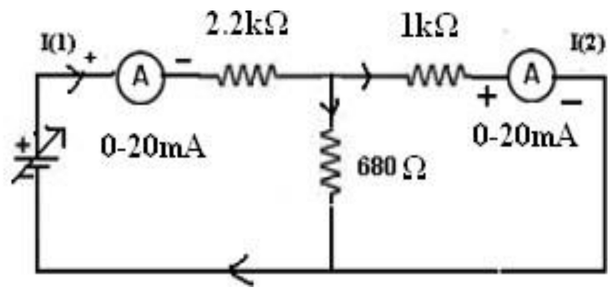


fig .3.When $V_1 = 0$ **fig.4. When $V_2 = 0$:**

THEORY:

A pair of terminals between which a signal may enter or leave the network is known as port. If a network has only one such pair of terminals, it is known as One-Port Network and those with two ports are known as Two-Port Networks.

Consider a general two-port network composed of linear, bilateral elements and no independent sources.

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 (= 1 / Z) is a general term used to represent either the impedance or the admittance of a network.

The voltage and current at port1 are V_1 and I_1 and at port2are 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 these four variables, only two are independent variables. 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:

$Z_{11}=V_1/I_1$, for $I_2=0$
$Z_{22}=V_2/I_2$, for $I_1=0$
$Z_{12}=V_1/I_2$, for $I_1=0$
$Z_{21}=V_2/I_1$, for $I_2=0$

Y-PARAMETERS

$Y_{11}=I_1/V_1$, for $V_2=0$
$Y_{22}=I_2/V_2$, for $V_2=0$
$Y_{12}=I_1/V_2$, for $V_1=0$
$Y_{21}=I_2/V_1$,for $V_2=0$

PROCEDURE

1. Connections are made as per the circuitdiagram.
2. Open circuit the port – 1 i.e., I_1=0, find the values ofV_1, I2 andV_2.
3. Short circuit the port-1 i.e. V_1 =0, find the values of V_2, I_1andI_2.
4. Open circuit the port – 2 i.e., I_2=0, find the values of V_1, I1 andV_2.
5. Short circuit the port-2 i.e. V_2 =0, measure the values of V_1, I_1andI_2.
6. Find the Z and Y parameters of the given two port network

THEORITICAL VALUES

$V_1 = 0$	$V_{2}=$	$I_{1}=$	$I_{2}=$
$V_2 = 0$	$V_{1}=$	$I_{1}=$	$I_{2}=$
$I_1 = 0$	$V_{1}=$	$V_{2}=$	$I_{2}=$
$I_2 = 0$	$V_{1}=$	$V_{2}=$	$I_{1}=$

PRACTICAL VALUES:

$V_1 = 0$	$V_{2}=$	$I_{1}=$	$I_{2}=$
$V_2 = 0$	$V_{1}=$	$I_{1}=$	$I_{2}=$
$I_1 = 0$	$V_{1}=$	$V_{2}=$	$I_{2}=$
$I_2 = 0$	$V_{1}=$	$V_{2}=$	$I_{1}=$

parameters	Theoretical	Practical
Z PARAMETERS		
Y PARAMETERS		

PRECAUTIONS:

1. Initially keep the RPS output voltage knob in zero voltposition.
2. Avoid looseconnections.
3. Avoid short circuit of RPS outputterminals.

RESULT:

VIVA QUESTIONS:

1. DefinePort?
2. Define Z & Yparameters?
3. What is the condition for symmetry in case Z & Yparameters?
4. Define characteristicimpedance?
5. What is the condition for reciprocity in case Z & Yparameters?

Experiment:4 Date:

B.DETERMINATION OF TRANSMISSION AND HYBRID PARAMETERS OF A TWO-PORT NETWORK

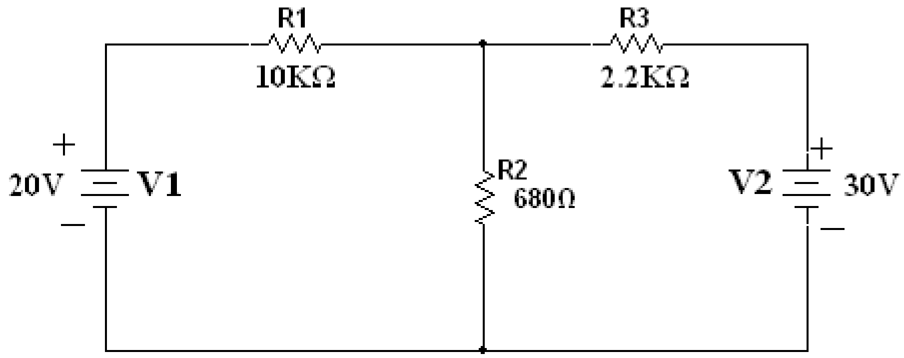
AIM: To determine the Transmission and Hybrid parameters of a two port network

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
		2.2Ω		1 NO
		680 Ω		1 NO
5	Breadboard	-	-	1 NO
6	Connecting wires			Required Number

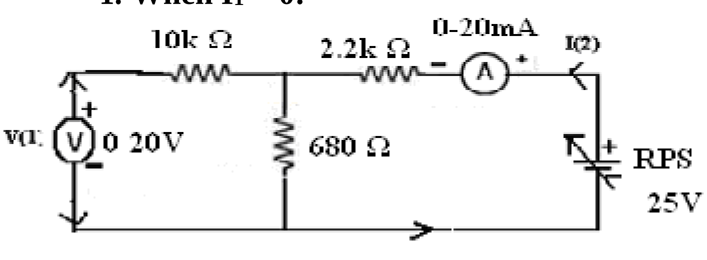
CIRCUIT DIAGRAMS

GIVEN CIRCUIT:

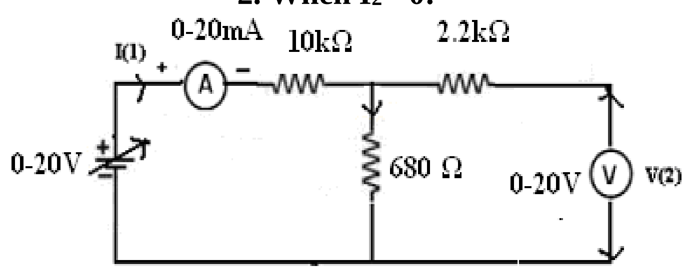


PRACTICAL CIRCUITS:

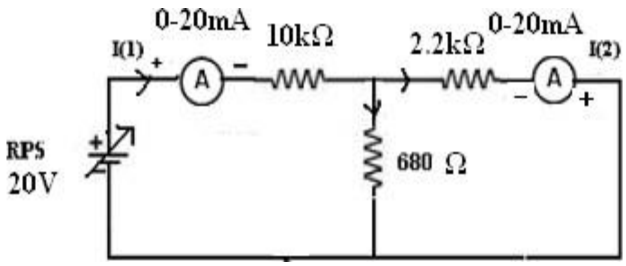
1. When $I_1 = 0$:



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:

$V_1=AV_2-BI_2$ $A=V_2/V_1,\ I_2=0$ $B=V_1/I_2,\ V_2=0$
$I_1=CV_2-DI_2$ $C=I_1/V_2,\ I_2=0$ $D=I_1/I_2, V_2=0$

HYBRID PARAMETERS

$V_1=h_{11}I_1+h_{12}V_2$ $h_{11}=V_1/I_1,\ V_2=0$ $h_{12}=V_1/V_2,\ I_1=0$

$I_2=h_{21}I_1+h_{22}V_2$ $h_{21}=I_2/I_1,\ V_2=0 h_{22}=I_2/V_2,\ I_1=0$

PROCEDURE:

1. Connections are made as per the circuitdiagram.
2. Open circuit the port – 1 i.e., I_1=0 measure the values ofV_1, I2 andV_2.
3. Short circuit the port-1 V_1 =0 measure the values of V_2, I_1andI_2.
4. Open circuit the port – 2 i.e., I_2=0 measure the values of V_1, I1 andV_2.
5. Short circuit the port-2 i.e. V_2 =0 measure the values of V_1, I_1andI_2
5. Measure the ABCD and h-parameters of the given two port network from the above data.

THEORITICAL VALUES:

$V_2 = 0$	$V_{1=}$	$I_{1=}$	$I_{2=}$
$I_1 = 0$	$V_{1=}$	$V_{2=}$	$I_{2=}$
$I_2 = 0$	$V_{1=}$	$V_{2=}$	$I_{1=}$

PRACTICALVALUES:

$V_2 = 0$	$V_{1=}$	$I_{1=}$	$I_{2=}$
$I_1 = 0$	$V_{1=}$	$V_{2=}$	$I_{2=}$
$I_2 = 0$	$V_{1=}$	$V_{2=}$	$I_{1=}$

Parameters	Theoretical	Practical
ABCD		
HYBRID		

PRECAUTIONS:

1. Initially keep the RPS output voltage knob in zero voltposition.
2. Avoid looseconnections.
3. Avoid short circuit of RPS outputterminals.

RESULT:

VIVA QUESTIONS

1. DefinePort?
2. What is the condition for symmetry in case h-parameters & ABCD (T)parameters?
3. Define characteristicimpedance?
4. What is the condition for reciprocity in case Hybrid (h) & ABCD (T)parameters?

Experiment:5 Date:

Simulation of 2^{nd} order RLC using P-spice/MATLAB

AIM: To plot the magnitude curve for various frequencies for the given RLC series circuit

SOFTWAREREQUIRED

S. No	SOFTWARE USED	DESK TOP QUANTITY
1	MATLAB	01
2.	PSPICE	01

THEORY:

A circuit is said to be in resonance when applied voltage V and current I are in phase with each other. Thus at resonance condition, the equivalent complex impedance of the
R-L-C circuit consists of only resistance (R) with inductive and capacitive reactance cancelling each other and hence current is maximum. Since V and I are in phase, the power factor isunity.

The complex impedance

$Z = R + j (XL – XC)$

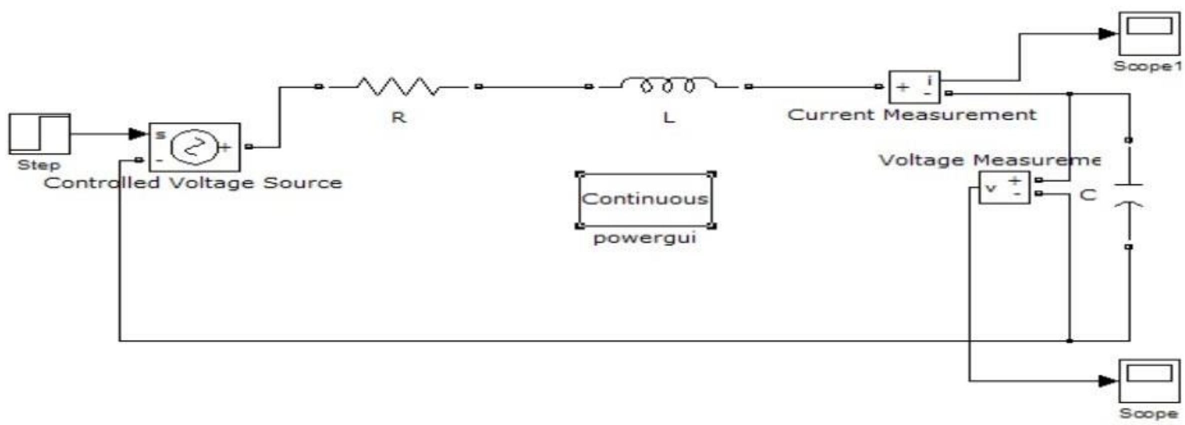
Where $X_L = \omega L$ and $X_C = 1/\omega C$

At resonance, $X_L = X_C$ and hence $Z = R$

Bandwidth of a Resonance Circuit:

Bandwidth of a circuit is given by the band of frequencies which lies between two points on either side of resonance frequency, where current falls through 1/1.414 of the maximum value of resonance. Narrow is the bandwidth, higher the selectivity of the circuit. As shown in the model graph, the bandwidth AB is given by f2 – f1. f1 is the lower cut off frequency and f2 is the upper cut offfrequency

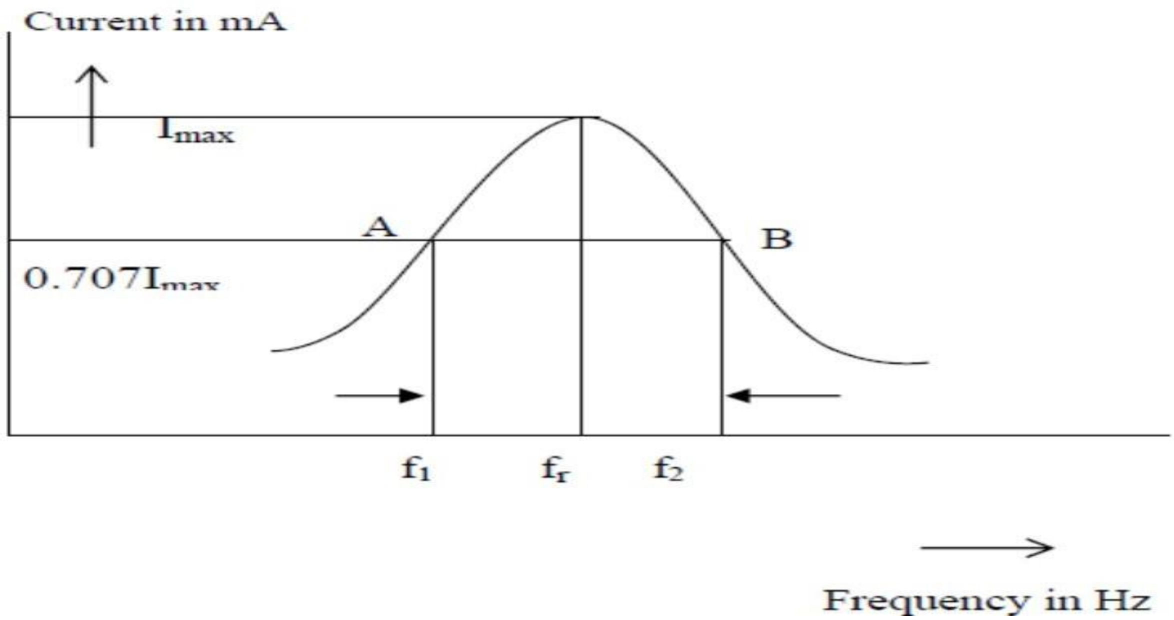
CIRCUITDIAGRAM:



PROCEDURE:

1. Open a new MATLAB/SIMULINKmodel
2. Connect the circuit as shown in thefigure
3. Debug and run thecircuit
4. By double clicking the powergui plot the value of current for the different values offrequencies

MODEL GRAPH FOR SERIESRESONANCE



%PROGRAM TO FIND THE SERIESRESONANCE:

```
clc;
clear all;
closeall;
r=input('enter theresistancevalue-- >');
l=input('enter theinductancevalue--- >');
c=input('enter thecapacitancevalue -->');
v=input('enter theinputvoltage --- >');
f=5:2:300;
xl=2*pi*f*l; xc=(1./(2*pi*f*c));
x=xl-xc;
z=sqrt((r^2)+(x.^2));
i=v./z;
```

```
%plotting thegraph
subplot(2,2,1);
plot(f,xl);
grid;
xlabel('frequency'); ylabel('X1');
subplot(2,2,2);
plot(f,xc); grid;
xlabel('frequency'); ylabel('Xc');
subplot(2,2,3);
plot(f,xc); grid;
xlabel('frequency'); ylabel('Z');
subplot(2,2,4);
plot(f,xc); grid;
xlabel('frequency'); ylabel('I');
```

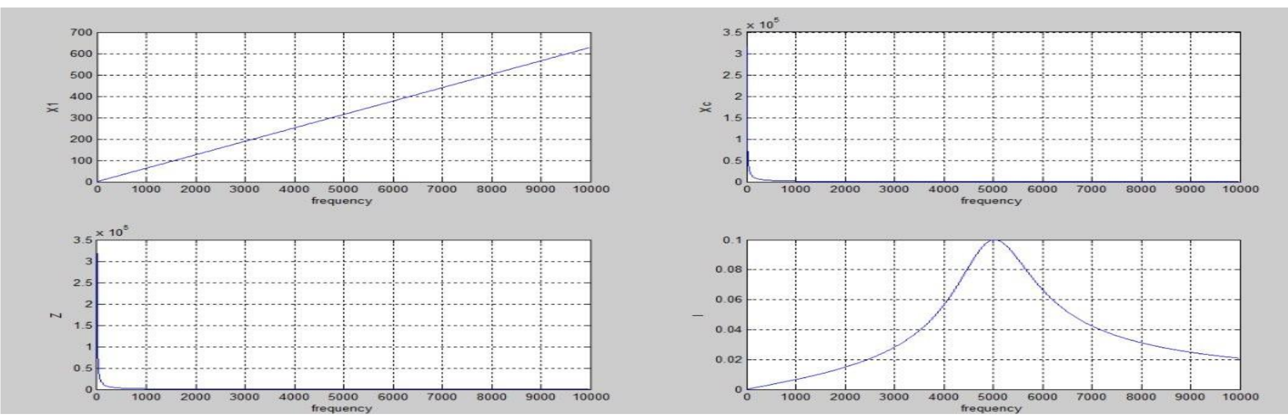
PROGRAMRESULT:

Enter the resistance value ->100

Enter the inductance value------>10e-3

Enter the capacitancevalue----->0.1*10^-6

Enter the input voltage -- >10



VIVA QUESTIONS

Q.1 If frequency is 50 Hz, what is the angular frequency?

Q.2 If time period is 1/50 sec, what is the frequency?

Q.3 If I=200sin 100πt, at which time it will have the value of 100A?

Q.4 What is the average value of a square wave of peak value 200V?

Q.5 What is the relation between the max value and the average value of the square wave?

Q.6 What is the form factor?
Q.7 What is the form factor for a sine wave?
Q.8 What is the impedance for a series resonance circuit?
Q.9 What is the condition for resonance in a series RLC circuit ?
Q.10 What is the quality factor?

Experiment:6 Date:

Measurements of low resistance by Kelvin's double bridge

AIM:
To measure the given low resistance using Kelvin's double bridge method.

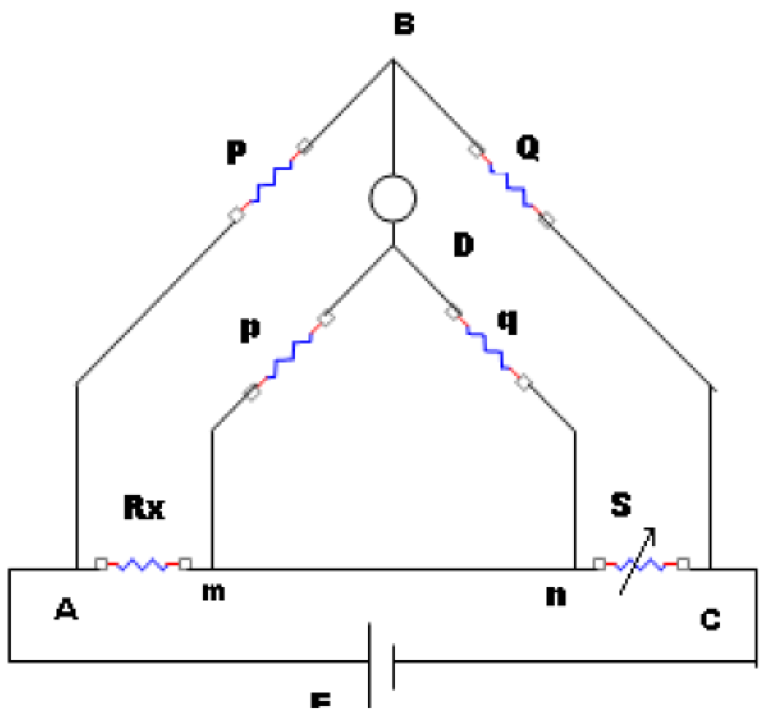
OBJECTIVE:

To study the working of bridge under balanced and unbalanced condition and to study the sensitivity of bridge.

APPARATUS REQUIRED:

S.No	NAME OF THE APPRATUS	RANGE	TYPE	QTY
1	Kelvin Double bridge kit			
2	Unknown resistance			
3	Multi - meter			
4	Connecting Wires			

CIRCUIT DIAGRAM:



FORMULA USED:
$R_x = (P/Q)\, S$ ohms
Where
P, Q first set of ratio arms.
p, q Second set of ratio arms.
S Standard resistance,
R_x unknown resistance.

PROCEDURE:

1. The resistance to be measured is connected such that the leads from +C and + P are connected to one end and those from –C and –P are connected to the other end in the kit.
2. The P/Q ratio (multiplier) is initially kept at position '1' and the deflection of the galvanometer is observed by pressing the galvanometer key.
3. The 'S' arm (main dial) is adjusted and two positions are identified for which the deflection of the galvanometer is on either side of the null point. [If not some other P/Qratio is to be tried].
4. The lowest of the two position indicates the coarse value of the unknown resistance and the null point is obtained by adjusting the Vernier scale, with the galvanometer sensitivity knob at the maximum position.
5. The value of unknown resistance is read. ['S' Value]
6. Steps 3, 4, 5 are repeated for some other P/Q ratio for the unknown resistance.
   Themean value is taken.
7. The above procedure is repeated with another sample.

TABULAR COLUMN

S.No.	**P/Q RATIO (Multiplier)**	**S VALUE COARSE , FINE**	**UNKNOWN RESISTANCE R_x**	
1				
2				
3				
4				
5				
6				

RESULT:

VIVA QUESTIONS

1. A bridge circuit uses which method of measurement
2. The principle on which a bridge circuit operates is
3. The accuracy of a bridge depends on the _________ a) null indicatorb) bridge components
   c) current sourced) voltage source

Experiment:7 Date:

Measurement of active, reactive powerusing two watt meter method

AIM

To conduct a suitable experiment on a 3-phase load connected in star or delta to measure the three phase power and power factor using 2 wattmeter method.

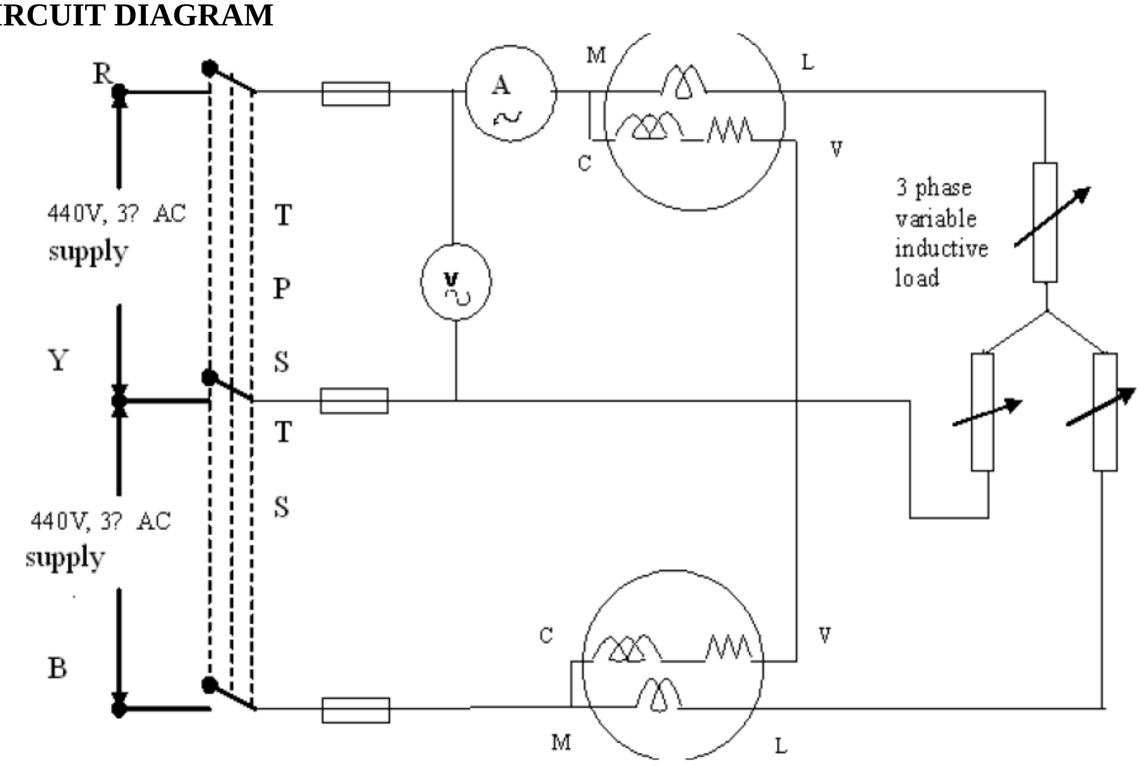
OBJECTIVES

1. To study the working of wattmeter
2. To accurately measure the 3 phase power
3. To accurately measure the power factor
4. To study the concept of star connected load and delta connected load

APPARATUS REQUIRED:

S.NO	NAME OF THE APPRATUS	RANGE	TYPE	QTY
1	Ammeter			
2	Voltmeter			
3	Wattmeter			
4	Connecting Wires			
5	3 phase inductive load			

CIRCUIT DIAGRAM



FORMULA USED:

1. Total power, P = W_1+W_2 (W)

2. $Ø = \tan^{-1} \sqrt{3} [(W_1 - W_2) / (w1 + w2)]$

3. P.F = CosØ

4. Reactive Power = $\sqrt{3}(W_1 - W_2)$ (VAr)

PROCEDURE:

1. Connection are made as per the circuit diagram, keeping the inductive load in the minimum position.
2. Supply switch is closed and reading of ammeter and wattmeter are noted.If one of the Wattmeter reads negative, then its potential coils (C and V) are interchanged and reading is taken as negative.
3. The above procedure is repeated for different values of inductive coil. Care should be taken that current should not exceed 10A during the experiment.

TABULAR COLUMN:

S.NO	I	V	W1	W2	POWER	REACTIVE POWER	PF
1 2 3 4 5 6							

RESULT:

VIVA QUESTIONS

1. Which method is the commonest method of measuring three balanced or unbalanced power?
2. The reactive power can be measured with wattmeter when voltage across voltage coil is adjusted to be out of phase with the current by------------
3. The total power P measured in Y star three-phase circuit is
4. The power in delta three-phase circuit is
5. The dynamometer wattmeter can be used to measure----- POWER
6. Induction wattmeter can be used to measure--- power
7. The one “unit” of energy measured in AC circuit is
8. How do you calculate Real Power , Reactive power and Apparent power , given W_1 and W_2?

Experiment:8 Date:

Calibration of single phase energy meter by phantom loading

AIM:

To calibrate the given single phase energy meter at unity and other power factors

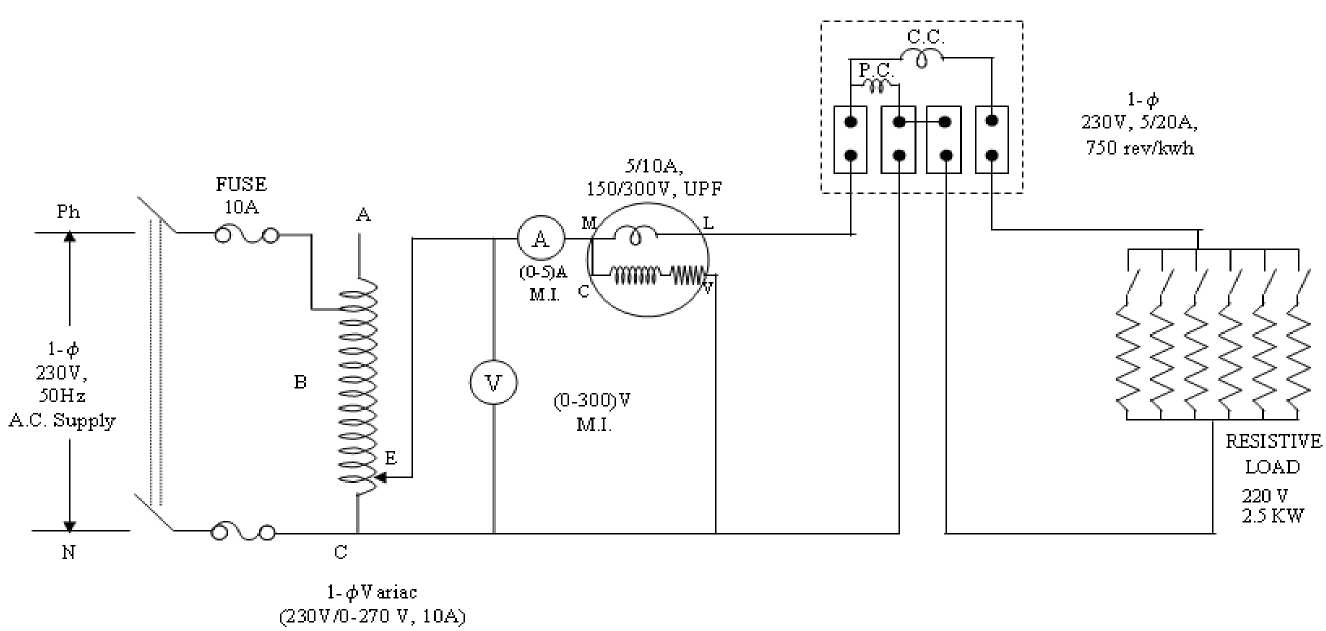
OBJECTIVE:

1. To study the working of energy meter.
2. To accurately calibrate the meter at unity and other power factor.
3. To study the % of error for the given energy meter.

APPARATUS REQUIRED:

S.NO	NAME OF THE APPRATUS	TYPE	RANGE	QTY
1	Energy meter			
2	Wattmeter			
3	Ammeter			
4	Voltmeter			
5	Stop watch			
6	Connecting Wires			

CIRCUIT DIAGRAM



FORMULAE USED:

Let *x* revolution / kwh be the rating.

Now *x* revolution = 1 kwh= 1* 3600*1000 watt-sec.

Constant k of energymeter = $3600 * 10^3 / x$ watt-sec

For each load, indicated power Wi is given as Wi = k/t watts

Where

K= energy meter constant (watt-sec)

t = time for 1 revolution(sec)

% error = Wi – Wa / Wi * 100

Where Wi is indicated power in watts

Wa is actual power shown by wattmeter in watts

% error can be zero +ve or –ve.

4. At marked current and 0.5 lagging pf.

PROCEDURE:

1. Connections are given as shown in the circuit diagram.
2. Supply is switched ON and load is increased in steps, each time noting the readings ofammeter and wattmeter. Also the actual time taken for 1 revolution of the disc ismeasured using stop watch.
3. Step 2 is repeated till rated current of the energy meter is reached.
4. % error is calculated and calibration curve is drawn

TABULAR COLUMN:

S.NO	LOAD CURRENT	WATTMETER READING, W_a(W)	INDICATED POWER, W_i(W)	Timetaken T (sec)	% ERROR
1 2 3					

NOTE:

From the calibration curve it is possible to predict the error in recording the energy. So the correction can be applied to the energy meter reading so that correct energy reading can be obtained and used.

RESULT:

VIVA QUESTIONS:

1. What is an energy meter?
2. What are the types of energy meter?
3. Which type of energy meters are used in dc circuits?
4. Energy meter is an ______________ (i) integrating instrument (ii) indicating instrument
5. Can the measured percentage error be negative?
6. What do you mean by ‘torque adjustment’?
7. What is operating torque?
8. Define braking torque?
9. When does the disc on the spindle rotate with a constant speed?
10. The operating torque is directly proportional to speed, state true or false.

Experiment:9 Date:

MEASUREMENT OF SINGLE PHASE POWER AND POWER FACTOR USING THREE AMMETERS.

AIM

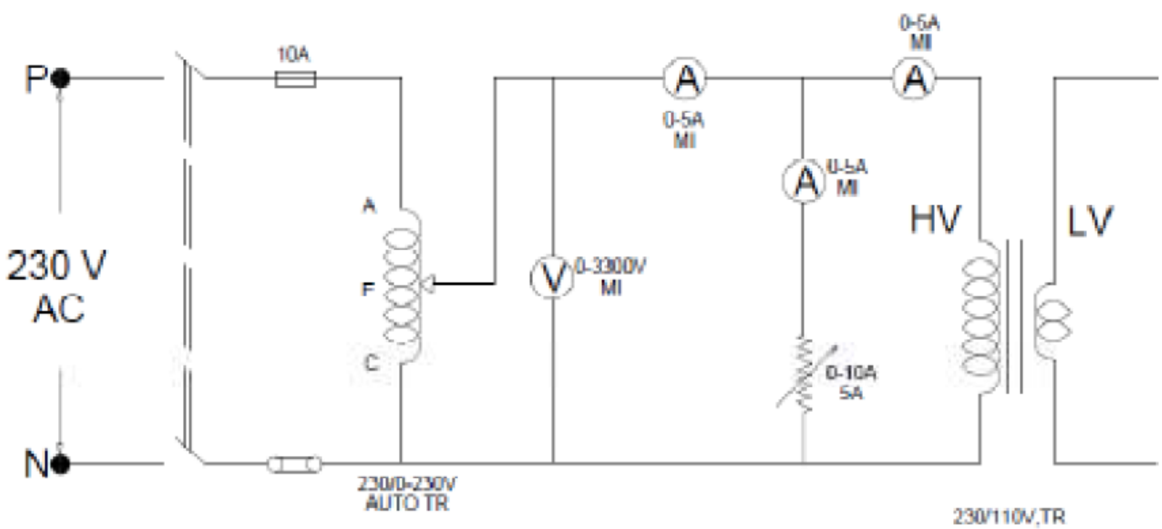
To measure the power and power factor of the given R-L circuit using three Ammeters.

APPARATUS REQUIRED:-

S.NO	Apparatus	Specification	Quantity	
1 2 3 4 5	Ammeter Voltmeter Rheostat Autotransformer Transformer			

CIRCUIT DIAGRAM

THREE AMMETER METHOD



THEORY

Power factor is the cosine of the angle between phase voltage and current. The maximum value of power factor is unity, i.e. for pure resistive load and minimum value is zero.ie for pure inductive load (lagging) or pure capacitive load (leading).

PROCEDURE:

1. Connect the circuit as in the connection diagram.
2. Check the connections and correct the mistake if any.
3. Switch on the supply
4. First note the reading in the Voltmeter, then gradually increase the input voltage and takethe corresponding readings in all the three meters. Tabulate.
5. Calculate the results accordingly.

OBSERVATION

S.NO	V/m Reading- Volts	I_1 Amps	I_2 Amps	I_3 Amps	Power= $(R/2)\ (I_1^2-I_2^2-I_3^2)$	PF= $(I_1^2-I_2^2-I_3^2)/(2\ I_2 I_3)$

RESULT

Power =

Power factor =

VIVA QUESTIONS:

1. What are the choke coil parameters?
2. What is the function of choke?
3. What are the methods are there to find choke coil parameters?
4. Which method is very important for finding the choke coil parameters?
5. What are the disadvantages of 3-voltmeter and 3-ammeter method?

Experiment:10 Date:

A) MEASUREMENT OF INDUCTANCE USING MAXWELLS BRIDGE

AIM: To find the unknown inductance and Q factor of a given coil.

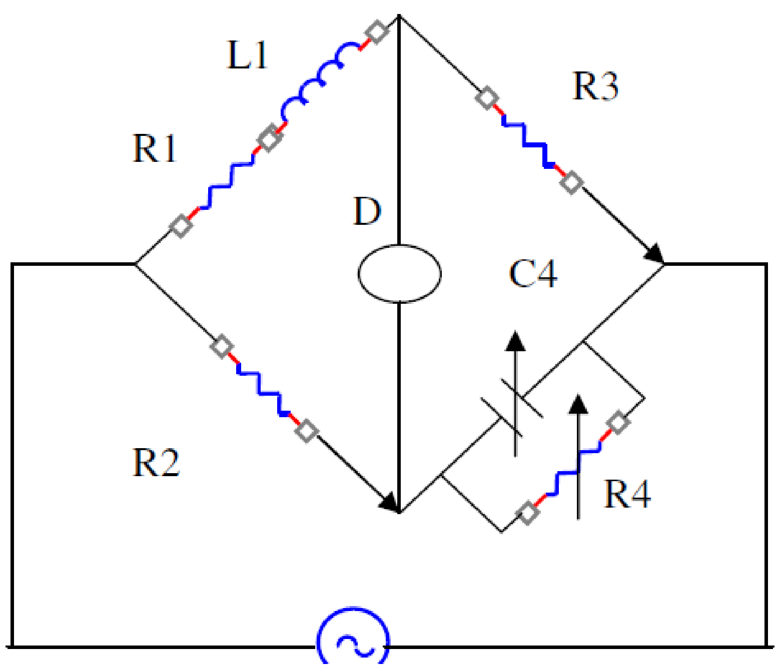
OBJECTIVE:

To find the unknown inductance of the given coil using bridge circuit and to studythat Maxwell inductance-capacitance bridge is suitable for the measurement oflow Q coils.

APPARATUS REQUIRED:

SL.NO	NAME OF THE APPRATUS	RANGE	TYPE	QTY
1	Maxwell's inductance			
2	Capacitance Bridge kit			
3	Unknown Inductance			
4	Multimeter			
5	Connecting Wires			
6	CRO			
7	Bridge oscillator			

CIRCUIT DIAGRAM:



FORMULAE USED:

1. Unknown resistance, $R_1=R_2R_3 / R_4$ (Ω)
2. Unknown Inductance, $L_1=R_2R_3C_4$ Henry

Thus we have two variables R4 and C4 which appears in one of the twobalance equation and hence the two equations are independent, andbalance is obtained by varying R4 and C4 alternately.
3. Quality factor, $Q = \omega L_1 / R_1 = \omega C_4 R_4$

PROCEDURE:

1. The inductance to be measured is connected between L1 terminal of the kit.
2. The bridge oscillator is set for 10Vpp, 1 kHz and connected to the OSC terminal of the kit.
3. The detector CRO or headphone is connected to the headphone terminal of the kit.
4. The R4 and C4 are adjusted from the highest range (among the 3 range knobs) to obtain the null point in the detector.

[Null point – For increase in R4 and C4values the point at which the amplitude reduces to a minimum and then increases is the null point].
5. At the null point the values of R4 and C4 are noted.
6. The value of unknown resistance, inductance and quality factor are calculated.
7. The experiment is repeated with other samples provided

TABULAR COLUMN:

S.NO	$R_4(\Omega)$	C_4 (F)	UNKNOWN INDUCTANCE (H)	
1 2 3 4 5				

RESULT:

VIVA QUESTIONS

1. What is the purpose of a bridge circuit
2. What is the formula of self-inductance
3. List the advantages of Maxwell’s Bridge
4. What are the disadvantages of Maxwell’s Bridge.
5. What are the other types of Maxwell’s Bridge.

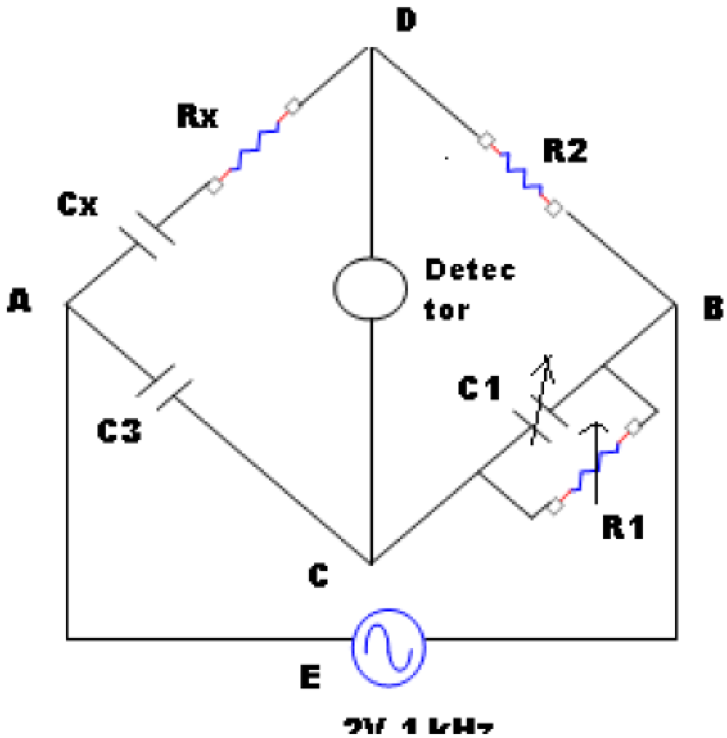
B) MEASUREMENT OF CAPACITANCE USING DeSauty BRIDGE

AIM: To measure the unknown capacitance using **DeSauty** bridge.
OBJECTIVE:
To measure the unknown capacitance and to study about dissipation factor.

APPARATUS REQUIRED

S.NO	NAME OF THE APPRATUS	RANGE	TYPE	QTY
1	Schering Bridge kit			
2	Unknown capacitance			
3	Multimeter			
4	Connecting Wires			
5	CRO			

CIRCUIT DIAGRAM:



FORMULA USED:

1. Unknown capacitance, $C_x = (R_1/R_2)\, C_3$,
Where C_3 is known capacitance in µF
R_2 is Non-Inductive Variable Resistor
2. Dissipation factor, $D = \omega R_1 C_1 = \omega R_x C_x$

PROCEDURE:

1. The oscillator AB and the bridge AB terminals are connected.
2. From the CD terminals of the bridge, the detector (loudspeaker) is connected through an imbalance amplifier.
3. Connections of the bridge arm are made as per the circuit diagram.
4. The value of R_2 is selected arbitrarily (say1K) and R_1 is kept at maximum position.
5. The kit is switched on and R1 is decreased until the null point is observed as a dip in the sound from the loudspeaker.
6. The capacitor C_1 can be varied for fine balance adjustment.
7. When the balance condition is reached, the trainer kit is switched OFF and the value R_1 is measured using a multimeter.
8. The value of unknown capacitance and dissipation factor is calculated.

9. The experiment is repeated for various samples provided.

TABULAR COLUMN:

S.NO	**R_2 (Ω)**	**R_1 (Ω)**	**UNKNOWN CAPACITANCE C_x (μF)**	
1 2 3 4 5 6				

RESULT:

VIVA QUESTIONS

1. What is Desauty bridge?
2. How is unknown capacitance measured
3. What is dissipation factor of capacitor
4. Which bridge is used for capacitance measurement

11. Measurement of 3Phase Reactive Power with a single wattmeter

AIM:-
To measure 3phase reactive power using single wattmeter method.

APPARATUS:-
1. 1 Wattmeter (0-300/600V, 5/10 A, UPF) 2. Voltmeter (0-600)V, MI
3 Ammeter (1-10) A, MI 4. 3-Ø Star Connected load(0-400) V, 2.2 KW, 3 HP
5 Connecting wires.

THEORY:-
Single Wattmeter method:-

Reactive Power Measurement in Balanced Three-Phase Circuit

The single wattmeter method is used for measuring the power of the balanced three-phase circuit. The current coil of the Wattmeter is connected to one phase, and the pressure coil is connected to the other phase of the line.

Let the current through the current coil – I_2

$$Reading\ of\ Wattmeter = V_{13} I_2 \cos(90^\circ + \emptyset)$$

$$= \sqrt{3} VI \cos(90^\circ + \emptyset)$$

$$= \sqrt{3} VI Sin 90^\circ$$

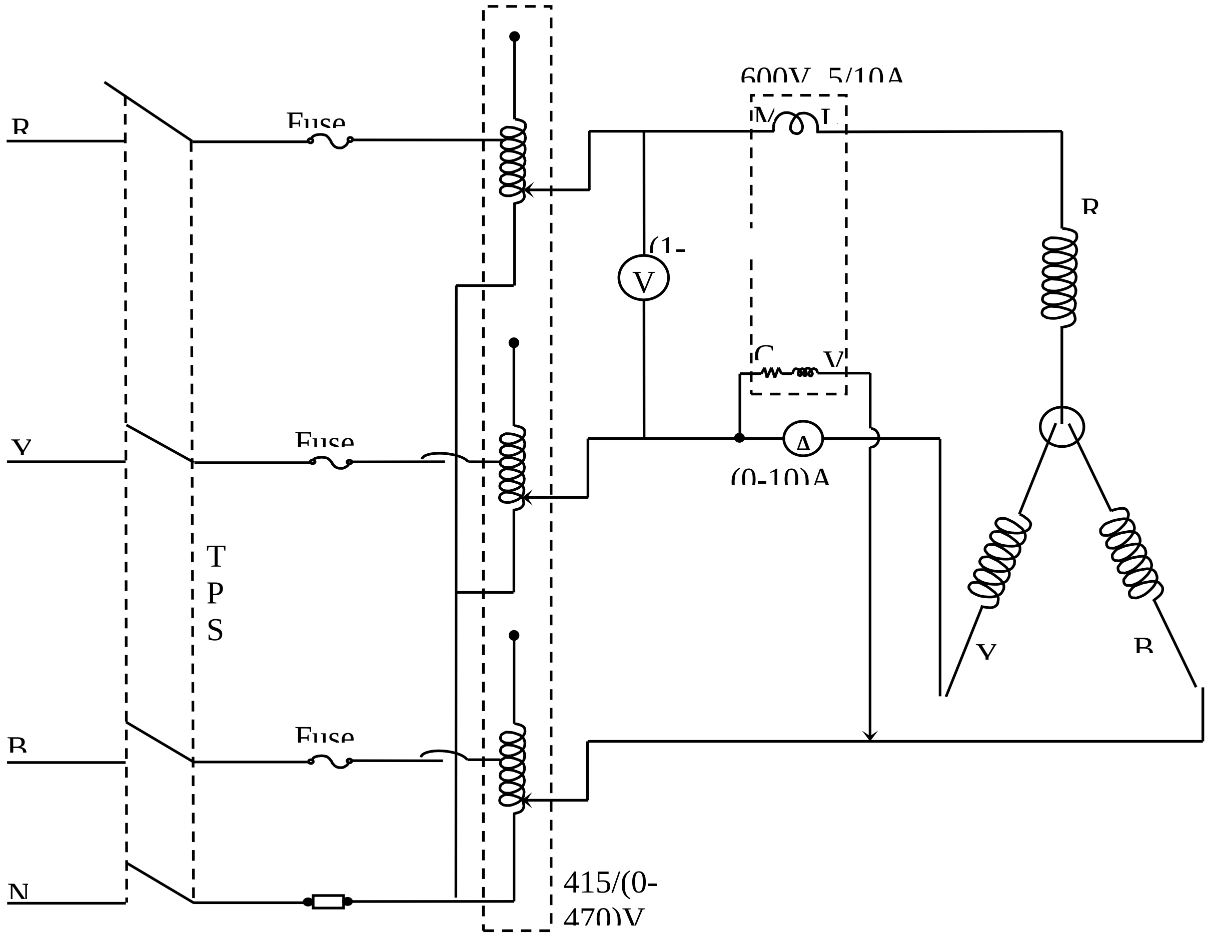
Voltage across the pressure coil – V_{13}

Total reactive volt amperes of the circuit

$$Q = 3VI Sin\emptyset$$

$$= \left(-\sqrt{3}\right) \times reading\ of\ Wattmeter$$

The phase angle $\emptyset = \tan^{-1} \frac{Q}{P}$



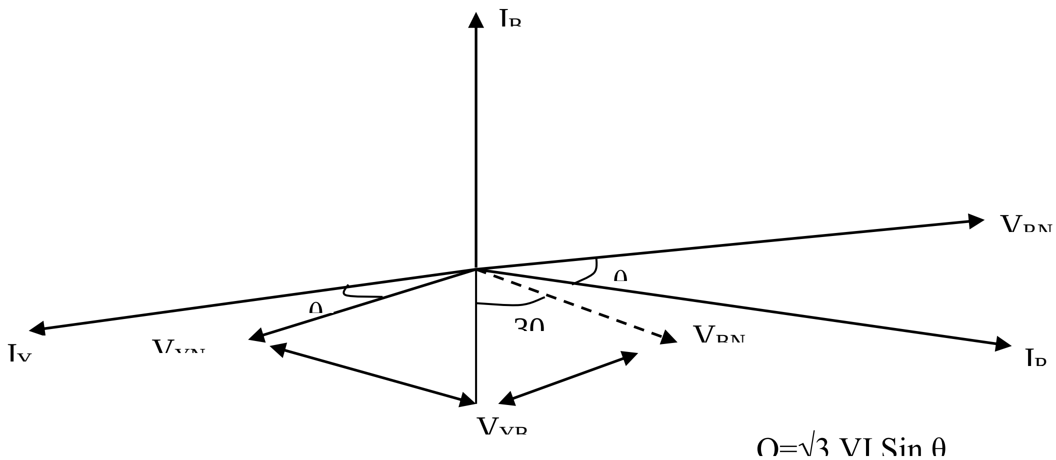
PROCEDURE:-

1. Connect the circuit as per circuit diagram.
2. Adjust the voltmeter reading to rated value using 3 phase auto transformer.
3. Note down the readings of voltmeter, current & wattmeter reading.
4. Repeat the process for different loads.

PRECAUTIONS:-

1. No loose connections should be there.
2. Take the readings without error.
3. Check the fuse & switch which is connected to supply.

Phasor Diagram:-



$Q = \sqrt{3}\,VI \sin\theta$

Tabular form:-

S. No.	V	I	WXMI	√3 W
1				
2				
3				
4				
5				
6				

RESULT:-

The 3-Ø reactive power is measured by using single wattmeter method.

12.SIMULATION OF

(A) VERIFICATION OF THEVENIN'S THEOREM USING DIGITAL SIMULATION.

AIM:

To verify Thevenin's theorem using digital simulation.

APPARATUS:

S. No	SOFTWARE USED	DESK TOP QUANTITY
1	MATLAB	01

CIRCUIT DIAGRAMS:

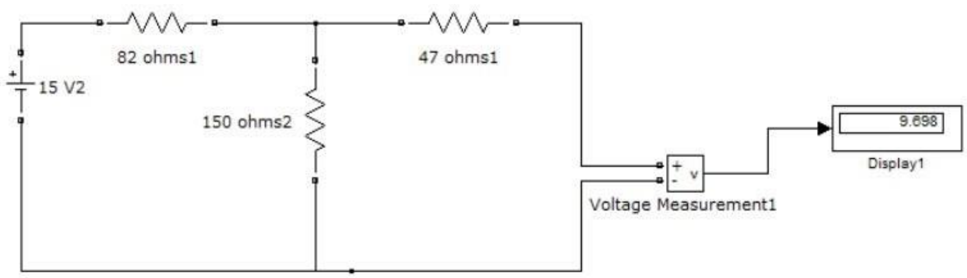


Fig Measurement of V_{TH} or V_{OC}

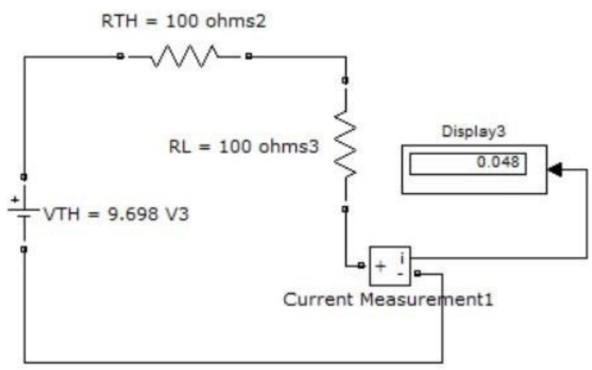


Fig Measurement of I_L ($I_L = V_{TH}$ or $V_{OC} / R_{TH} + R_L$)

PROCEDURE:

1. Make the connections as shown in the circuit-8.4 diagram by using MATLAB Simulink.
2. Measure the open circuit voltage across the load terminals using voltage measurement.
3. Connect circuit fig 8.5 Thevenin's equivalent circuit in MATLAB and find the load current.

RESULT:

VIVA QUESTIONS:

1. What is load resistance?
2. How will you calculate Thevenin's resistance R_{TH}?
3. How will you calculate Thevenin's voltage V_{TH}?
4. How will you calculate load current I_L?

(B) VERIFICATION OF NORTON’S THEOREM USING DIGITAL SIMULATION

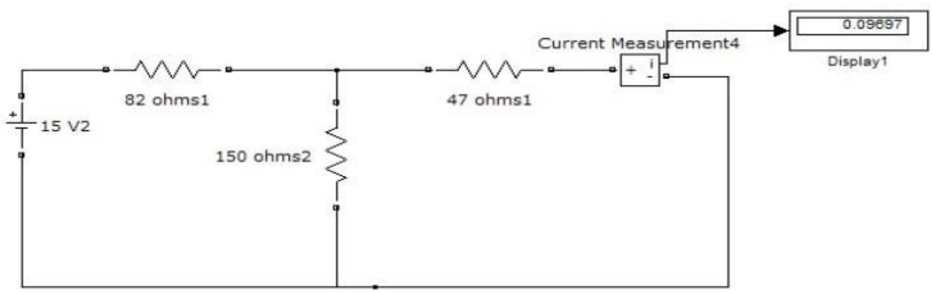
AIM:

To verify Norton’s theorem using digital simulation.

APPARATUS:

S. No	SOFTWARE USED	DESK TOP QUANTITY
1	MATLAB	01

CIRCUIT DIAGRAMS:



FigNorton’s current in MATLAB

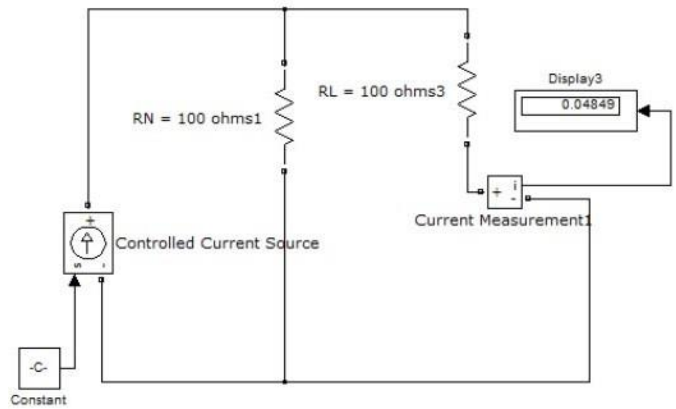


Fig Load current in MATLAB

PROCEDURE:

1. Make the connections as shown in the circuit-9.4 diagram by using MATLAB Simulink.
2. Measure the short circuit current through the load terminals using current measurement.
3. Connect circuit fig 9.5 Norton's equivalent circuit in MATLAB and find the load current.

PRECAUTIONS:

1. Check for proper connections before switching ON the supply
2. Make sure of proper color coding of resistors
3. The terminal of the resistance should be properly connected

RESULT:

VIVA QUESTIONS:

1. State Norton's theorem.
2. Define R_N.
3. Define I_N.

(C) VERIFICATION OF SUPERPOSITION THEOREM USING DIGITAL SIMULATION.

AIM:

To verify Superposition theorem using digital simulation.

APPARATUS:

S. No	SOFTWARE USED	DESK TOP QUANTITY
1	MATLAB	01

CIRCUIT DIAGRAMS:

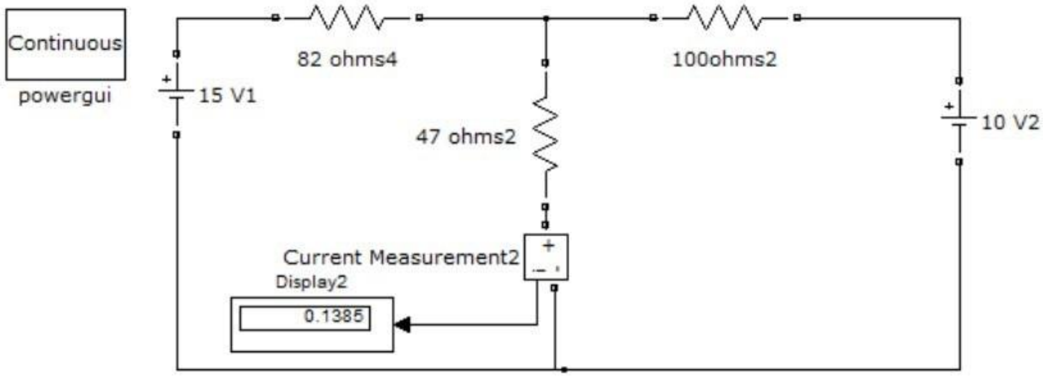


Figure. Verification of super position theorem.

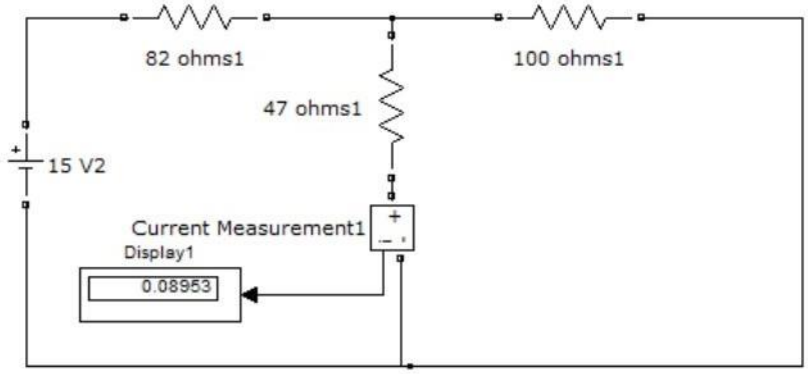


Figure – Verification of super position theorem.

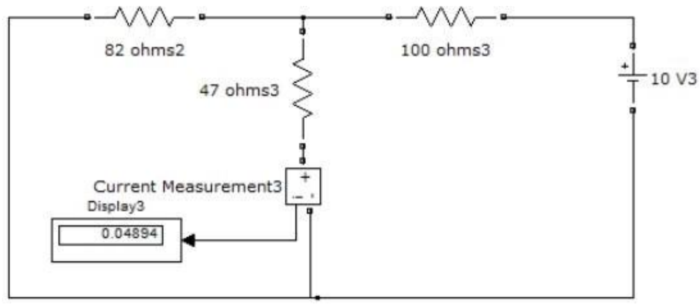


Figure Verification of super position theorem.

PROCEDURE:

1. Make the connections as shown in the circuit diagram by using MATLAB Simulink.
2. Measure the current in each circuit using current measurement.
3. Verify with the theoretical results obtained with practical results

RESULT:

VIVA QUESTIONS:

1. State Superposition theorem.
2. How to find power using Superposition theorem?
3. Write applications of super position theorem.

(D)VERIFICATION OF MAXIMUM POWER TRANSFER THEOREM

AIM:

To verify maximum power transfer theorem using digital simulation.

APPARATUS:

S. No	SOFTWARE USED	DESK TOP QUANTITY
1	MATLAB	01

CIRCUIT DIAGRAMS:

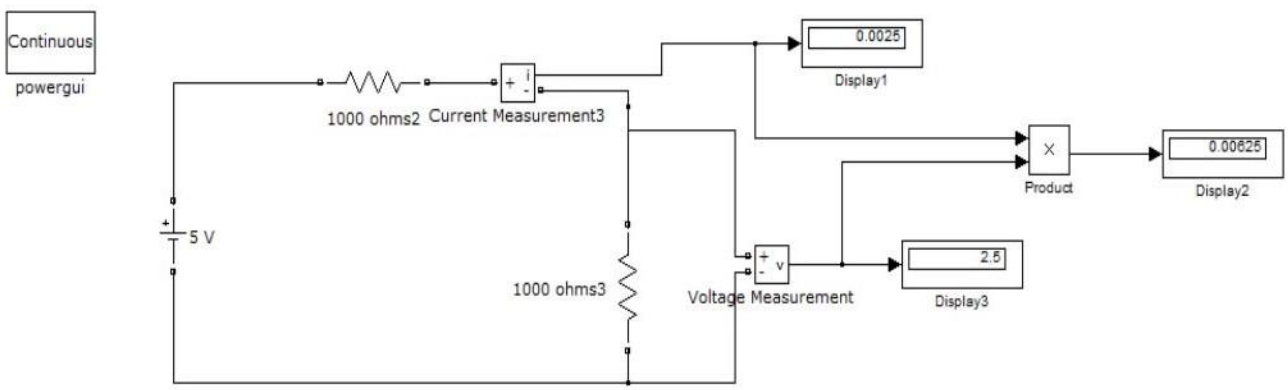


Fig –Maximum Power Transfer Circuit

PROCEDURE:

1. Make the connections as shown in the circuit-7.3 diagram by using MATLAB Simulink.
2. Measure the voltage and current through the load resistor using voltage measurement and current measurement
3. Calculate the power .
4. Find the resistance at which maximum power delivered

RESULT:

VIVA QUESTIONS:

1. State maximum power transfer theorem.
2. Is it possible to apply maximum power transfer theorem to ac as well as dc circuit?
3. How to find power using maximum power transfer theorem?