Laboratory manual for

BASIC ELECTRICAL ENGINEERING LAB

Subject Code: EEE1227

Regulations: R22

Class: B.Tech I Year I Semester CSE, CSE-DS, CS,CSIT &IT

Department of Electrical and Electronics Engineering

Sri Indu College of Engineering and Technology

(An Autonomous Institution Under UGC)

Ibrahimpatnam - 501 510, Hyderabad

VISION AND MISSION OF THE INSTITUTION

INSTITUTION VISION

To be a premier Institution in Engineering & Technology and Management with competency, values and social consciousness.

INSTITUTION MISSION

IM_1 Provide high quality academic programs, training activities and research facilities.

IM_2 Promote continuous Industry-Institute interaction for employability, Entrepreneurship, leadership and research aptitude among stakeholders.

IM_3 Contribute to the economical and technological development of the region, state and nation.

VISION AND MISSION OF EEE DEPARTMENT

DEPARTMENT VISION

To be a centre of excellence in Electronics and Communication Engineering Education to produceprofessionals for ever-growing needs of society.

DEPARTMENT MISSION

The Department has following Missions:

DM_1 To promote and facilitate student- centric learning.

DM_2 To involve in activities that enable overall development of stakeholders.

DM_3 To provide holistic environment with state-of-art facilities for students todevelop solutions for various social needs.

DM_4 Organize trainings in embedded systems with Industry interaction.

PROGRAM OUTCOMES (POs) & PROGRAM SPECIFIC OUTCOMES (PSOs)

PO	Description
PO 1	**gineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**oblem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design / development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO 6	**The engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**vironment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological Change
Program Specific Outcomes	
PSO 1	**Basic Electronic and communications knowledge:** Apply basic knowledge related to electronic circuits, VLSI, communication systems, signal processing and embedded systems to solve engineering/societal problems.
PSO 2	**Design Methods:** Design, verify and authenticate electronic functional elements for different applications, with skills to interpret and communicate results.
PSO 3	**Experimentation & Communications:** Engineering and management concepts are used to analyze specifications and prototype electronic experiments/projects either independently or in teams.

HOD

Program Educational Objectives (PEOs)

Program: B. Tech –Electronics & Communication Engineering

PEO 1: **Higher Degrees & Professional Employment:** Graduates with ability to pursue career in core industries or higher studies in reputed institution.

PEO 2: **Domain Knowledge:** Graduates with ability to apply professional knowledge/skills to design and develop product or process.

PEO 3: **Engineering Career:** Graduates with excellence in Electronics and Communication Engineering along with effective inter-personnel skills.

PEO 4: **Lifelong Learning:** Graduates equipped with skills in recent technologies and be receptive to attain professional competence through life-long learning.

Head of the Department

ELECTRICAL AND ELECTRONICS ENGINEERING

Laboratory Practice

Safety Rules

1. **SAFETY** is of paramount importance in the **ELECTRICAL ENGINEERING** Laboratories.
2. Electricity **NEVER EXCUSES** careless persons. So, exercise enough care and attention in handling electrical equipment and follow safety practices in the laboratory. (Electricity is a good servant but a bad master).
3. Avoid direct contact with any voltage source and power line voltages. (Otherwise, any such contact may subject you to electrical shock).
4. Wear rubber-soled shoes. (To insulate you from earth so that even if you accidentally contact a live point, current will not flow through your body to earth and hence you will be protected from electrical shock).
5. Wear laboratory-coat and avoid loose clothing. (Loose clothing may get caught on an equipment/instrument and this may lead to an accident particularly if the equipment happens to be a rotating machine).
6. Girl students should have their hair tucked under their coat or have it in a knot.
7. Do not wear any metallic rings, bangles, bracelets, wristwatches and neck chains. (When you move your hand/body, such conducting items may create a short circuit or may touch a live point and thereby subject you to electrical shock).
8. Be a certain that your hands are dry and that you are not standing on wet floor. (Wet parts of the body reduce the contact resistance thereby increasing the severity of the shock).
9. Ensure that the power is OFF before you start connecting up the circuit. (Otherwise you will be touching the live parts in the circuit).
10. Get your circuit diagram approved by the staff member and connect up the circuit strictly as per the approved circuit diagram.
11. Check power chords for any sign of damage and be certain that the chords use safety plugs and do not defeat the safety feature of these plugs by using ungrounded plugs.
12. When using connection leads, check for any insulation damage in the leads and avoid such defective leads.
13. Do not defeat any safety devices such as fuse or circuit breaker by shorting across it. Safety devices protect you and your equipment.
14. Switch on the power to your circuit and equipment only after getting them checked up and approved by the staff member.
15. Take the measurement with one hand in your pocket. (To avoid shock in case you accidentally touch two points at different potentials with your two hands).
16. Do not make any change in the connection without the approval of the staff member.

17. In case you notice any abnormal condition in your circuit (like insulation heating up, resistor heating up etc), switch off the power to your circuit immediately and inform the staff member.

18. Keep hot soldering iron in the holder when not in use.

19. After completing the experiment show your readings to the staff member and switch off the power to your circuit after getting approval from the staff member.

20. Determine the correct rating of the fuse/s to be connected in the circuit after understanding correctly the type of the experiment to be performed: no-load test or full-load test, the maximum current expected in the circuit and accordingly use that fuse-rating. (While an over-rated fuse will damage the equipment and other instruments like ammeters and watt-meters in case of over load, an under-rated fuse may not allow one even to start the experiment).

21. At the time of starting a motor, the ammeter connected in the armature circuit overshoots, as the starting current is around 5 times the full load rating of the motor. Moving coil ammeters being very delicate may get damaged due to high starting current. A switch has been provided on such meters to disconnect the moving coil of the meter during starting. This switch should be closed after the motor attains full speed. Moving iron ammeters and current coils of watt-meters are not so delicate and hence these can stand short time overload due to high starting current. No such switch is therefore provided on these meters. Moving iron meters are cheaper and more rugged compared to moving coil meters. Moving iron meters can be used for both a.c. and d.c. measurement. Moving coil instruments are however more sensitive and more accurate as compared to their moving iron counterparts and these can be used for d.c. measurements only. Good features of moving coil instruments are not of much consequence for you as other sources of errors in the experiments are many times more than those caused by these meters.

22. Some students have been found to damage meters by mishandling in the following ways:(a) Keeping unnecessary material like books, lab records, unused meters etc. causing meters to fall down the table.(b) Putting pressure on the meter (especially glass) while making connections or while talking or listening to somebody.

ELECTRICAL AND ELECTRONICS ENGINEERING

Guidelines for Laboratory Note Book

The laboratory notebook is a record of all work pertaining to the experiment. This record should be sufficiently complete so that you or anyone else of similar technical background can duplicate the experiment and data by simply following your laboratory notebook. Record everything directly into the notebook during the experiment. Do not use scratch paper for recording data. Do not trust your memory to fill in the details at a later time. Organization in your notebook is important. Descriptive headings should be used to separate and identify the various parts of the experiment. Record data in chronological order. A neat, organized and complete record of an experiment is just as important as the experimental work.

1. **Heading:** The experiment identification (number) should be at the top of each page. Your name and date should be at the top of the first page of each day's experimental work.
2. **Object:** A brief but complete statement of what you intend to find out or verify in the experiment should be at the beginning of each experiment.
3. **Diagram:** A circuit diagram should be drawn and labelled so that the actual experiment circuitry could be easily duplicated at any time in the future. Be especially careful to record all circuit changes made during the experiment.
4. **Equipment List:** List those items of equipment which have a direct effect on the accuracy of the data. It may be necessary later to locate specific items of equipment for rechecks if discrepancies develop in the results.
5. **Procedure:** In general, lengthy explanations of procedures are unnecessary. Be brief. Short commentaries alongside the corresponding data may be used. Keep in mind the fact that the experiment must be reproducible from the information given in your notebook.
6. **Data:** Think carefully about what data is required and prepare suitable data tables. Record instrument readings directly. Do not use calculated results in place of direct data; however, calculated results may be recorded in the same table with the direct data. Data tables should be clearly identified and each data column labelled and headed by the proper units of measure.
7. **Calculations:** Not always necessary but equations and sample calculations are often given to illustrate the treatment of the experimental data in obtaining the results.
8. **Graphs:** Graphs are used to present large amounts of data in a concise visual form. Data to be presented in graphical form should be plotted in the laboratory so that any questionable data

points can be checked while the experiment is still set up. The grid lines in the notebook can be used for most graphs. If special graph paper is required, affix the graph permanently into the notebook. Give all graphs a short descriptive title. Label and scale the axes. Use units of measure. Label each curve if more than one on a graph.

9. **Results:** The results should be presented in a form which makes the interpretation easy. Large amounts of numerical results are generally presented in graphical form. Tables are generally used for small amounts of results. Theoretical and experimental results should be on the same graph or arrange in the same table in a way for easy correlation of these results.
10. **Conclusions:** This is your interpretation of the results of the experiment as an engineer. Be brief and specific. Give reasons for important discrepancies.

ELECTRICAL AND ELECTRONICS ENGINEERING

Lab Code

1. Students should report to the concerned labs as per the time table schedule.
2. Students who turn up late to the labs will in no case be permitted to perform the experiment scheduled for the day.
3. After completion of the experiment, certification of the concerned staff in-charge in the observation book is necessary.
4. Students should bring a note book of about 100 pages and should enter the readings/observations into the note book while performing the experiment.
5. 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 member in-charge.
6. Not more than three students in a group are permitted to perform the experiment on a setup.
7. The group-wise division made in the beginning should be adhered to, and no mix up of student among different groups will be permitted later.
8. The components required pertaining to the experiment should be collected from stores in-charge after duly filling in the requisition form.
9. When the experiment is completed, students should disconnect the setup made by them, and should return all the components/instruments taken for the purpose.
10. Any damage of the equipment or burn-out of components will be viewed seriously either by putting penalty or by dismissing the total group of students from the lab for the semester/year.
11. Students should be present in the labs for the total scheduled duration.
12. Students are required to prepare thoroughly to perform the experiment before coming to Laboratory.
13. Procedure sheets/data sheets provided to the students' groups should be maintained neatly and to be returned after the experiment.

BASIC ELECTRICAL ENGINEERING LAB

LIST OF EXPERIMENTS

Compulsory Experiments

S.NO	Name of the Experiment	Page No
1.	Verification of KVL and KCL.	
2.	Verification of Thevenin's and Norton's theorem.	
3.	Transient Response of Series RL and RC circuits using DC excitation	
4.	Resonance in series RLC circuit	
5.	Calculations and Verification of Impedance and Current of RL, RC and RLC series circuits.	
6.	Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single Phase Transformer	
7.	Performance Characteristics of a DC Shunt Motor	
8.	Torque-Speed Characteristics of a Three-phase Induction Motor.	
9.	Verification of Superposition theorem.	
10.	Three Phase Transformer: Verification of Relationship between Voltages and Currents (Star-Delta, Delta-Delta, Delta-star, Star-Star)	
11.	Load Test on Single Phase Transformer (Calculate Efficiency and Regulation)	
12.	Measurement of Active and Reactive Power in a balanced Three-phase circuit	
13.	No-Load Characteristics of a Three-phase Alternator	

BASIC ELECTRICAL ENGINEERING

ATTAINMENT OF PROGRAM OUTCOMES &PROGRAM SPECIFIC OUTCOMES

S.NO	Name of the Experiment	Program Outcomes (PO's) Attained	Program Specific Outcomes (PSO's)	Program Educational Objectives (PEO's)
1	Verification of KVL and KCL	PO1,PO2,PO3,PO4,PO9,PO11,PO12	PSO1,PSO2	
2	Verification of Thevenin's and Norton's theorem.	PO1,PO2,PO3,PO4,PO9,PO11,PO12	PSO1,PSO2	
3	Transient Response of Series RL and RC circuits using DC excitation	PO1,PO2,PO3,PO4,PO9,PO11,PO12	PSO1,PSO2	
4	Resonance in series RLC circuit	PO1,PO2,PO3,PO4,PO9,PO11,PO12	PSO1,PSO2	
5	Calculations and Verification of Impedance and Current of RL, RC and RLC series circuits.	PO1,PO2,PO3,PO4,PO9,PO11,PO12	PSO1,PSO2	
6	Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single Phase Transformer	PO1,PO2,PO3,PO4,PO9,PO11,PO12	PSO1,PSO2	
7	Performance Characteristics of a DC Shunt Motor	PO1,PO2,PO3,PO4,PO9,PO11,PO12	PSO1,PSO2	
8	Torque-Speed Characteristics of a Three-phase Induction Motor.	PO1,PO2,PO3,PO4,PO9,PO11,PO12	PSO1,PSO2	
9	Verification of Superposition theorem.	PO1,PO2,PO3,PO4,PO9,PO11,PO12	PSO1,PSO2	
10	Three Phase Transformer: Verification of Relationship between Voltages and Currents (Star-Delta, Delta-Delta, Delta-star, Star-Star)	PO1,PO2,PO3,PO4,PO9,PO11,PO12	PSO1,PSO2	
11	Load Test on Single Phase Transformer (Calculate Efficiency and Regulation)	PO1,PO2,PO3,PO4,PO9,PO11,PO12	PSO1,PSO2	
12	Measurement of Active and Reactive Power in a balanced Three-phase circuit	PO1,PO2,PO3,PO4,PO9,PO11,PO12	PSO1,PSO2	
13	No-Load Characteristics of a Three-phase Alternator	PO1,PO2,PO3,PO4,PO9,PO11,PO12	PSO1,PSO2	

BASIC ELECTRICAL ENGINEERING

Course Objectives:

- To measure the electrical parameters for different types of DC and AC circuits using conventional and theorems approach.
- To study the transient response of various R, L and C circuits using different excitations.
- To determine the performance of different types of DC, AC machines and Transformers.

Course Outcomes:

CO1: Verify the basic Electrical circuits through different experiments.

CO2: Evaluate the performance calculations of Electrical Machines and Transformers through various testing methods.

CO3: Analyze the transient responses of R, L and C circuits for different input

COURSE-POS/PSO MAPPING

ATTAINMENT OF PROGRAM OUTCOMES, PROGRAM SPECIFIC OUTCOMES& COURSE OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	0	1	0	0	0	2	0	2	2	2	2
CO2	3	2	1	0	3	1	0	1	1	2	1	2	1	1
CO3	3	2	1	1	3	2	0	0	1	0	2	2	2	1

EXPERIMENT - 1

VERIFICATION OF KVL AND KCL

AIM:

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

APPARATUS:

S. No	Apparatus Name	Range	Type	Quantity
1	RPS	0-15V	DIGITAL	1
2	Ammeter	0-200mA	DIGITAL	4
3	Voltmeter	0-20V	DIGITAL	4
4	Resistors	1 KΩ -10 KΩ	-	3
5	Bread Board	-	-	01
6	Connecting Wires	-	-	As required

CIRCUIT DIAGRAMS:

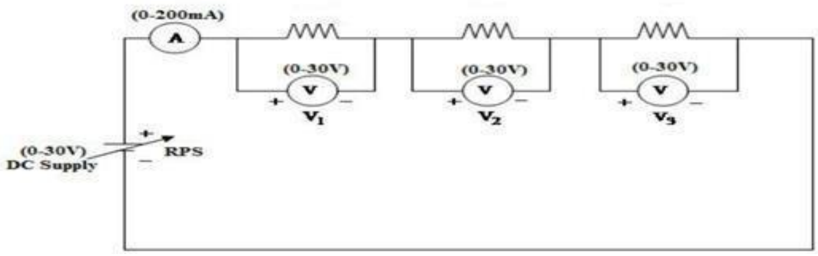


Figure – 1.1 Verification of KVL

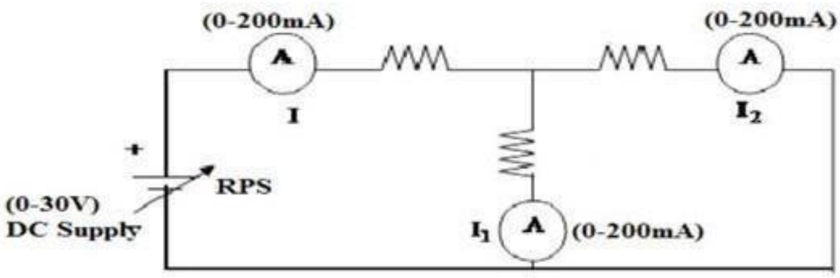


Figure – 1.2 Verification of KCL

PROCEDURE:

To Verify KVL

1. Connect the circuit diagram as shown in Figure 1.
2. Switch ON the supply to RPS.
3. Apply the voltage (say 5v) and note down the voltmeter readings.
4. Gradually increase the supply voltage in steps.
5. Observe the readings of voltmeters.
6. Sum up the voltmeter readings (voltage drops), that should be equal to applied voltage
7. Thus KVL is verified practically.

To Verify KCL

1. Connect the circuit diagram as shown in Figure 2.
2. Switch ON the supply to RPS.
3. Apply the voltage (say 5v) and note the Ammeter readings.
4. Gradually increase the supply voltage in steps.
5. Note the readings of Ammeters.
6. Sum up the Ammeter readings (I_1 and I_2), that should be equal to total current (I).
7. Thus KCL is verified practically

OBSERVATIONS:

For KVL

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

For KCL

AppliedVoltage 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 the supply
2. Make sure of proper color coding of resistors
3. The terminal of the resistance should be properly connected.

RESULT:

Experiment-2
(A)VERIFICATION OF THEVENIN'S THEOREM

Aim:
To Verify the Thevenin's Theorem Analytically and Practically.

Apparatus:

S.No.	Name	Range	Quantity
1	Bread Board		1
2	Regulated Power Supply(RPS)	0-15V	1
3	Digital Ammeter	0-200mA	2
4	Digital Voltmeter	0-20V	2
5	Resistors	1 KΩ -10 KΩ	4
6	Connecting Wires	As Required	

Circuit Diagram:
Measuring Current through the load directly

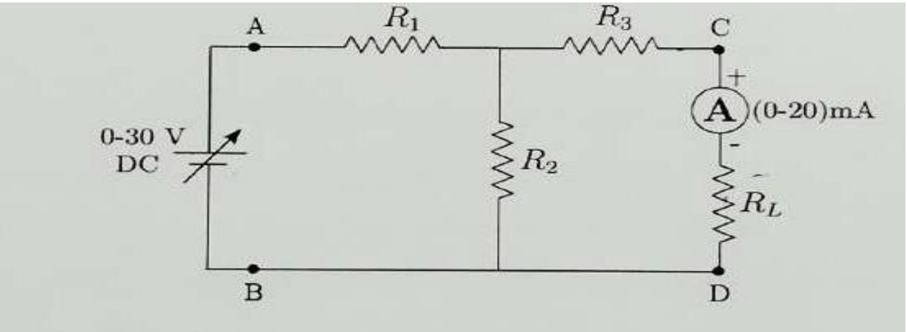


Figure 1: Circuit diagram to find out load current.

Procedure To Find out V_{th}:

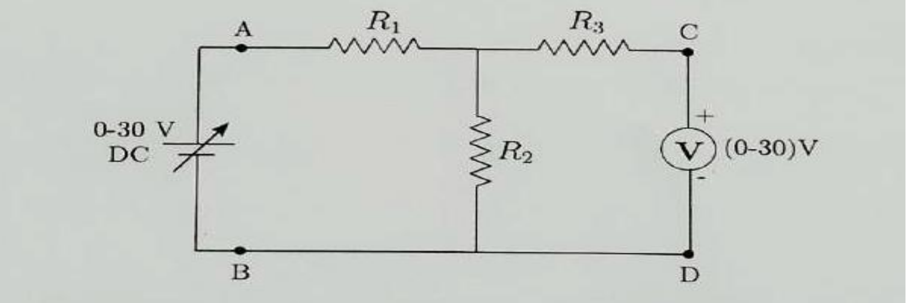


Figure 2: Circuit diagram to find out Thevenin's voltage.

1. Connect the circuit as shown in Figure 2.
2. Apply 20V DC Supply between terminals A and B.
3. Measure the open circuit voltage (Voc) by connecting the voltmeter across the terminals C and D.

Procedure to find out Rth :

1. Short circuit the terminals A and B as shown in Figure3.
2. Apply 20V DC supply across terminals C and D and measure the Current.
3. Find out the R_{th} from the above data by using the formula $R_{th} = V/I$.

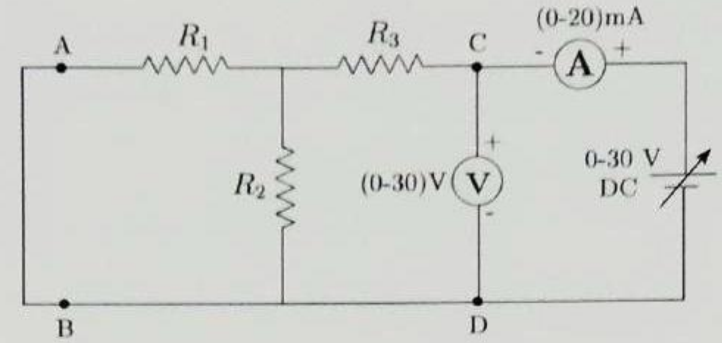


Figure 3: Circuit diagram to find out Thevenin's resistance.

Procedure to find out Load Current (I_L):

1. Connect the circuit as shown in Figure 4.
2. Include the load resistance to the Thevenin's equivalent circuit.
3. Measure the current flowing through the load resistance and verify the Thevenin's theorem.

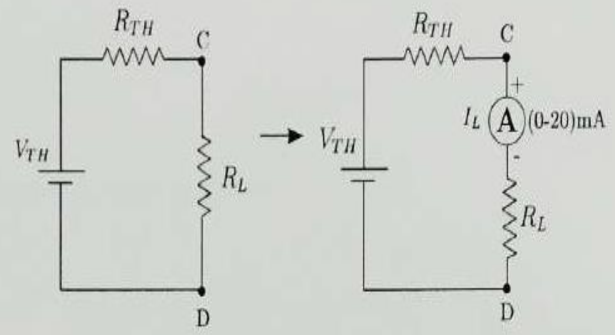


Figure 4: Thevenin equivalent circuit to find out the load current I_L.

Observations

	V_S	V_{OC}	To determine R_{TH}			$I_L = \frac{V_{TH}}{R_{TH}+R_L}$
			V	I	$R_{TH} = \frac{V}{I}$	
Theoretical						
Practical						

Result

	Theoretical	**Practical**
V_{TH}		
R_{TH}		
I_L		

B. VERIFICATION OF NORTON'S THEOREM

Aim:

To Verify the Norton's Theorem Analytically and Practically.

Apparatus:

S.No.	Name	Range	Quantity
1	Bread Board	-	1
2	Regulated Power Supply(RPS)	0-15V	1
3	Digital Ammeter	0-200mA	2
4	Digital Voltmeter	0-20V	2
5	Resistors	1 KΩ -10 KΩ	4
6	Connecting Wires	As Required	

Circuit Diagram:

Measuring Current through the load directly

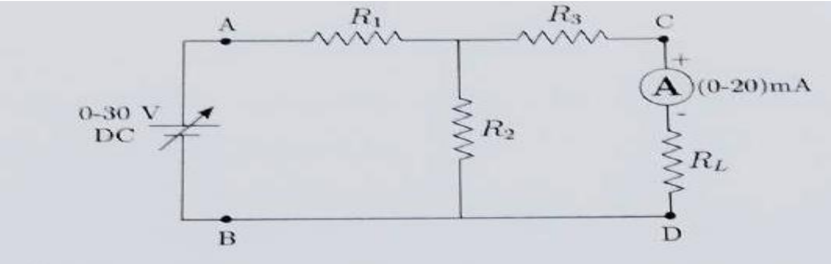


Figure 5: Circuit diagram to find out load current.

Procedure To Find out I_N:

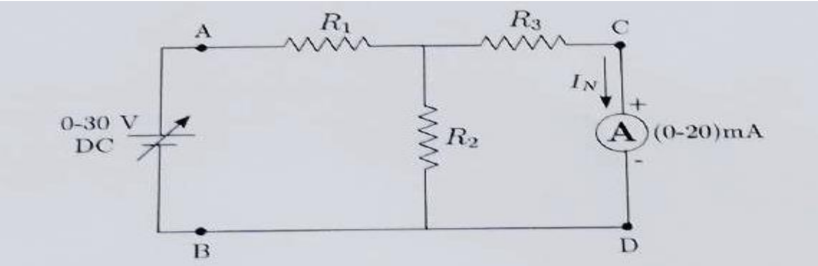


Figure 6: Circuit diagram to find out Norton's current.

1. Connect the circuit as shown in Figure 6.
2. Apply 20V DC Supply between terminals A and B.
3. Ammeter across C and D terminals is used to measure the Norton Current.

Procedure to find out R_N :

1. Short circuit the terminals A and B as shown in Figure7.
2. Apply 20V DC supply across terminals C and D and measure the Current.
3. Find out the R_N from the above data by using the formula $R_N = V/I$.

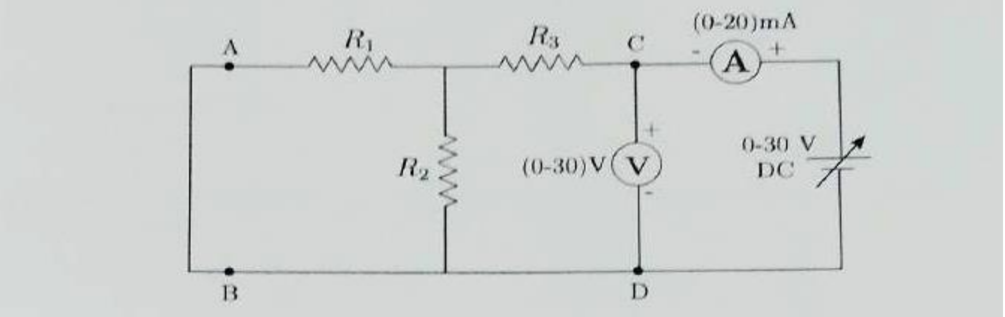


Figure 7: Circuit diagram to find out Norton's equivalent resistance.

Procedure to find out Load Current (I_L):

1. Connect the circuit as shown in Figure 4.
2. Include the load resistance to the Norton's equivalent circuit.
3. Measure the current flowing through the load resistance and verify the Norton's theorem.

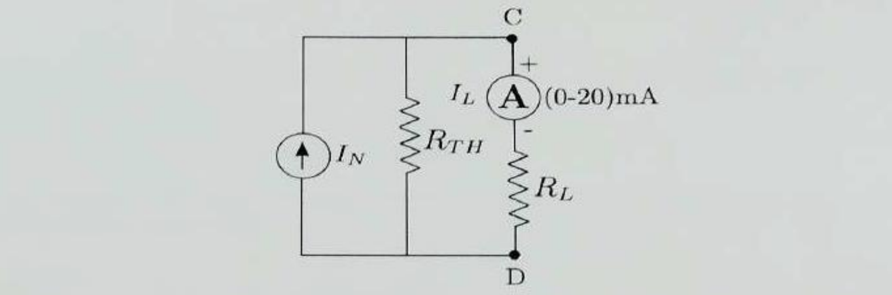


Figure 8: Norton equivalent circuit to find out the load current I_L

Observations

	V_S	I_{SC}	To determine R_N			$I_L = \frac{I_N R_{TH}}{R_{TH}+R_L}$
			V	I	$R_N = \frac{V}{I}$	
Theoretical						
Practical						

Result

	Theoretical	**Practical**
I_N		
R_N		
I_L		

EXPERIMENT - 3

TRANSIENT RESPONSE OF SERIES RL & RC CIRCUITS USING DC EXCITATTION

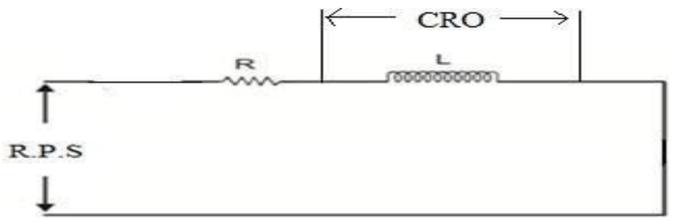
AIM: To study & plot the transient response of series RL & series RC circuit.

APPARATUS:

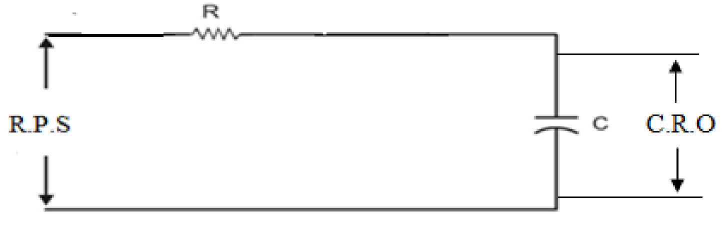
S. No.	Name of the Equipment	Range	Type	Quantity
1.	R.P.S		Digital	1
2.	Decade resistance box	-	-	1
3.	Decade inductance box	-	-	1
4.	Decade capacitance box	-	-	1
5.	Ammeter	0-200mA	Digital	1
6.	CRO	-	Digital	1
7.	Connecting wires.	-	-	As required

CIRCUIT DIAGRAM:

Series R-L Circuit:



Series R-C Circuit:

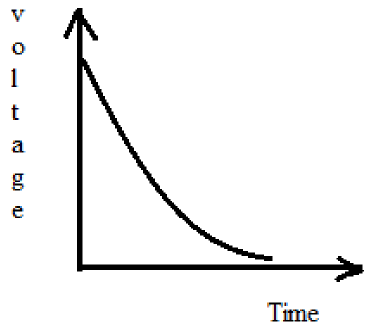


PROCEDURE:

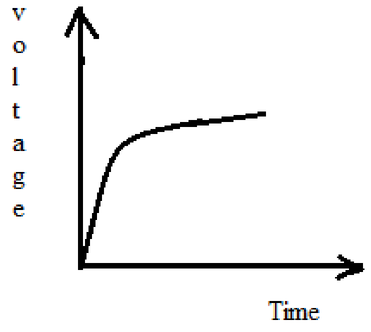
1. Connect the circuit as per circuit diagram.
2. Apply DC supply to the circuit
3. Observe the current, note down reading
4. Plot the graph
5.

Nature of Graph:

Series RL Circuit:



Series RC circuit:



RESULT:

EXPERIMENT - 4

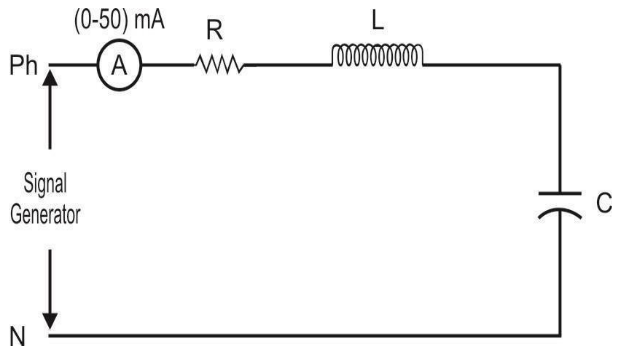
RLC SERIES RESONANCE

AIM: To find the resonant frequency, quality factor, band width of a series resonant circuit.

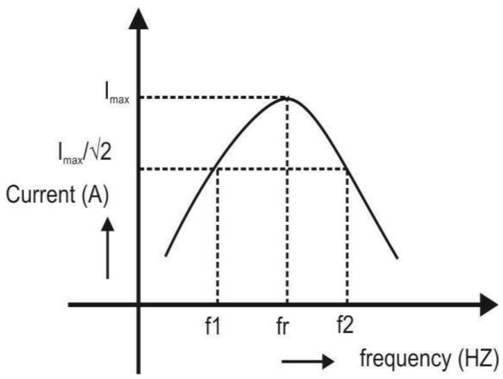
APPARATUS:

S. No.	Name of the Equipment	Range	Type	Quantity
1.	Function generator	1 MHz	Digital	1
2.	Decade resistance box	-	-	1
3.	Decade inductance box	-	-	1
4.	Decade capacitance box	-	-	1
5.	Ammeter	0-200mA	Digital	1
6.	CRO	-	Digital	1
7.	Connecting wires.	-	-	As required

CIRCUIT DIAGRAM:



MODEL GRAPHS:



PROCEDURE:

1. Calculate the resonant frequency ($f_r = 1/2\pi\sqrt{LC}$ of the network.
2. Connect the circuit as per the circuit diagram.
3. Vary the frequency of the input signal and note down the current flowing through thecircuit.
4. Observe the current at resonant frequency.
5. Draw the graph frequency Vs current.
6. Draw the graph frequency Vs current.

TABULAR COLUMN:

Sl. No.	Freq. (Hz)	Current (mA)
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		

RESULT:

EXPERIMENT – 5

VERIFICATION OF IMPEDANCE AND CURRENT OF RL,RC,AND RLC EERIES CIRCUITS

AIM: To verify the impedance and current of RL, RC, and RLC eeries circuits.

APPARAUS REQUIRED:

SL.No.	Apparatus	Range	Quantity
1	Resistors	----	1
2	Inductors	-----	1
3	Capacitors	----	1
4	Ac Power Supply Source	30V	1
5	Connecting Wires		Required

CIRCUIT DIAGRAM FOR RL SERIES CIRCUIT:

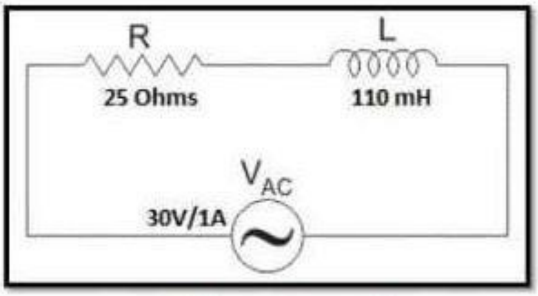


Fig: 1 RL SERIES CIRCUIT

CIRCUIT DIAGRAM FOR RC SERIES CIRCUIT:

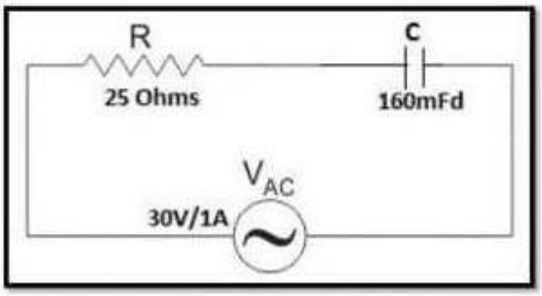


Fig: 2 RC SERIES CIRCUIT

CIRCUIT DIAGRAM FOR RLC SERIES CIRCUIT:

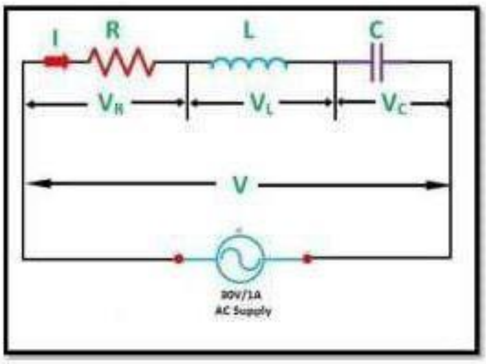


Fig: 3 RLC SERIES CIRCUIT

PROCEDURE:

A) RL SERIES CIRCUIT:

1. Connect the Mains Cord to the trainer and switch 'on' the main supply.
2. Make the connections as per the Fig:1 as shown In above.
3. Apply some Voltage using Variac upto 30V in Step Wise.
4. Note down all parameters (Voltage And Current).
5. Tabulate the Readings.
6. Calculate the Impedance and Current.

B) RC SERIES CIRCUIT:

1. Connect the Mains Cord to the trainer and switch 'on' the main supply.
2. Make the connections as per the Fig:2 as shown In above.
3. Apply some Voltage using Variac upto 30V in Step Wise.
4. Note down all parameters (Voltage And Current).
5. Tabulate the Readings.
6. Calculate the Impedance and Current.

C) RLC SERIES CIRCUIT:

1. Connect the Mains Cord to the trainer and switch 'on' the main supply.
2. Make the connections as per the Fig:3 as shown In above.
3. Apply some Voltage using Variac upto 30V in Step Wise.
4. Note down all parameters (Voltage And Current).
5. Tabulate the Readings.
6. Calculate the Impedance and Current.

OBSERVATION TABLE:

	V(Volts)	I(Current)	Z(Ohms)
RL Circuit			
RC Circuit			
RLC Circuit			

RESULT:

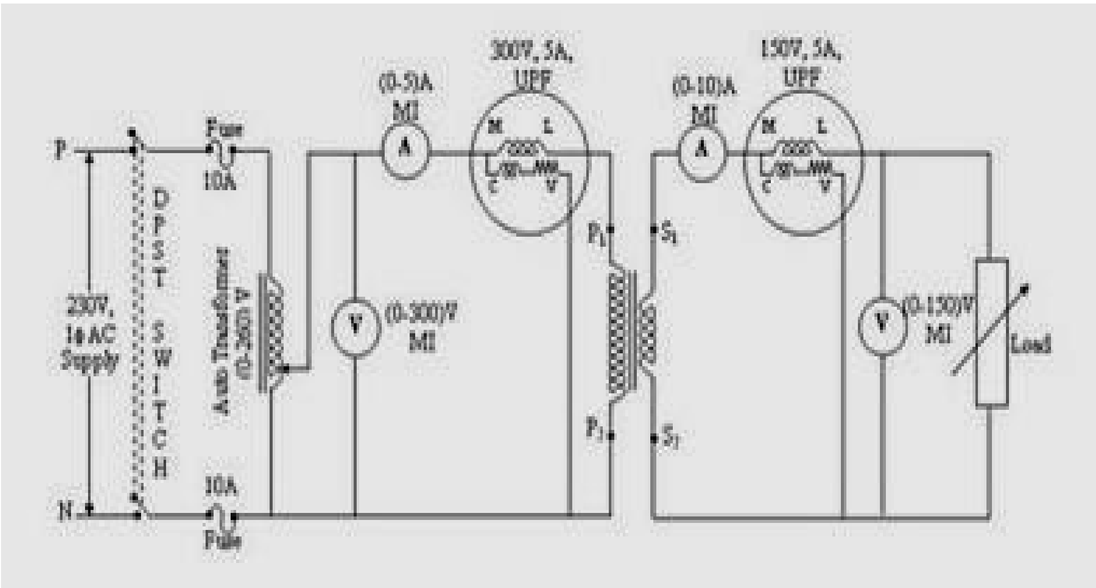
EXPERIMENT – 6
MEASUREMENT OF VOLTAGE, CURRENT AND REAL POWER IN PRIMARY AND SECONDARY CIRCUITS OF A SINGLE PHASE TRANSFORMER

AIM: To measure the primary and secondary voltages, currents & powers of a single phase transformer.

APPARATUS:

Serial No.	Equipment	Range	Quantity	Remark
1	1-Φ Transformer	1KVA	1	
2	Ammeter	(0-10)A (0-5) A	1 1	MI MI
3	Voltmeter	(0-150)V (0-300) V	1 1	MI MI
4	Wattmeter	(300V, 5A) (150V, 5A)	1 1	UPF UPF
5	Auto Transformer	1ϕ, (0-260)V	1	-
6	Resistive Load	1ϕ, 230V,10A	1	-
7	Connecting Wires		Few	

CIRCUIT DIAGRAM:



PROCEDURE:

1. Connections are made as per the circuit diagram.
2. After checking the no load condition, minimum position of auto transformer and DPST switch is closed.
3. Ammeter, Voltmeter and Wattmeter readings on both primary side and secondary side are noted.
4. The load is increased and for each load, Voltmeter, Ammeter and Wattmeter readings on both primary and secondary sides are noted.
5. Again no load condition is obtained and DPST switch is opened.

OBSERVATION:

S.NO	Primary			Secondary		
	V1	I1	W1	V2	I2	W2

PRECAUTIONS:

1. Auto Transformer should be in minimum position.
2. The AC supply is given and removed from the transformer under no load condition.

RESULT:

EXPERIMENT – 7

PERFORMANCE CHARACTERISTICS OF D.C. SHUNT MOTOR

AIM: To obtain the performance characteristics of a D.C. shunt motor by conducting brake test.

APPARATUS:

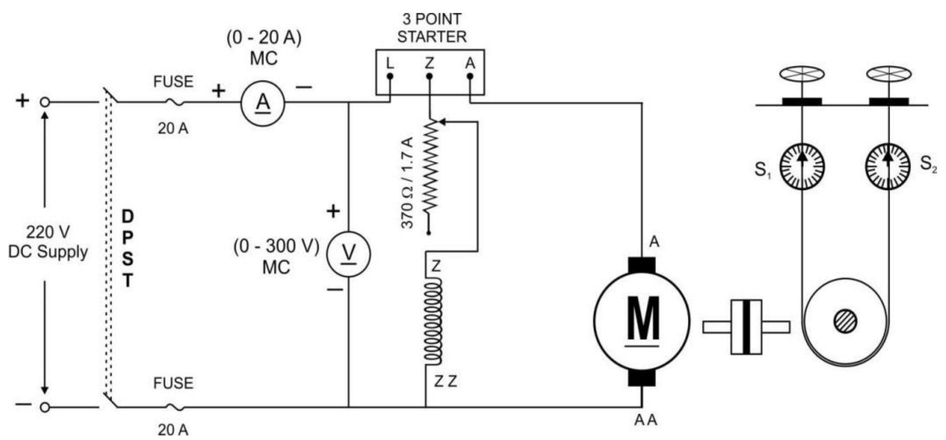
S. No.	Item	Type	Range	Quantity
1	Ammeter	(M.C)	0 – 15 A	1 No
2	Ammeter	(M.C)	0 – 2 A	1 No
3	Voltmeter	(M.C)	0 – 300 Volts	1 No
4	Rheostat		400 ohms / 1.6A	1 No
5	Connecting Wires			Required

NAME PLATE DETAILS:

Motor

Voltage	220V
Current	11A
Output	3HP
Speed	1500RPM

CIRCUIT DIAGRAM:



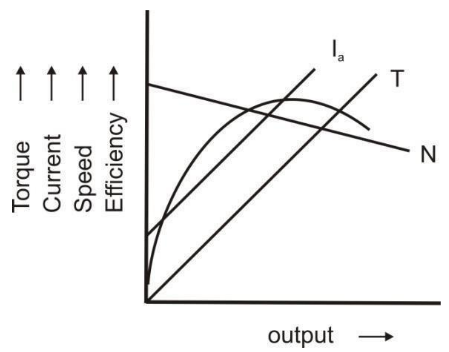
PROCEDURE:

1. Make the connections as shown in the circuit diagram.
2. Keeping the field rheostat (R_f) at the minimum position, switch on the supply and start the motor.
3. Adjust the speed of the motor on no load to its rated value by means of the field rheostat. DO NOT DISTRUB THE POSITION OF THE RHEOSTAT THROUGH OUT THE TEST.
4. Apply the load by tightening the screws of the spring balances. Note down the spring tensions, the speed, the voltage and the currents at different loads until full load current is obtained.

TABULAR COLUMN:

S.No	I_L (A)	V_L (V)	W_1 (Kg)	W_2 (Kg)	W = W_1-W_2 (Kg)	N (rpm)	T= Wrg (Nm)	P_0 = 2ΠNT/60	P_1 = $V_L I_L$	$\eta = \frac{P_0}{P_i} X 100$
1.										
2.										
3.										
4.										
5.										
6.										

MODEL GRAPH:



RESULT:

EXPERIMENT – 8

TORQUE -SPEED CHARACTERISTICS OF THREE PHASE INDUCTION MOTOR

AIM:

To determine the torque –speed characteristics of a 3-phase induction motor by performing brake test on it

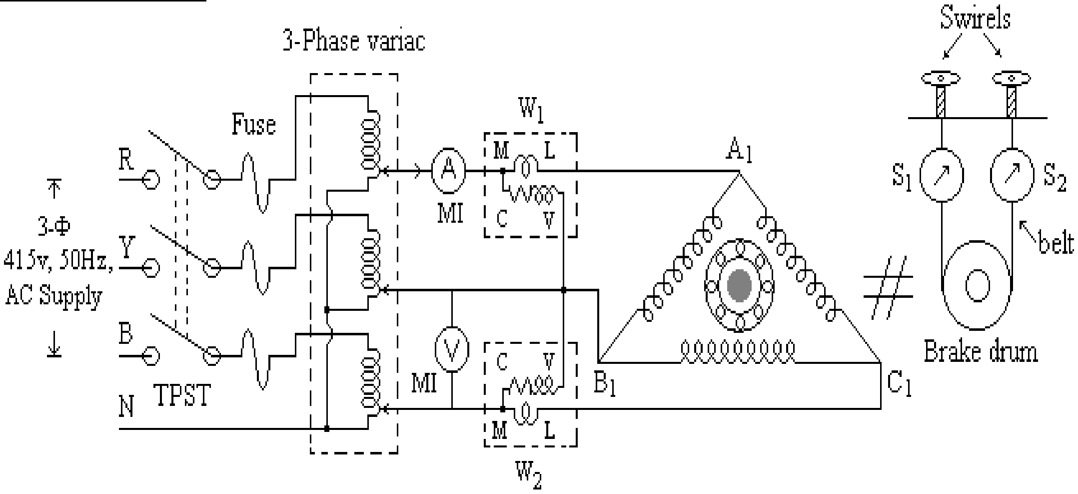
APPARATUS:

S. No.	Name	Range	Type	Quantity
1.	Voltmeter	0-600V	MI	1
2.	Ammeter	0-10A	MI	1
3.	Wattmeter	300V/10A	UPF	2
4.	Tachometer	0-9999 RPM	Digital	1
5	Connecting Wires			Required

Name plate details:

Induction Motor	
1. HP/KW	: 3 HP
2. Voltage	: 415V
3. Current	: 4.8A
4. Speed	: 1445 RPM
5. Phases	: 3-PHASE
6. Frequency	: 50 HZ

CIRCUIT DIGARAM



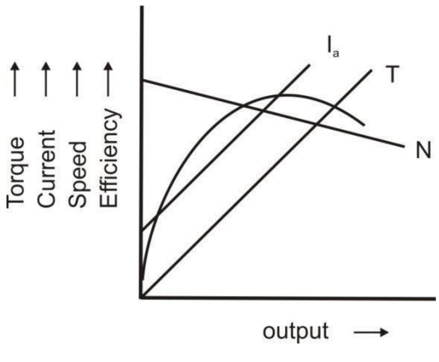
PROCEDURE:

1. Connections are made as per the circuit diagram.
2. Switch on the 3–phase AC mains, apply the rated voltage by using 3-ϕ variac
3. Take down the readings of all the meters, spring balance readings and the speed under no load condition.
4. Increase the load on the motor gradually by tightening the belt.
5. Record the readings of all the meters, spring balance readings and the speed at every setting of the load.
6. Observations may be continued up to the full load current rating of the motor.
7. Reduce the load gradually and finally unload it completely and decrease the voltage to zero.
8. Switch off the supply.
9. Note down the effective diameter of the brake drum.

OBSERVATIONS:

S. No.	V (volts)	I (amps)	Wattmeter (watts)		Spring Balance		N (rpm)	Torque= $r(S_1–S_2)9.81$ Nm	Input(W) = W_1+W_2	O/P = $2\pi NT/60$	Efficiency = O/P / I/P	$\cos\phi = 1/\sqrt{(1+\tan^2\phi)}$
			W_1	W_2	S_1	S_2						
1												
2												
3												

MODEL GRAPH:



PRECAUTIONS:

1. There should not be loose connections in the circuit.
2. Don't run the machine beyond the full-load current.
3. Make sure that Auto Transformer is in zero position before starting.

RESULT:

EXPERIMENT – 9

VERIFICATION OF SUPERPOSITION THEOREM

AIM:

To find out the current flowing through particular branch by using superposition Theorem analytically and practically.

Apparatus:

S.No.	Name	Range	Quantity
1	Bread Board		1
2	Regulated Power Supply(RPS)	0-15V	1
3	Digital Ammeter	0-200mA	2
4	Digital Voltmeter	0-20V	2
5	Resistors	1K Ω-10KΩ	4
6	Connecting Wires	As Required	

CIRCUIT DIAGRAM:

To Find out I:

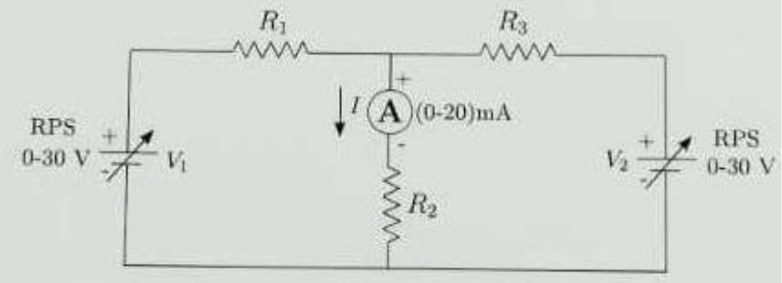


Figure 1: Circuit diagram to find out the total current I.

To Find out I_1:

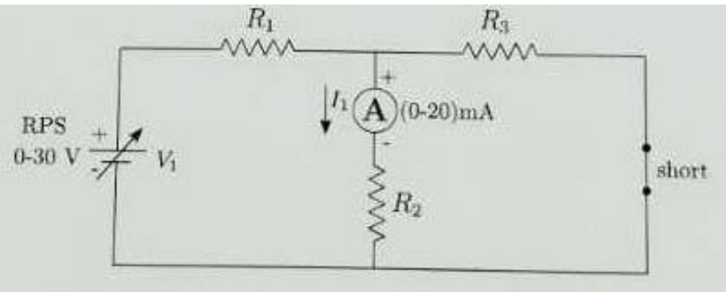


Figure 2: Circuit diagram to find out the current I_1.

To Find out I_2:

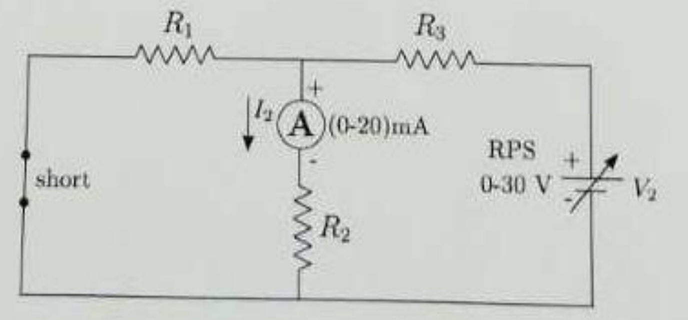


Figure 3: Circuit diagram to find out the current I_2.

Procedure:

1. Make the Connections as per the Circuit Diagram Show in Figure 1
2. Adjust Channel -1 Voltage to 20V and channel -2 to 10v.
3. Note down ammeter reading in Table 1.
4. Switch off RPS and make the connections as per the circuit Diagram shown in figure 2.
5. Adjust the Channel-1 Voltage to 20V.
6. Note down ammeter reading in Table 2.
7. Switch off RPS and make the connections as per the circuit Diagram shown in figure 3.
8. Adjust the Channel-2 Voltage to 10V.
9. Note down ammeter reading in Table 3.
10. Switch off RPS and remove the Connections.

PRECAUTIONS:

1. Avoid loose Connections
2. Note down the readings without any offset.

OBSERVATIONS:

V_1(Volts)	V_2(Volt)	I(mA)

Table 1: Total Current I Value for Figure 1.

V_1(Volts)	V_2(Volt)	I_1(mA)

Table 2: Total Current I_1 Value for Figure 2.

V_1(Volts)	V_2(Volt)	I_2(mA)

Table 3: Total Current I_2 Value for Figure 3.

RESULT:

EXPERIMENT – 10

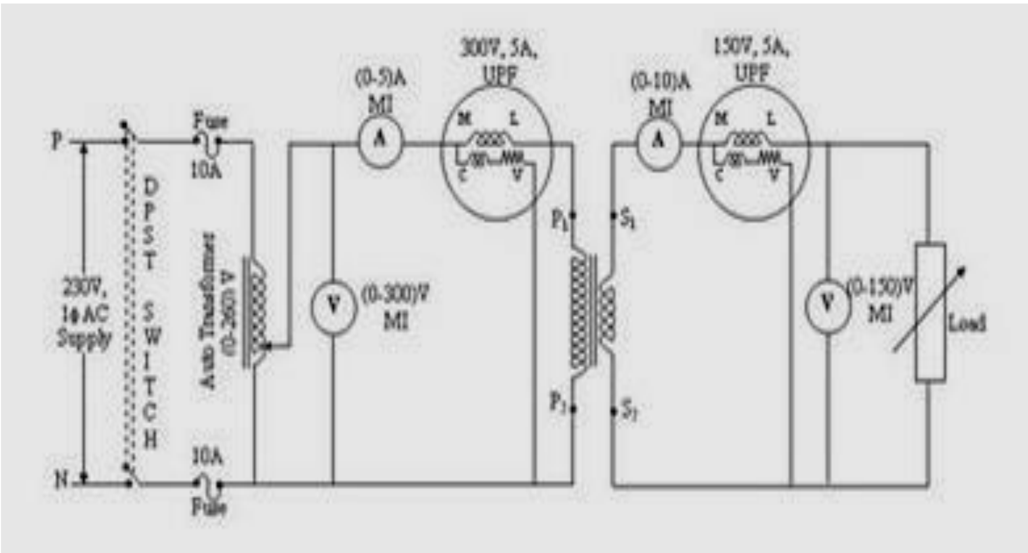
LOAD TEST ON SINGLE PHASE TRANSFORMER

AIM: To determine efficiency by load test of a single phase transformer.

APPARATUS:

Serial No.	Equipment	Range	Quantity	Remark
1	1-Φ Transformer	1KVA	1	
2	Ammeter	(0-10)A (0-5) A	1 1	MI MI
3	Voltmeter	(0-150)V (0-300) V	1 1	MI MI
4	Wattmeter	(300V, 5A) (150V, 5A)	1 1	UPF UPF
5	Auto Transformer	1ϕ, (0-260)V	1	-
6	Resistive Load	$1-\Phi$, $230V$	1	-
7	Connecting Wires		Few	

CIRCUIT DIAGRAM:



PROCEDURE:

1. Connections are made as per the circuit diagram.
2. After checking the no load condition, minimum position of auto transformer and DPST switch is closed.
3. Ammeter, Voltmeter and Wattmeter readings on both primary side and secondary side are noted.
4. The load is increased and for each load, Voltmeter, Ammeter and Wattmeter readings on both primary and secondary sides are noted.
5. Again no load condition is obtained and DPST switch is opened.

OBSERVATION:

S.NO	Primary			Secondary			Efficiency
	V1	I1	W1	V2	I2	W2	

PRECAUTIONS:

1. Auto Transformer should be in minimum position.
2. The AC supply is given and removed from the transformer under no load condition.

RESULT:

EXPERIMENT – 11

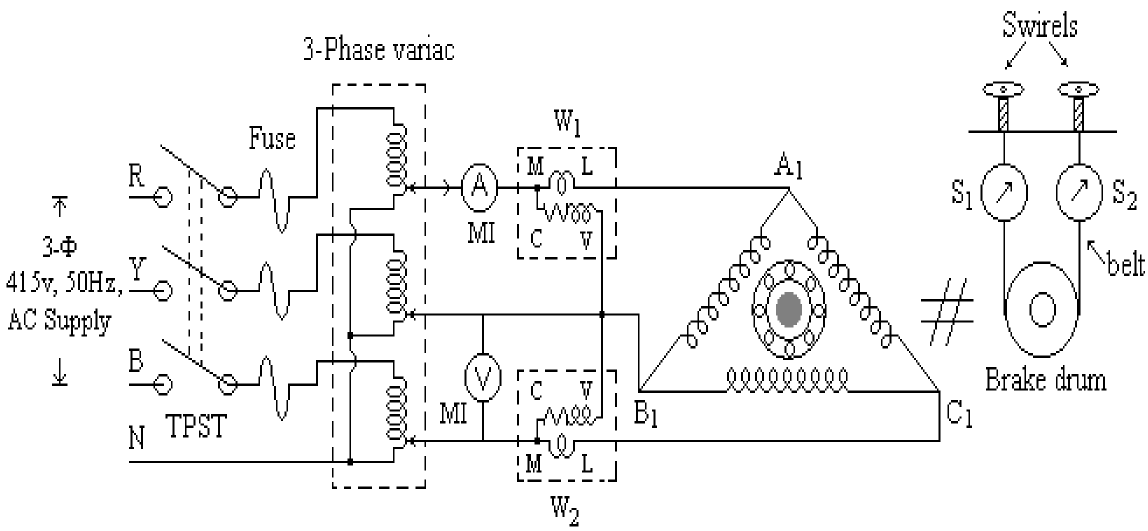
MEASUREMENT OF ACTIVE AND REACTIVE POWER IN A BALANCED THREE- PHASE CIRCUIT

AIM: To measure 3-phase powers using two watt-meters.

APPARATUS:

S. No.	Name	Range	Type	Quantity
1	Voltmeter	0-600V	MI	1
2	Ammeter	0-10A	MI	1
3	Wattmeter	300V/10A	UPF	2
4	Tachometer	0-9999 RPM	Digital	1
5	Connecting Wires			Required

CIRCUIT DIAGRAM:



PROCEDURE:

1. Connect the circuit as shown in fig.
2. Switch 'ON' the supply.
3. Apply 415 volts & Note down the corresponding readings and calculate 3 –ϕ reactive power.

4. Now increase the load of three phase Inductive load steps and note down the corresponding meter readings.

5. Remove the load and switch ‘off’ the supply.

CALCULATIONS:

Sum of reading of two Watt-meters P1 + P2

This is total power consumed by load P = P1 + P2

Difference of readings of two Watt -meters P1 - P2

Total Reactive power consumed by load P = √**3** *(P1 - P2)

S.NO	voltage	current	W1 reading	W2 reading	Real power	Reactive power
1						
2						
3						

RESULT:

EXPERIMENT – 12

NO LOAD CHARACTERISTICS OF 3-ϕ ALTERNATOR

To draw no load characteristics of an alternator

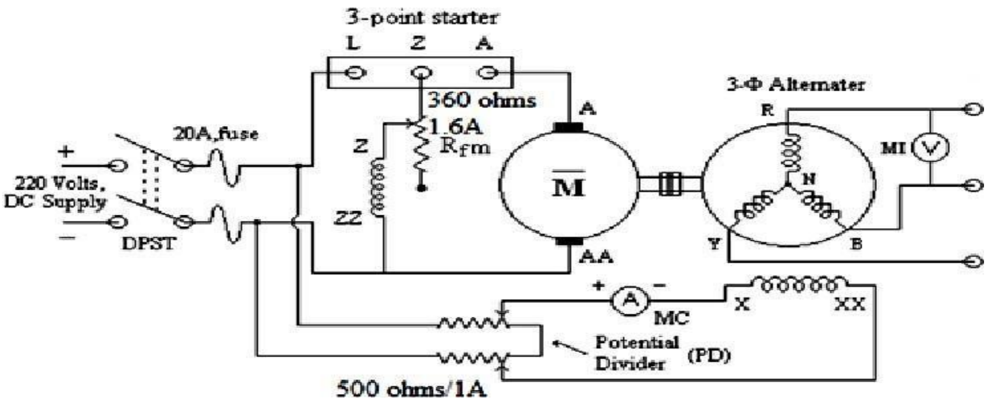
APPARATUS:

S. No.	Name	Range	Type	Quantity
1.	Voltmeter	0-600V	MI	1
2.	Ammeter	0-2.5A	MC	1
3.	Ammeter	0-5/10A	MI	1
4.	Rheostat	50Ω/5A, 145 Ω /2.8A	wire wound	2
5.	Tachometer	0-9999 RPM	Digital	1
6.	Connecting Wires			Required

Name plate details:

3-phase alternator		*DC shunt motor*	
1. Rated voltage	:415V	1. Rated KW	:3HP
2. Rated current	: 3A	2. Rated Speed :	1500RPM
3. Rated speed	:1500 RPM	3. Rated Voltage	: 220V
4.Frequency	: 50 HZ	4. Rated Current	:11A

CIRCUIT DIAGRAM:



PROCEDURE:

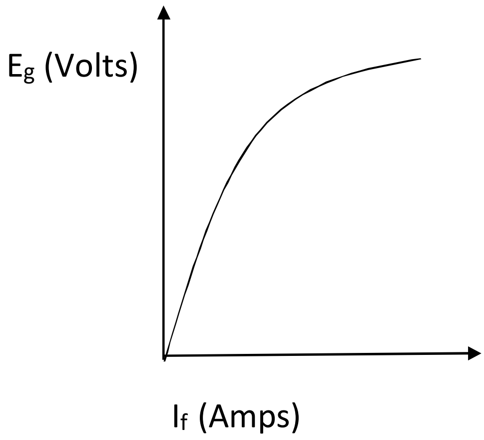
O.C. Test:

1. Give connections as per the circuit diagram.(Fig.1)
2. Keep the resistance in the motor armature circuit in its maximum resistance position and field circuit in its minimum resistance position. Keep the resistance in generator field circuit in its maximum resistance position.
3. Switch on the supply, bring the starter to its maximum position, cut off the resistance in the motor armature circuit gradually and adjust the speed of the motor to the rated speed of generator.
4. Keeping the speed as constant note down the open circuit voltage by varying the field current of generator in steps till rated voltage is obtained.
5. Bring the resistance in generator field circuit to its maximum position, bring the field resistance of motor to its minimum position and armature resistance to maximum position and switch off the supply.

OBSERVATIONS:

S.NO	Field current I_F	Open circuit voltage V_{OC}

MODEL GRAPH:



PRECAUTIONS:

2. The motor field rheostat should kept minimum & armature rheostat in maximum position before starting.
3. The alternator exciter field Rheostat is kept maximum position before starting theexperiment.
4. Keep all the switches in open and stator is at initial (OFF) position.
5. Check if the field winding is properly connected.
6. The alternator field potential divider should be in the maximum voltage position.

RESULT: