Shri Ramdeobaba College of Engineering and Management, Nagpur (MS)

(An Autonomous Institution Permanently affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

An ISO 9001:2015 Certified Institution. NAAC Certified 'A' Grade

Department of Electrical Engineering

Laboratory Manual

Network Analysis

Laboratory EEP 251

(III Semester Electrical)

VISION & MISSION OF THE DEPARTMENT

Vision

Department of Electrical Engineering endeavours to be one of the best departments in India having expertise to mould the students to cater the needs of society in the field of technology, leadership, administration, ethical and social.

Mission

To provide dynamic and scholarly environment for students to achieve excellence in core electrical and multidisciplinary fields by synergetic efforts of all stake holders of the Electrical Engineering Department and inculcate the ethical and social values.

Program Outcomes (UG)

- PO1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals to the solution of engineering problems.
- PO2. **Problem analysis:** Identify, formulate, review literature, and analyze complex engineering problems using first principles of mathematics, natural sciences, and engineering sciences.
- PO3. **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 safety, societal and environmental considerations.
- PO4. Conduct problem investigations: Use research-based knowledge including experimentation, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- PO5. Modern tool usage: Select, and apply appropriate techniques, resources, and modern engineering and IT tools for analyzing the engineering activities with an understanding of the limitations.
- PO6. **The engineer, industry and society:** Apply contextual knowledge to assess industrial, societal and safety related issues and understand consequent relevance to the professional 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.
- PO8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the 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 such as, being able to understand and write effective reports, 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 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.

Program Specific Outcomes

- PSO1. Analyze and design electrical networks, machines, control systems, power systems, and power converters and evaluate the performance.
- PSO2. Understand and develop electrical systems considering energy efficiency, power scenario, environmental issues and industry applications.

NETWORK ANALYSIS LAB

Course Details

Course Name: Network Analysis Lab

Laboratory Course Code : EEP251

Lab Hours : Two /Week

Credits : 0ne

Prerequisite: Basic Electrical Engineering,

Curse Objective:

The objectives of this laboratory course are to prepare students for Network Analysis experimentations to realize the theoretical Network Analysis concepts underlined to practically use and draw the perfect solutions of various network / circuits problems.

Course Outcomes:

Student shall be able to:

1. Apply analyze and co-relate fundamental principles of Engineering with laboratory experimental work.
2. Understand and connect the circuit and perform the experiment, Analyze the observed data & make valid conclusion.
3. Understand & write Journal with effective presentation of Drawing diagrams / characteristics /Graphs
4. Match the practical and theoretical analysis results, for conceptual verification.

Evaluation Scheme:

Internal Evaluation : 25 Marks	External Evaluation: 25 Marks
Continuous evaluation (Attendance & Performance): 10 • Selecting Instruments & Making Connections • Taking Reading & Calculation • Correct Observations & Drawing conclusion **Journal writing: 10** **Viva voce : 05**	**Performance of Experiment : 8M** **Calculation & Drawing conclusion:7M** **Viva Voce : 10M**

Ref Books/Resources:1. Laboratory manual

2. Network Analysis By Van E Velkenburg

CO and PO Mapping

Course Outcomes	PO and PSOs													
At the completion of this course, students will be able to:	**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**
	Engineering knowledge	**Problem analysis**	**Design/development of solutions**	**Conduct problem investigations**	**Modern tool usage**	**The engineer, industry and society**	**Environment and sustainability**	**Ethics**	**Individual and team work**	**Communication**	**Project management and finance**	**Life-long learning Life-long learning**	**Analyze and design Analyze and design**	**Understand and develop**
CO1 Apply analyze and co-relate fundamental principles of Engineering with laboratory experimental work.	3	2							2					
CO2 Understand and connect the circuit and perform the experiment, Analyze the observed data & make valid conclusion.				3								2	2	
CO3 Understand & write Journal with effective presentation of Drawing diagrams / characteristics /Graphs										3	2			
CO4 Match the practical and theoretical analysis results, for conceptual verification.				3										

RUBRICS FOR CO ATTAINMENT

Sr.No.	Parameter	Attendance & Performance	Journal Writing	ViVa-Voce
1	COs Addressed	1,2,4	2,3	1,2
2	Total Marks	10	10	5
3	Marks Distribution	Presence (1)	Understanding of Aim & Theoretical Background (2)	Understanding of Aim (1)
		Selection of meters & Connecting Set to get correct readings (3)	Understanding of Connections and meters (2)	Understanding of Theory behind Experiment (1)
		Making Changes in set to take and use reading (3)	Understanding of Calculations & Graphs (2)	Understanding of Practical Application (1)
		Correct Observations (3)	Understanding of Result & Conclusion (2)	Understanding of Maths Behind Engineering (1)
			Punctuality in Journal Submission (1)	Clarity in Concept (1)
			Cleanliness and Overall text writing (1)	

SHRI RAMDEOBABA COLLEGE OF ENGINEERING & MANAGEMENT, GITTIKHADAN, NAGPUR

ELECTRICAL DEPARTMENT

NETWORK ANALYSIS LAB

LIST OF EXPERIMENT

1. VERIFICATION OF THEVENIN'S THEOREM.
2. VERIFICATION OF NORTON'S THEOREM.
3. VERIFICATION OF SUPERPOSITION THEOREM.
4. VERIFICATION OF MAXIMOM POWER TRANSFER THEOREM.
5. VERIFICATION OF MILLIMAN'S THEOREM.
6. VERIFICATION OF RECIPROCITY THEOREM.
7. TO FIND THE VOLTAGE TRANSFER RATIO OF A TWO PORT, BRIDGED-T NETWORK.
8. TO FIND Z-PARAMETERS OF A TWO PORT, T -NETWORK.
9. TO STUDY THE RESONANCE OF RLC SERIES/PARALLEL NETWORK & PLOT THE V_R vs F CURVE.
10. TO VERIFY THE NETWORK THEOREMS USING MATLAB SIMULATION.
11. TO FIND THE VOLTAGE TRANSFER RATIO USING MATLAB SIMULATION.
12. TO FIND Z-PARAMETERS T-NETWORK USING MATLAB SIMULATION.

SHRI RAMDEOBABA COLLEGE OF ENGINEERING & MANAGEMENTEL, NAGPUR-13

ECTRICAL ENGINEERING DEPARTMENT

NETWORK ANALYSIS LAB

EXPERIMENT NO. 01

Aim : To Verify the Superposition Theorem.

Apparatus : 1. Dimmerstat = 1Phase , 4 Amp (2 nos.)

2. Rheostats = (0-100) ohms, 5 Amp (3 Nos.)

3. Voltmeters = 0-150/300 V (2 nos.)

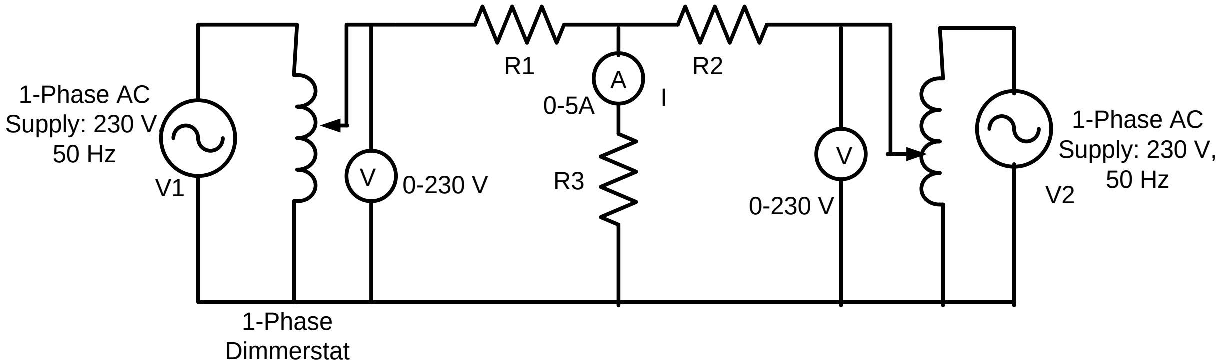
4. Ammeters = 0 - 2.5 /5A 1 No.

5. Multimeter = 1 No.

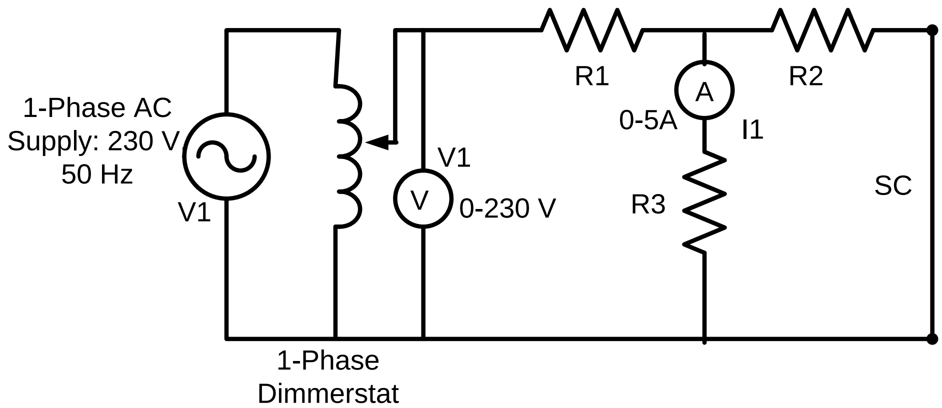
Theory : State, explain & Prove Superposition Theorem.

Circuit Diagram:

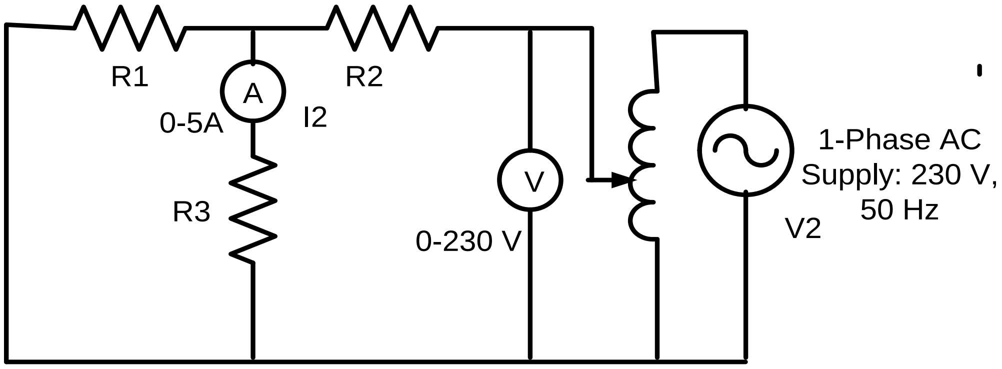
SET - 1: To find Current I directly.



SET - 2: To find Current I_1 due to Voltage source E_1 only with E_2 deactivated.



SET – 3: To find Current I_2 due to Voltage source E_2 only with E_1 deactivated**.**



Procedure:

1. Adjust rheostat at different suitable positions and measure resistances R1, R2 and R3 using a MultiMate , before circuit connections.

SET – 1: For finding current I due to both voltage source E_1 & E_2 .

2. Connect as per Ckt diagram Set – I. *** Caution:** Take precaution regarding proper phase/neutral connections of dimmerstat outputs, specially when two sources are used.
3. Switch on the voltage sources E_1 & E_2 and adjust them for different values using dimmerstat for different reading.
4. Measure the corresponding current I through R_3 .

SET – 2: For finding current I_1 due to both voltage source E_1 .

5. Connect as per ckt diagram Set – II.
6. Switch on the voltage source E_1 and adjust it for different values same as in Set-I.
7. Measure the corresponding values of I_1 for different readings.

SET – 3: For finding current I_2 due to voltage source E_2 .

8. Connect as per ckt diagram Set-III.
9. Switch on the voltage source E_2 and adjust it for different values same as in Set-I.
10. Measure the corresponding values of I_2 for different readings.

Observation Table:

R1 = Ω, R2 = Ω, R3 = Ω.

SET – 1

Sr No	V1(Volts)	V2(Volts)	I (Amps)

SUPERTHEOREM THEOREM

This theorem states that in any linear network containing two or more sources in any element is equal to the algebraic sum of the responses caused by individual sources acting alone, while other sources are non-operative.

This theorem is valid or applied only to linear systems.

SET – 2

Sr No	V1(Volts)	V2(Volts)	I (Amps)

SET – 3

Sr No	V1(Volts)	V2(Volts)	I (Amps)

Verification:

1. Practically :- $I = I_1 + I_2$
2. Therotically:

    a). Find out the value of I_1 by deactivating E_2.

    b). Find out the value of I_2 by deactivating E_1.

    c) . Get the sum of I_1 & I_2. This is theoretical value of I. Verify this with practical value of I.

Result & Conclusion :

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ECTRICAL ENGINEERING DEPARTMENT

NETWORK ANALYSIS LAB

EXPERIMENT NO: 02

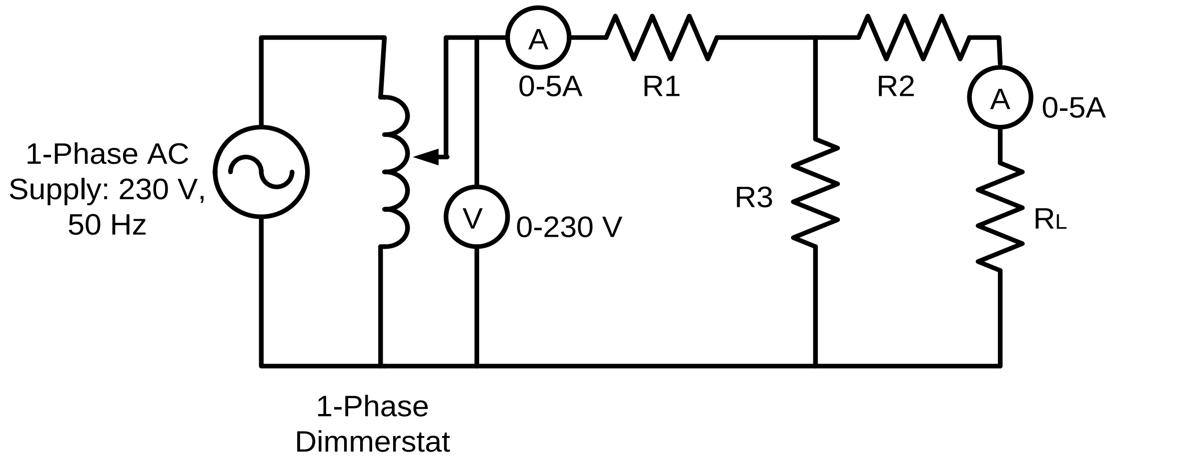
Aim: To verify the Thevenin's Theorem

Apperatus: 1. 1-Phase Dimmerstat---1 no.
2. Rheostats: 100 Omh, 5 Amp--4 Nos.
3. Voltmeters: 0 – 75/150/300 Volts--2 Nos.
4. Ammeters: 0 – 2,5/5 Amps—2 Nos
5. Digital Multimeter: 1 No.

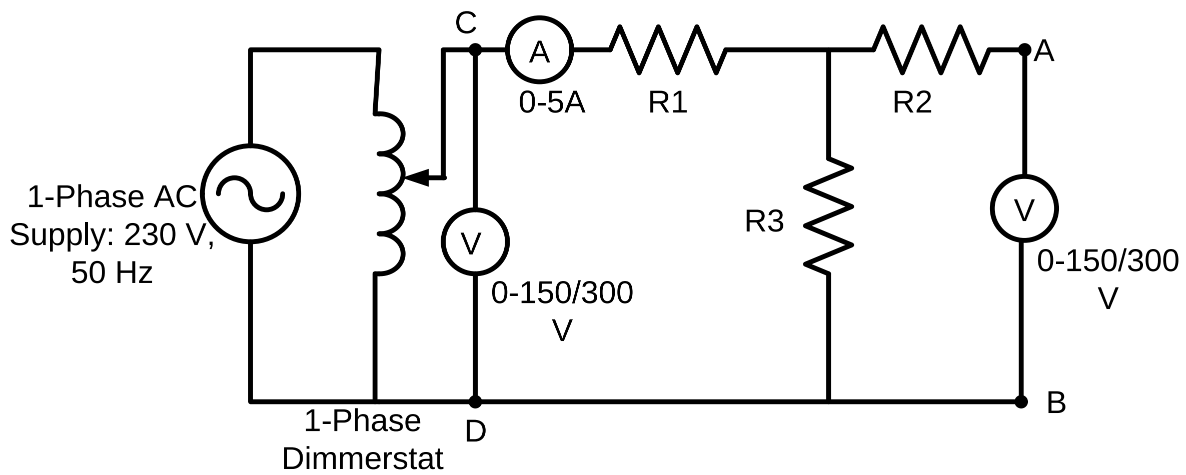
Theory : State, explain and prove the Thevenin's Theorem in detail

Circuit Diagram –

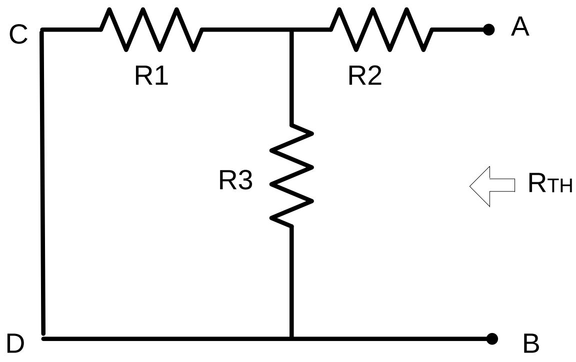
1.Set-1:



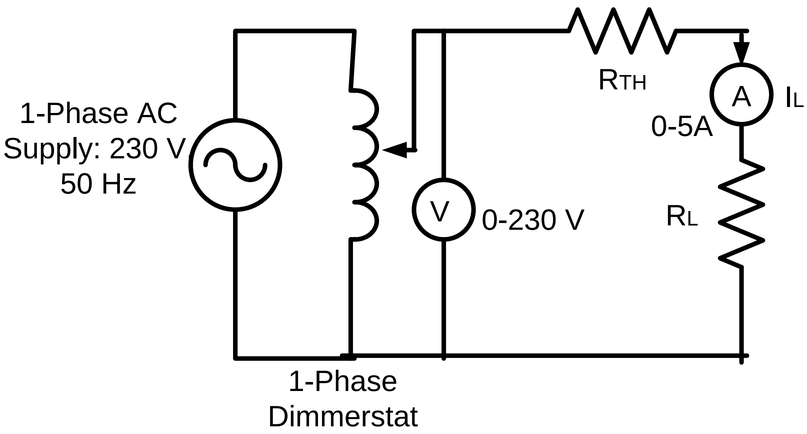
2.Set-2:



3. Set-3



4. Set-4



Procedure:

I. To find current (IL) through load resistance RL (Set-1)

1. Set the rheostats at different suitable positions and measure resistance R1, R2, R3 & RL using multimeter.
2. Connect as per the circuit diagram od set-1.
3. Apply suitable voltages through dimmerstat and measure the current through RL foe each applied voltage.

II. To find Thevenin's equivalent voltage: (Set-2)

1. Connect as per the circuit diagram od set-2.
2. Apply the voltages through dimmerstat same as that in set-1
3. Measure the voltage Vth for each applied voltage.

III. To find Thevenin's equivalent Rth: (Set-3)

1. Connect as per the circuit diagram od set-3 and measure the resistance using the multimeter.

IV. To find current IL through RL: (Set-4)

1. Set the resistance in rheostat equel to Rth.
2. Connect as per the circuit diagram of set-4, this is the Thvenin's equivalent ciecuit.
3. Apply the voltages equel to Vth through the dimmerstat and measure the current IL for each voltage Vth.

Observation Table :- R1= ------Ω, R2= -----Ω, R3 = ------Ω, RL= -----Ω

THEVENINS THEOREM (Statement) :

It states that any circuit having a number of voltage sources, impedances between the open output terminal can be replaced by a simple equivalent circuit consisting of a single phase source (V_{th}) in series with a impedance (Z_{th}) where the value of the voltage source is equal to the open circuit voltage across the output terminal and impedance is equal to the impedance seen into the network across the output terminals. By connecting Thevenin's equivalent circuit along with load impedance ZL the current through this Z_L is:

$$I_L = \frac{V_{Th}}{Z_{Th} + Z_L}$$

(I) To find I_L directly

S.No.	Applied Voltage (V)	I_L
1 2 3		

(II) To Find Thevenins Equivalent voltage V_{TH}

S.No.	Applied Voltage (V)	V_{TH}
1 2 3		

(III) Rth= -----------Ω (By Multimeter)

(IV) To Find I_L by Thevenins equivalent circuit

S.No	V_{th}	I_L
1 2 3		

<u>Verification:-</u>

1. Verify the values of load current I_L measured directly as in Part I & the Values of I_L found by using Thevenins Theorem.
2. Calculate load current I_L using Thevenins theorem, theoretically for each reading & verify.

Conclusion:-

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ECTRICAL ENGINEERING DEPARTMENT

NETWORK ANALYSIS LAB

EXPERIMENT NO. 03

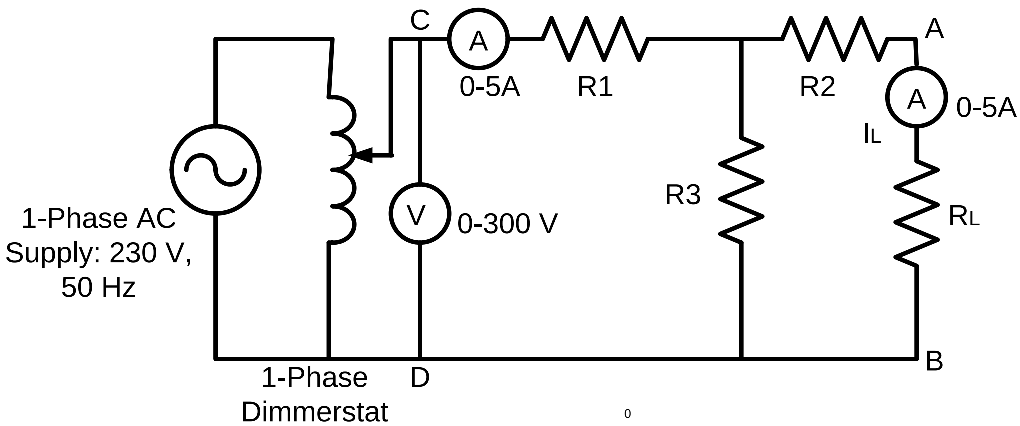
Aim :- To verify the Norton's Theorem

Apparatus :- 1.Rheostat - 0-100 ohms, 5A (4 Nos)
2. Single phase dimmerstat
3. Ammeter – O 2 5/5A
(1 No)
4. Multimeter - 1 No
5. Voltmeters - 0-6.- 1 No
150/300V -1 Nos

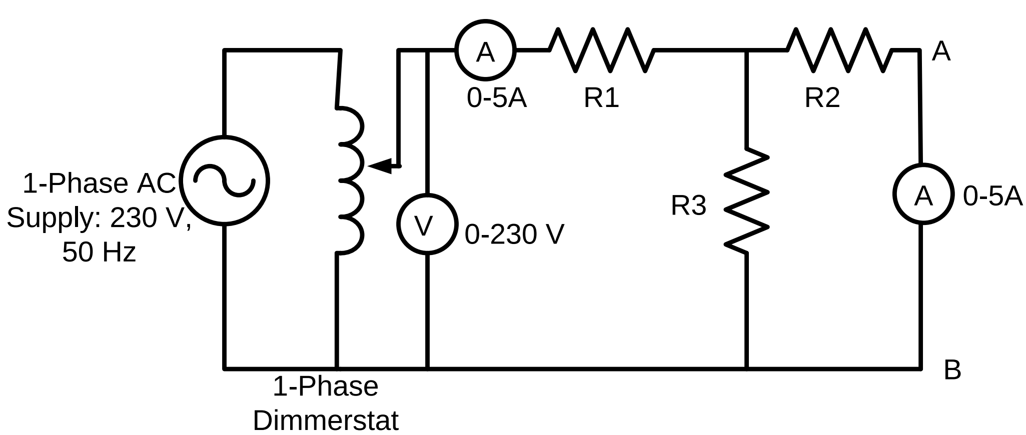
Theory:- State, Explain & Prove Norton's Theorem

Circuit Diagram:

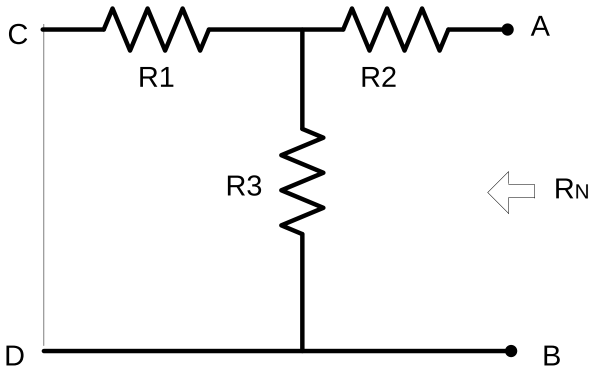
1. Set-1: To find load current I_L directly.



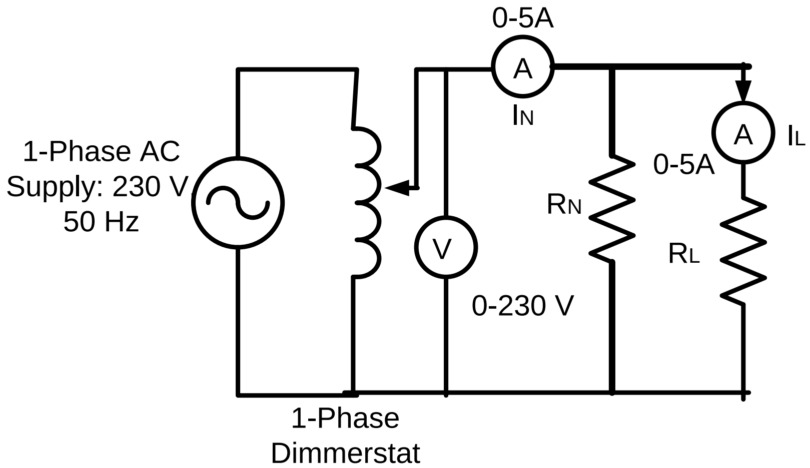
2. Set-2: To find Norton's equivalent current I_N.



Set-3: To find Norton's equivalent resistance R_N.



Set-4 : To Verify the Norton Theorem



NORTON'S THEOREM (Statement):

This theorem states that any circuit with voltage sources, impedances and open output terminals can be replaced by a single current source (I_N) in parallel with single impedance (Z_N) . Where the value of current source is equal to the current passing through the short circuit output terminals and the value of impedance is equal to the impedance seen into the output terminals.
This theorem is dual of the Thevnin's theorem.

Procedure:

1) **To find current I_L through load resistance R_L.**
   a) Set the rheostats at different sutaible positions & measure the load resistances R_1 R_2 R_3 &R_L using a multimeter.
   b) Connect as per circuit diagram Set-1.
   c) Apply sutaible voltages through dimmerstat & measure the load current I_L through R_L for each applied voltage.
2) **To find Norton's equivalent current I_N.**
   a) Connect as per circuit diagram Set-2.
   b) Apply same voltages as in part-[1] through the dimmerstat & measure IN for each applied voltage.
3) **To find Norton's equivalent resistance R_N & To find I_L.**

a) Measure RN using multimeter as shown in ckt diagram Set- 3.
b) Find $I_L = I_N \times R_N / RN + R_L$ (Norton's theorem).
For each value of R_N .

Observation Table: R1 = Ω, R2 = Ω, R3 = Ω , RL = Ω , RN = Ω .

1. **To find load current I_L directly**.

Sr No	Applied voltage (V)	I_L (A)
1		
2		
3		

2. **To find Norton's equivalent current I_N.**

Sr No	Applied voltage (V)	I_N (A)
1		
2		
3		

3. **To find I_L by theorem ($I_L = I_N \times R_N / RN + R_L$).**

Sr No	I_N	I_L
1		
2		
3		

Verification :

1) Verify the values of IL & measured directly as in part I & calculated value of IL by NORTON'S theorem.
2) Calculated IL using Norton's theorem thereotically for each reading and show them in verification table

Result & Conclusion :

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ECTRICAL ENGINEERING DEPARTMENT

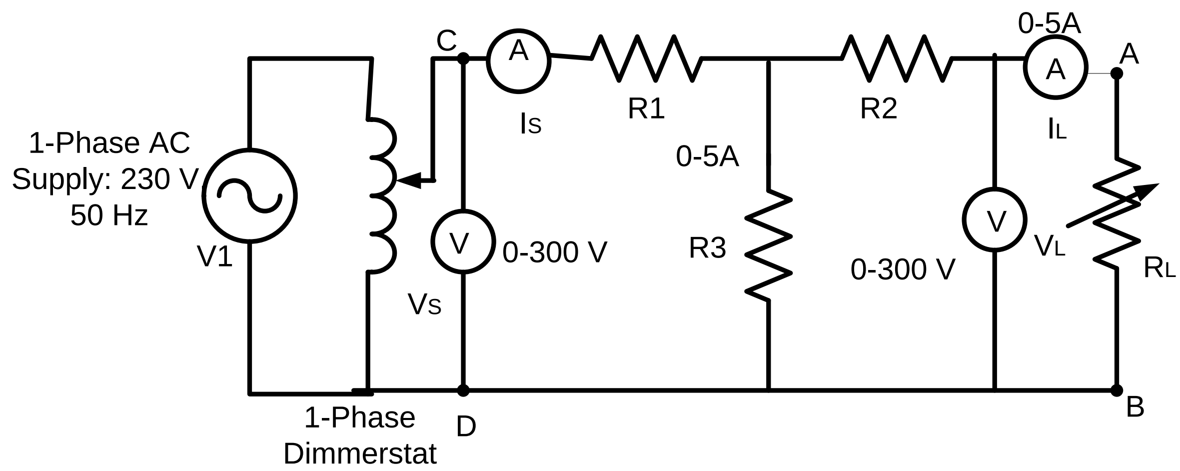
NETWORK ANALYSIS LAB

EXPERIMENT NO. 04

Aim : **To Verify the Maximum Power Transfer Theorem Theorem**

Apparatus : 1. Phase Dimmerstat – 1 No
2. Voltmeter (AC) – 0-75/150/300 V -02 No
3. Ammeters (AC) – 0-2.5/5 A, 0-1 A – 02 No
4. Rheostat 0-100 Ohm/5A – 04 No
5. Digital Multimeter – 01 No

Circuit Diagram: **Set-1:**



Theory : State, Explain & Prove the Maximum Power Transfer Theorem.

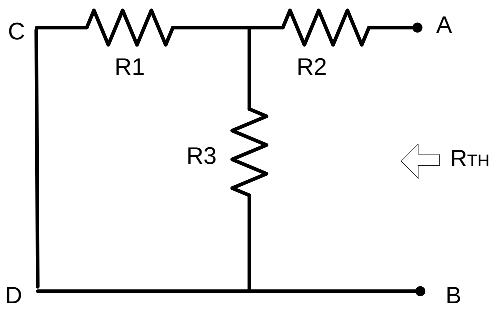
Procedure :

1. Adjust the Resistances R1, R2, R3 to any value between 25 Ohm to 50 Ohm and measure them using Digital multimeter**.**
2. Connect as per the ckt dig.
3. Apply certain voltage using 1 ph dimmerstat & keep it fixed. The current I_L through R_L should not be more than 5 A.
4. Vary the resistance R_L step by step and take readings of V_L and I_L of each step.
5. Remove the dimmerstat from its terminals and short circuit these terminals. Remove the load resistance R_L as well as the voltmeters and ammeters from the circuit and Measure Rth between terminals A & B using digital multimeter.

MAXIMUM POWER TRANSFER THEOREM (Statement):

It is often necessary to match the load on a source such that maximum possible power is delivered to the load. According to this theorem, maximum power is delivered to the load if impedance (Z_L) is completed conjugate of impedance of the network across the open output terminals.

Set-2 :



Observation Table : Supply Voltage = VS = ---------- Volts .

R_1 = ------------ Ohm

R_2 = -------------------- Ohm

R_3 = ------------ Ohm

R_{th} = ------------ Ohm

Sr No.	I_S	V_L	I_L	$P_L = V_L I_L$	$R_L = V_L/I_L$	$\eta = P_L/[I_L(R_L + R_{th})]$

Graphs: Plot the graph 1. P_L Vs R_L

2. η Vs R_L

Calculations: 1. Find the value of RL from graph I corresponding lo Maximum

corresponding to Maximum power transferred PLmax

2. Find the maximum power transferred PL max practically. (From Graph I)
3. Verify that for maximum power transfer, RL. = Rth (Practically)
4. Verify by theoretical calculations. (i.e. Calculate RL for maximum power transfer & PL.max)
5. Verify that for maximum power transfer, the efficiency is 5O%.

Verification: Verify the Maximum Power Transfer theorem theoretically & practically in tabular form.

Result & Conclusion:

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ECTRICAL ENGINEERING DEPARTMENT

NETWORK ANALYSIS LAB

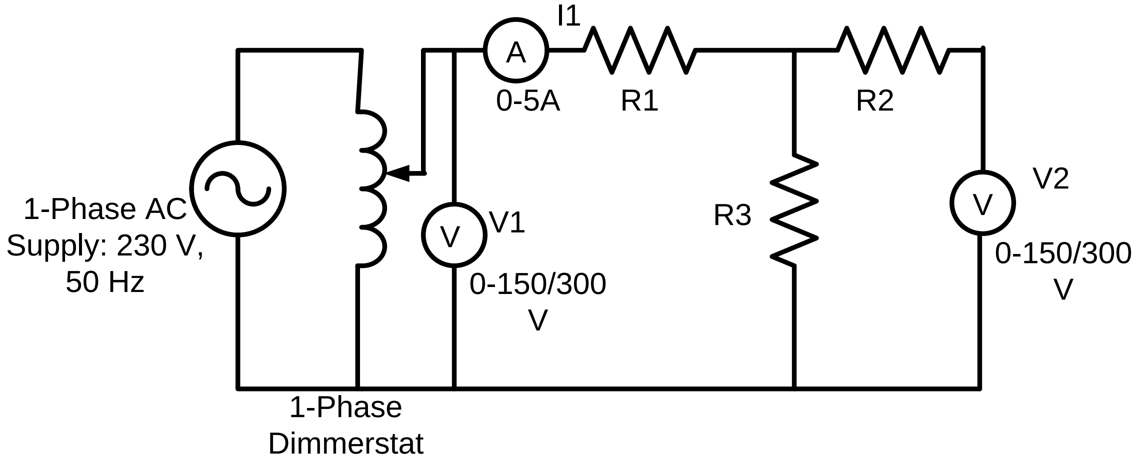
EXPERIMENT NO: 05

AIM : **TO find the Open Circuit z-parameters**

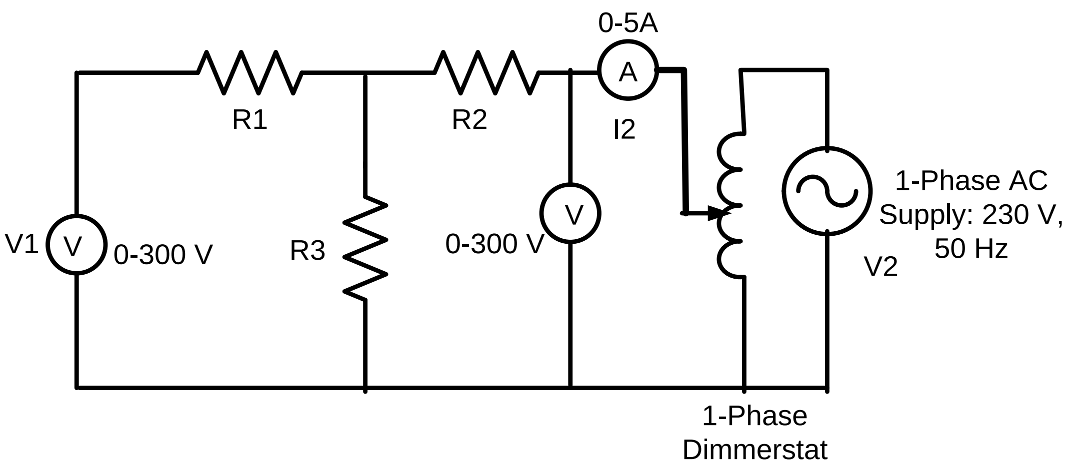
Apparatus : 1. Dimmerstat-1Phase 0-300 V (2 nos.)
2. Rheostats -100 ohms, 5 A (3 Nos.)
3. Voltmeters – 0-75/150/300 V (2 nos.)
4. Ammeters – 0-2.5/5A

Theory : Define z-parameters & explain the method to find z- parameters for a two Port network.

Circuit Diagram: **Set-1:**



Set-2:



Procedure :

1. Adjust the rheostats to suitable different position & measure their resistance R1,R2 & R3 using a multimeter.

   To find Z_{11} & Z_{21}
2. Connect as per the circuit diagram Set-1 by energizing port-1 & keeping port -2 open.
3. Apply suitable voltages through dimmerstat & measure I_1 & V_1 i.e. current through port 1 & voltage across port 1 . Also measure voltage V_2 across port 2.
   TO Find Z_{22} & Z_{12}
4. Connect as per the circuit diagram Set II by energizing port -2 & keeping port -1 open
5. Apply suitable voltage through dimmerstat & measure I_2 & V_2 i.e current through port 2 & voltage across port- 2 Also measure voltage V_1 across port -1.

Observation & Calculation Table:

Set I:- To Find Z_{11} & Z_{21}

Sr. No.	V_1	V_2	I_1	$Z_{11}=V_1/I_1$	$Z_{21}= V_2/I_1$
1 2 3					

Set II:- To Find Z_{22} & Z_{21}

Sr. No.	V_2	V_1	I_2	$Z_{22}= V_2/I_2$	$Z_{12}=V_1/I_2$
1 2 3					

Note:- Z11 & Z22 are also called as driving point impedance of port 1 & port 2 respectively Z12 & Z21 are called transfer impedance between port 1 & port 2.

Verification:-

1. Calculate the Z- Parameters for the circuit used & verify the result with the practical values.
2. Since the given network is linear & bilateral, verify $Z_{12} = Z_{21}$ from practical & theoretical (Calculated) Values.

Conclusion:-

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ECTRICAL ENGINEERING DEPARTMENT

NETWORK ANALYSIS LAB

EXPERIMENT NO: 06

Aim : - To find the voltage transfer ratio (voltage gain) of bridged (T) network verifying the same theoretically.

Apparatus : - 1. 1-Phase Dimmerstat (1 No)
2. AC voltmeter 75/150/300 (2 Nos)
3. Digital Multimeter (1 No)
4. Resistors : 0-100 Ω, 5Amp(1 No)
5. Inductor: 230 V, 50 mH (1 No)
6. Capacitor 20 mfd, 300V (1 No)
7. Ammeter 0-1Amp (1 No)

THEORY : A network may be single port, two port or multi-port. Port is a pair of terminals ready to be connected to the electrical source, load or any other circuit. A port connecting source called as the driving point port. Relations between currents and/or voltages of the same port are called as the driving point functions. The relations between currents and/or voltages of the different ports are called as the transfer functions. These two functions collectively called as the network functions.

The ratio of one port voltage term to another port voltage term is called as the "Voltage Transfer Function". The ratio of one port current term to another port current term is called as the "Current Transfer Function". The ratio of one port voltage/current term to another port current/voltage term is called as the "Transfer Impedance/Admittance Function".

A transfer function is a mathematical model of a system that maps output parameters to its input parameters.

The properties of transfer function are :-

1) The ratio of laplace transform of output to laplace transform of input assuming all initial condition to be zero with no any internal voltage or current sources except the controlled sources.
2) The transfer function used to describe the networks with at least two ports.
3) Replacing's' variable with linear differential term "d/dt " and '1/s' for linear integration term " ∫ dt " in transfer function of a system, the differential equation of the system can be obtained.
4) The transfer function of system does not depend on the inputs to the system.
5) The system poles and zeros can be determined from its transfer function.

The transfer function may be represented as,

$$N(s) = \frac{p(s)}{q(s)} = \frac{a_0 s^n + a_1 s^{n-1} + a_2 s^{n-2} + \cdots .. a_{n-1} s + a_n}{b_0 s^m + b1 s^{m-1} + b_2 s^{m-2} + \cdots .. b_{m-1} s + b_m}$$

Here a and b are real and positive coefficients for network of passive elements and s is the complex frequency. p(s) have n roots and q(s) have m roots. So, the transfer function will be,

$$N(s) = H\,\frac{(s-z_1)(s-z_2)\ldots(s-z_n)}{(s-p_1)(s-p_2)\ldots(s-p_m)}$$

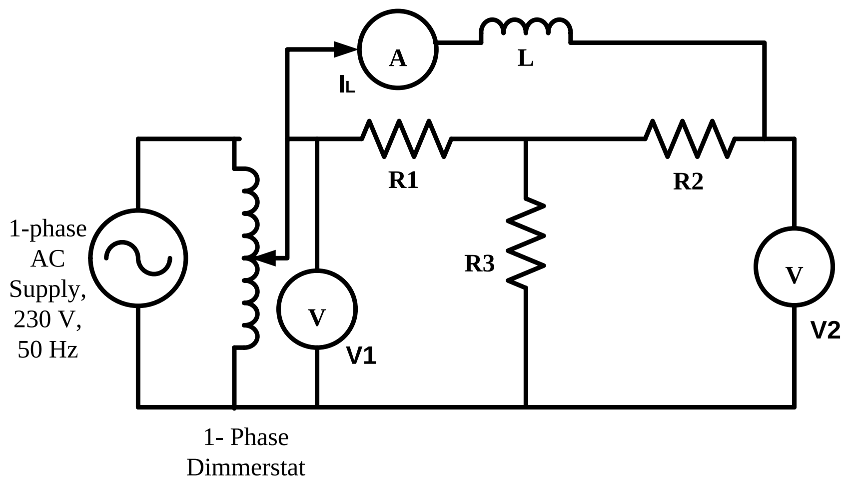
H is called the scale factor and given as = a0/b0.

The numerator factors like $(s - z_1)$ are called as zero factors with zeros z1, z2 etc, numerator have n such factors and zeros. The denominator factors like (s-p1) are called as the pole factors with poles p1, p2 etc, denominator have m such factors and poles. Zero and poles are the complex frequencies like s. Zeros are frequencies which makes the entire transfer function zero and poles are frequencies which makes the entire transfer function infinite.

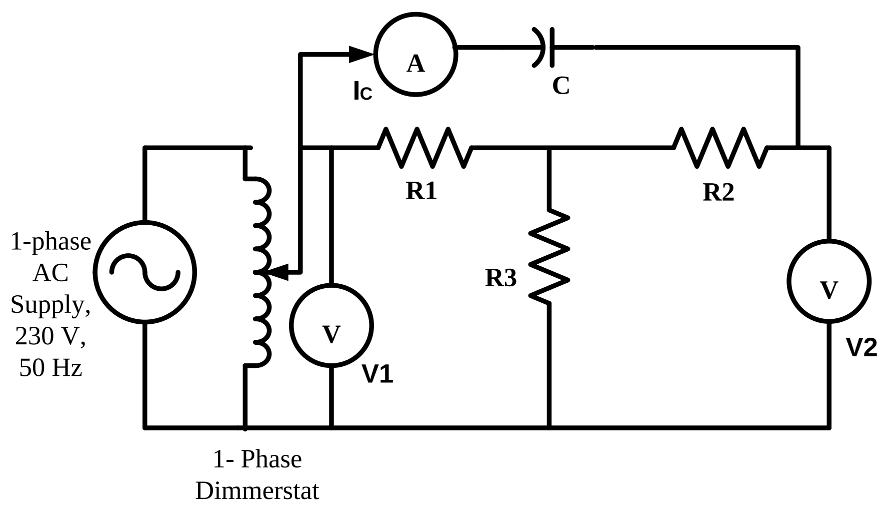
The knowledge of poles and zeros of the transfer functions are very important in order to regulate, control & modify the control systems represented by this transfer function.

CIRCUIT DIAGRAM :

SET-1: With Inductor Used as Bridging Element :



SET-2: With Capacitor Used as Bridging Element :



PROCEDURE:

1. Connect the circuit as shown in the diagram with inductor as a bridging element.

2. Place the dimmer at zero voltage before switching ON the supply.

3. Switch ON the supply and adjust the voltage to some suitable value, by dimmer and voltmeter V1.

4. Note the voltages and current of meters, with voltage across inductor, “VL”.

5. Increase the voltage and repeat the steps for more reading.

6. Repeat the procedure 2-4 for circuit with capacitor as a bridging element

7. Note the voltages and current of meters, with voltage across Capacitor, “VC”.

8. Disconnect the circuit and measure the resistors R1, R2 & R3, using multimeter.

PRECAUTIONS:

1. Dimmerstat should be at zero voltage before switching ON the supply.

2. Connections should be tightly fixed.

3. Proper range of meters should be selected.

OBSERVATION TABLE

Set-1: With Inductor Used as Bridging Element:

Sr. No.	**V1 (Volts)**	**V2 (Volts)**	**IL (Amp)**	**VL (Volts)**	**ZL= VL/ IL (Ω)**	**L (mH)**	**Voltage Gain**
1							
2							
3							
4							
5							

Set-2: With Capacitor Used as Bridging Element:

Sr. No.	**V1 (Volts)**	**V2 (Volts)**	**IC (Amp)**	**VC (Volts)**	**XC= VL/ IL (Ω)**	**C (µF)**	**Voltage Gain**
1							
2							
3							
4							
5							

CALCULATIONS:

1. Find the value of Voltage Transfer Ratio using the practical reading

2. Find the value of Voltage Transfer Ratio using the theoretically
3. Match the results.

RESULT: Thus the value of voltage gain for capacitance as well as inductance calculated practically as well as theoretically come out to be same.

DISCUSSION: Write at least 5 questions and their answers here.

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SHRI RAMDEOBABA COLLEGE OF ENGINEERING & MANAGEMENTEL, NAGPUR-13

ECTRICAL ENGINEERING DEPARTMENT

NETWORK ANALYSIS LAB

EXPERIMENT NO. 07

Aim : **To study three phase circuit with star connected unbalanced load and Verifying Milliman's Theorem.**

Apparatus : **1.** Three phase star connected loading rheostat. (01 No)

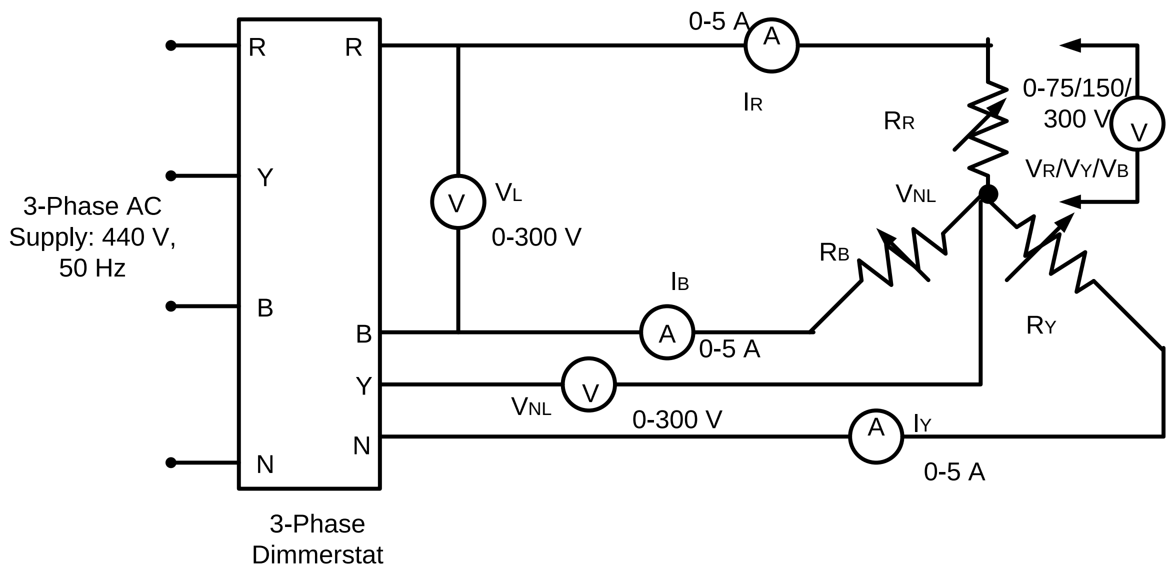
2. 3-ph dimmerstat. (01 No)

3. Ammeters = 0-2.5/5 A (03 Nos)

4. Voltmeters = 0-150/300 V (01 No)

Theory : The explaination of three phase circuit with star connected balanced/unbalanced load.

Circuit Diagram: Set-1:



Procedure:

1. Connect as per the circuit diagram. Use star connected loading rheostat as a load.
2. Make the load unbalanced by switching on different no and switches in each load phase.

3. Apply suitable voltages through three phase dimmerstat and take two set of reading as per the observation table. If two element type wattmeter is used , it will directly measure total power consumed.
4. Change the load setting and take one set of readings as per the observation table.

Observation Table :

Sr. No.	Supply Voltage Per phase	Load phase Vo;ltages			Load phase Currents			W_1 WATTS	W_2 WATTS	Total Power consumed $W_1 + W_2$	V_{NL} VOLTS
		V_R VOLTS	V_Y VOLTS	V_B VOLTS	I_R A	I_Y A	I_B A				
1.											
2.											
3.											

Calculation Table :

Sr No.	Supply Voltages Per phase.	$R_R=V_R/I_R$	$R_Y=V_Y/ I_Y$	$R_B=V_B/I_B$	Total Power = $Ir^2R_R+I_Y^2R_Y+I_B^2R_B$	$V_{N\,L}=\frac{VR/RR+VY/RY+VB/RB}{\frac{1}{RR}+\frac{1}{RY}+\frac{1}{RB}}$
1.						
2.						
3.						

Verification :

Calculate theoretically V_{NL} , Load phase voltages V_R , V_Y , V_B , Load phase currents I_R I_Y I_B and total power consumed .

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ECTRICAL ENGINEERING DEPARTMENT

NETWORK ANALYSIS LAB

EXPERIMENT NO. 08

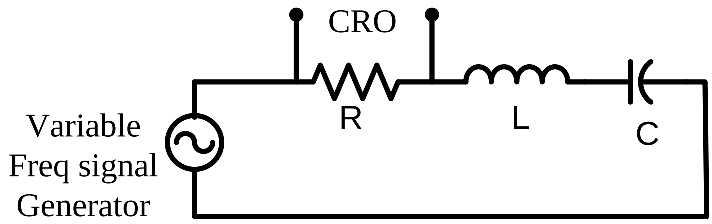
Aim: To Study and Draw The Voltage Vs Frequency Characteristics of the RLC Series and Parallel Resonance

Appratus: 1. Inductors,
2. Capacitors.
3. Resistors.
4. Function Generator,
5. CRO

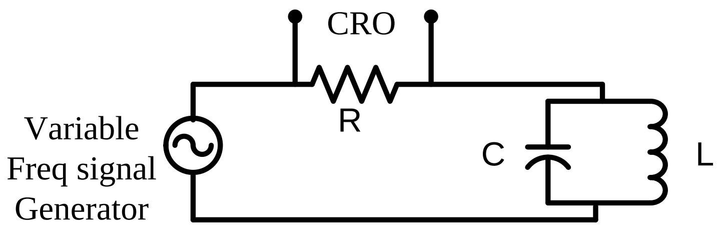
Theory : Explain the resonance concept with mathematical formula of Resonance Frequency

Circuit Diagram:

1. Set-1:



2. Set-2:



Procedure:

SET-1: RLC SERIES RESONANCE

1. Connect the circuit as per the Set-1
2. Feed a sine wave of 5 volt peak to peak amplitude at 1kHz to the input terminal of the circuit.
3. Observe the output on CRO
4. Vary the input frequency in steps of 1 kHz and note down the

Corresponding output peak to peak amplitude.

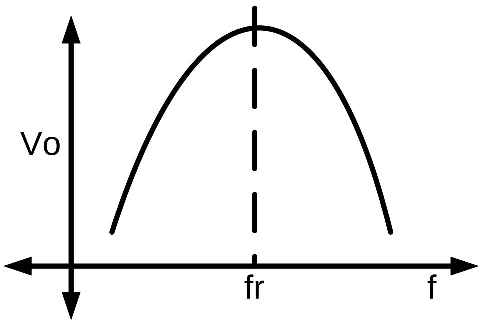
5) Draw graph between input frequency Vs output amplitude

SET 2: PARALLEL RESONANCE

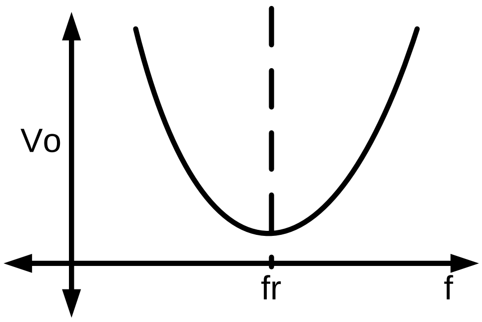
1. Connect the c1rcu1t as shown in Set- 2.
2. Repeat steps 2 to 5 of set –1

Nature of Graph:

Series Resonance



Parallel resonance



Observation Table:

1.Series Resonance

S.No.	Freq	Vo (Volts)

2. Parallel Resonance

S.No.	Freq	Vo (Volts)

Result:

Conclusion:

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MATLAB ASSIGNMENT:

1. To Verify the Superposition Theorems Using MATLAB Simulation.
2. To Verify the Thevenin’s Theorems Using MATLAB Simulation.
3. To Verify the Norton’s Theorems Using MATLAB Simulation.
4. To Verify the Maximum Power Transfer Theorems Using MATLAB Simulation.
5. To Find the Voltage Transfer Ratio Using MATLAB Simulation.
6. To Verify the Milliman’s Theorems Using MATLAB Simulation.
7. To Find Z-Parameters T-Network Using MATLAB Simulation.
8. To Verify the RLC Series/Parallel Resonance Using MATLAB Simulation.

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