ELECTRICAL MEASUREMENTS LAB MANUAL

Prepared by B.SAIDAMMA

R13 Regulation

Any 10 of the following experiments are to be conducted

1. Calibration and Testing of single phase energy Meter
2. Calibration of dynamometer wattmeter using phantom loading UPF.
3. Crompton D.C. Potentiometer- Calibration of PMMC Ammeter and PMMC voltmeter
4. Kelvin's double Bridge- Measurement of resistance- Determination of Tolerance.
5. Capacitance Measurement using Schering Bridge.
6. Inductance Measurement using Anderson bridge
7. Measurement of 3 phases reactive power with single –phase wattmeter for balanced loading.
8. Measurement of complex power with Tri-vector meter and verification.
9. Optical bench – Determination of polar curve measurement of MHCP of electric lamp.
10. Calibration LPF wattmeter –by direct loading
11. Measurement of 3 phase power with single watt meter and 2 No's C.T.
12. C.T. testing using mutual Inductor – Measurement of %ratio error and phase angle of given C.T.by Null method.
13. P.T. testing by comparison-V.G .as Null detector- Measurement of % ratio error and phase angle of the given P.T.
14. Dielectric oil testing using H.T.testing Kit
15. LVDT and capacitance pickup-characteristics and calibration
16. Resistance stain gauge-strain measurement and calibration
17. Polar curve using Lux, meter, Measurement of intensity of illumination of fluorescent lamp
18. Transformer turns ration measurement using A.c. Bridge.
19. A.C. Potentiometer – Polar form/Cartesian form- Calibration of AC Voltmeter, Parameters of Choke
20. Measurement of power by 3-voltmeter and 3-Ammeter methods
21. Parameters of Choke coil

LIST OF EXPERIMENTS

Cycle-1

1. Kelvin's double bridge

2. Scheringbridge

3. Anderson's bridge

4. Calibration and testing of single phase energy meter

5. Calibration of dynamometer type wattmeter using phantom loading UPF

Cycle-2

6. Measurement of power by 3-voltmeter and 3-Ammeter methods

7. Measurement of 3 phases reactive power with single –phase wattmeter for balanced loading

8. Measurement of parameters of choke coils using 3-voltmeter and 3-ammeter methods

9. Calibration of LPF wattmeter - by direct loading

10. Crompton dc potentiometer – calibration of PMMC ammeter & PMMC voltmeter

1. KELVIN'S DOUBLE BRIDGE

Aim:

To measure unknown resistance of low value and the resistance of connecting lead using a Kelvin's double bridge.

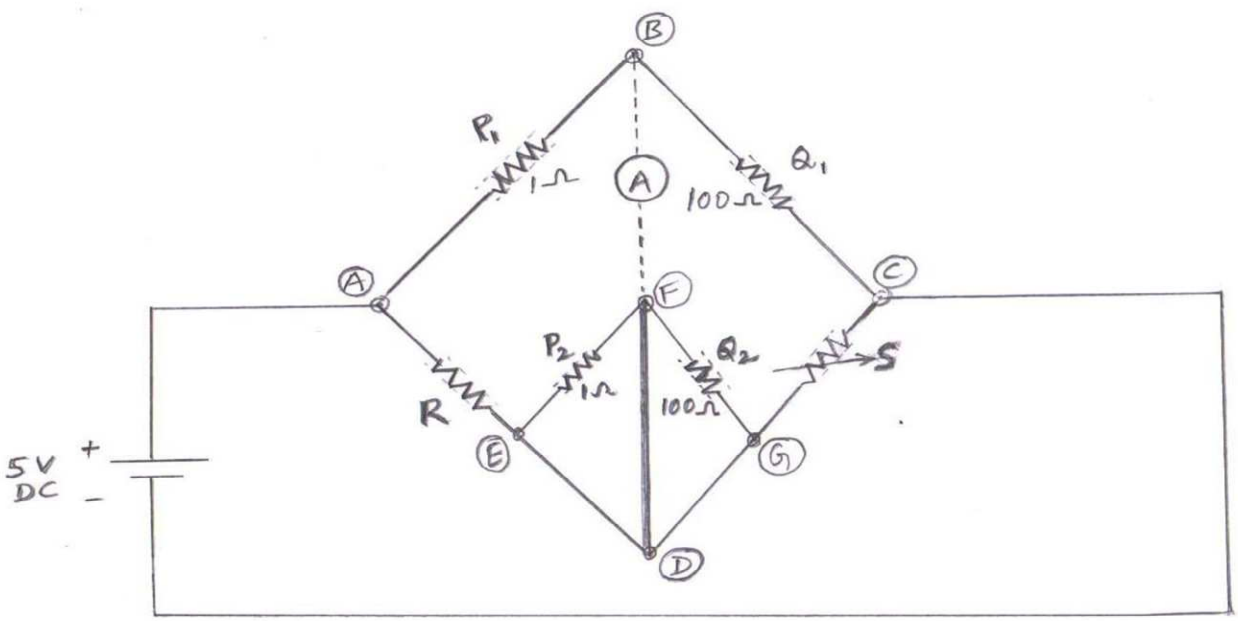
Apparatus Required:

Sl. No.	Description	Type	Range	Quantity
1	Portable Kelvin's double bridge Kit	----	----	01
2	Galvanometer	Analog	(0-100)mA	01
3	patch cards	----	----	As required

Procedure:

1. Connect the circuit as per circuit diagram on the Kelvin's double bridge trainee kit.
2. Switch on the single phase AC supply to the kit.
3. Keep all the knobs of the kit at minimum position.
4. Any one unknown resistance (**R_1, R_2, R_3, and R_4**) available at the bottom of the kit is connected across the terminals of **"R"**.
5. Now Switch on the bridge supply i.e. **5**Volts DC
6. Now vary the variable resistance "**S**" with the help of coarse and fine adjustment knobs.
7. At a particular value of "**S**" the bridge is balanced and galvanometer (ammeter) shows null position.
8. The practical value of unknown resistance **"R"** can be observed practically from the bridge.
9. Hence the unknown resistance **"R"** can be calculated theoretically by measuring the variable resistance "**S**" with the help of ohmmeter.
10. Switch OFF the bridge supply and then switch OFF the single phase AC supply to the kit.

CIRCUIT DIAGRAM



KELVIN 'S DOUBLE BRIDGE

Precautions:

1. There should not be any loose connections.
2. Meter readings should not be exceeded beyond their ratings
3. Handle the Bridge very carefully

Observation Table:

Sl. No.	P_1	Q_1	S	Calculated resistance R= $(P_1/Q_1) \times S$ (theoretical)	Observed Resistance in the bridge (practical)	% Error
1						
2						
3						
4						

Theoretical Calculations:

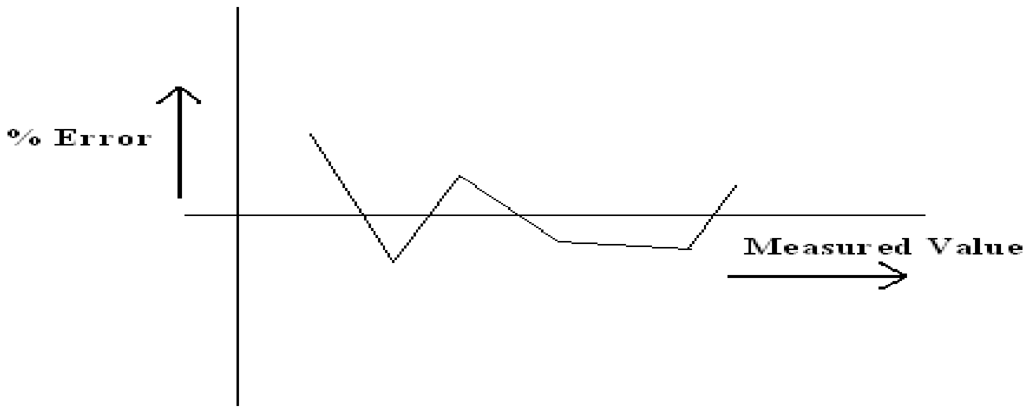
$$R = (P_1/Q_1) \times S$$

Where **R**= Unknown Resistance to be measured
P_1= cross arm resistance
Q_1= cross arm resistance
S= variable resistance

$$\% \text{ Error} = \frac{\text{Observed Resistance - Calculated resistance}}{\text{Calculated resistance}}$$

Model Graph:

A graph is drawn between **% Error Vs Measured Value**



Result:

2. SCHERING BRIDGE

Aim:

To find the capacitance of the unknown capacitor

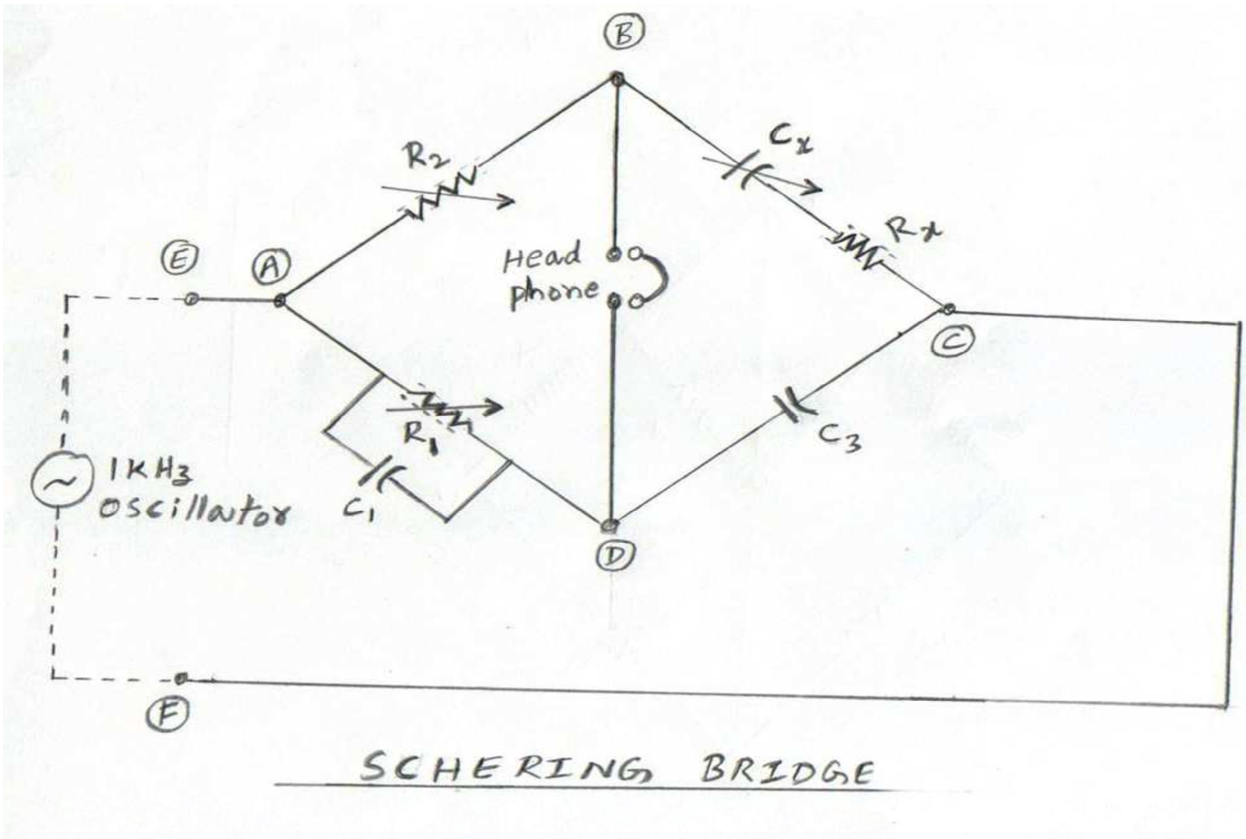
Apparatus Required:

Sl. No.	Description	Type	Range	Quantity
1	Schering bridge kit	----	----	01
2	Head Phones	----	----	01
3	patch cards	----	----	As per required

Procedure:

1. Connect the circuit as per circuit diagram on the Schering bridge trainee kit.
2. Switch on the single phase AC supply to the kit.
3. Keep all the knobs of the kit at minimum position.
4. Now switch on the bridge supply and adjust magnitude of 1 KHz oscillator to a definite value.
5. Vary the variable resistances R_1 with the help of 10K pot.
6. Vary the variable resistances R_2 with the help of coarse and fine adjustment knobs.
7. Now adjustment the different values of capacitor C_X.
8. At a particular value of C_X we can get the minimum sound or no sound in the headphone.
9. Note the value of R1, R2 and C_X.
10. Switch OFF the bridge supply and then switch OFF the single phase AC supply to the kit.
10. Calculate the value of unknown capacitor by using formula.

CIRCUIT DIAGRAM



Precautions:

1. There should not be any loose connections.
2. Handle the Bridge very carefully.

Observation Table:

Sl. No.	R_1 (Ohms)	R_2 (Ohms)	C_x (μ farads)	Calculated Value $C_3 = (R_2/R_1) \times C_x$ (theoretical)	Observed Value in the bridge (practical)	%Error
1						
2						
3						

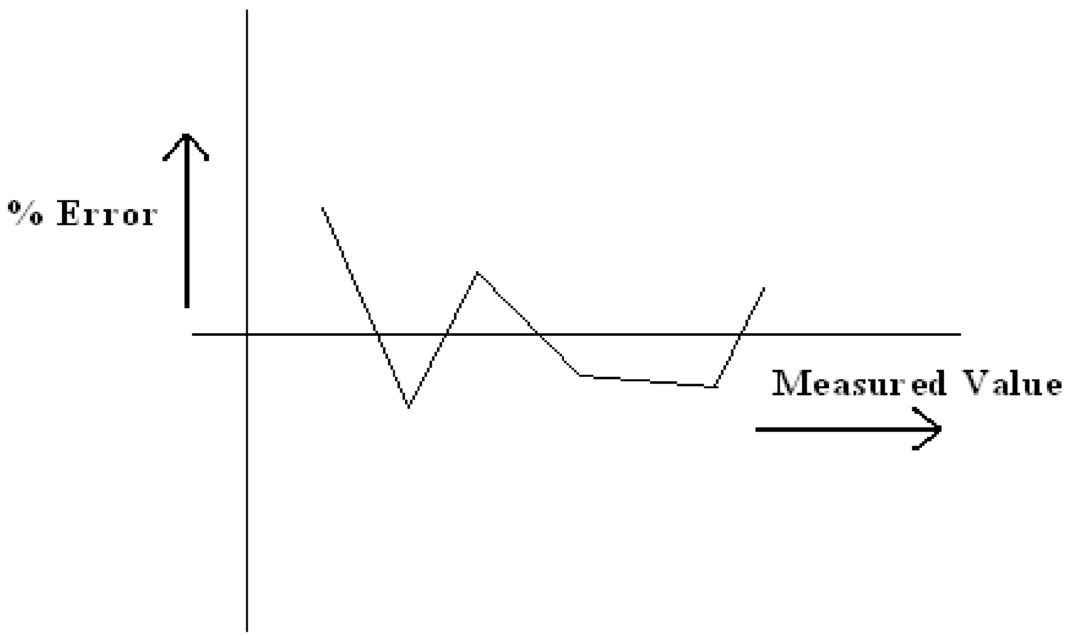
Theoretical Calculations:

Unknown Capacitance $C_3 = (R_2/R_1) \times C_x$

$$\% \text{ Error} = \frac{\text{Observed capacitance - Calculated capacitance}}{\text{Calculated capacitance}}$$

Model Graph:

A graph is drawn between % Error and Measured Value



Result:

3. ANDERSON BRIDGE

Aim:

To measure the self-inductance of the given coil using Anderson's bridge.

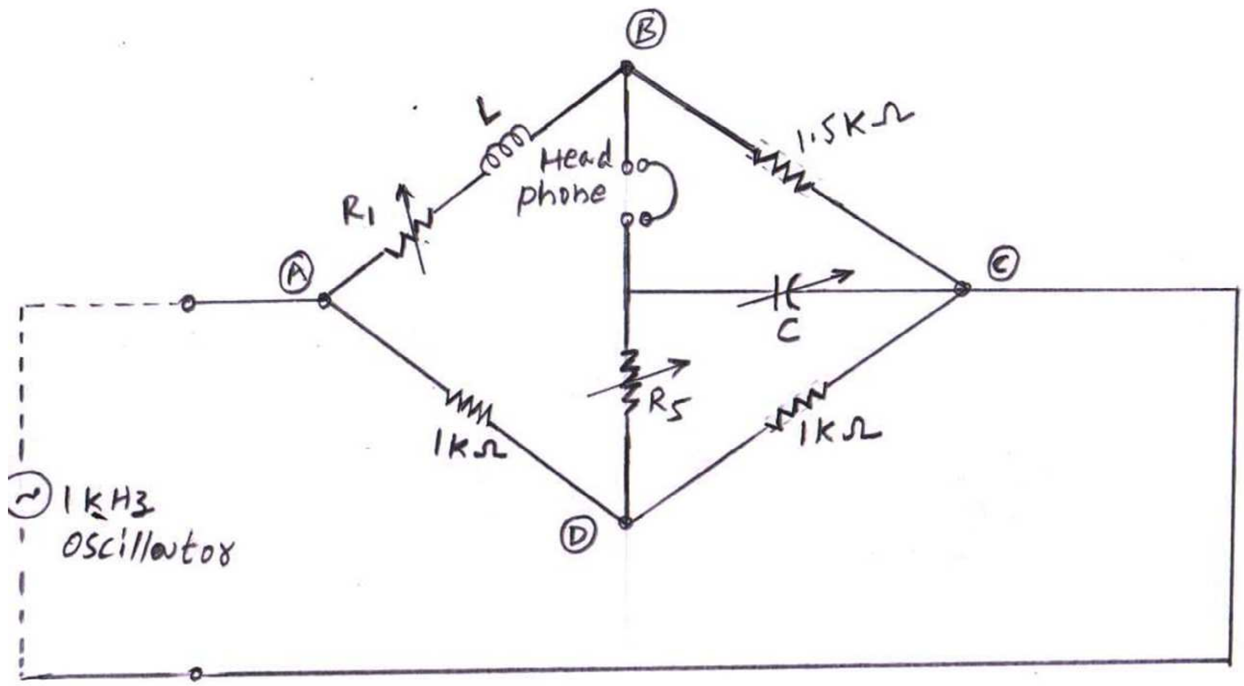
Apparatus Required:

Sl. No.	Description	Type	Range	Quantity
1	Anderson's Bridge kit	----	----	01
2	Head Phones	----	----	01
3	patch cards	----	----	As per required

Procedure:

1. Connect the circuit as shown in the diagram on the Anderson bridge trainee kit.
2. Switch on the single phase AC supply to the kit.
3. Keep all the knobs of the kit at minimum position.
4. Now switch on the bridge supply and adjust magnitude of 1 KHz oscillator to a definite value.
5. Vary the variable resistances R_1 with the help of 2.2K pot.
6. Vary the variable resistances R_5 with the help of coarse and fine adjustment knobs.
7. Now adjustment the different values of capacitor C.
8. At a particular value of C we can get the minimum sound or no sound in the headphone.
9. Now note down the values of R_5 and C.
10. Calculate the value of unknown inductor by using formula.

CIRCUIT DIAGRAM



ANDERSON BRIDGE

Precautions:

1. There should not be any loose connections.
2. Handle the Bridge very carefully.

Observation Table:

Sl. No.	C farad	R_2 Ω	R_3 Ω	R_4 Ω	R_5 Ω	Calculated Value $L=CR_3/R_4((R_5R_4+R_2)+R_2R_4)$ mH (theoretical)	Observed Value in the bridge (practical)	%Error
1		1 kΩ	1.5 kΩ	1 kΩ				
2								
3								
4								

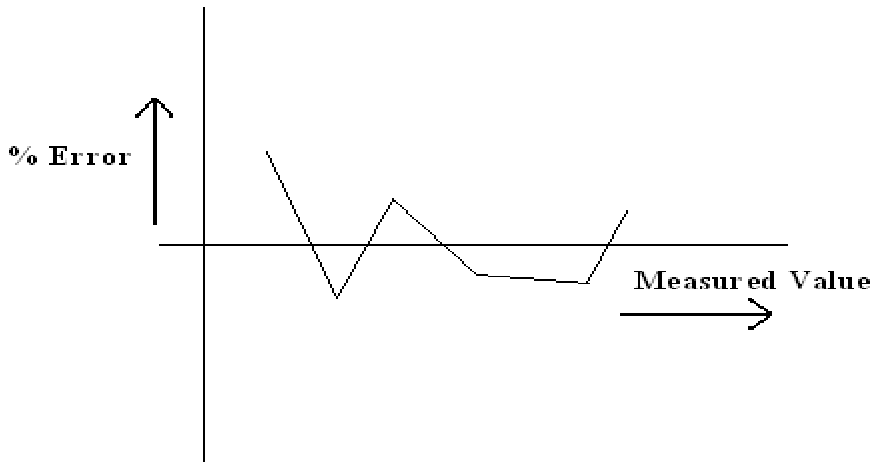
Theoretical Calculations:

Unknown inductance $L=CR_3/R_4((R_5R_4+R_2)+R_2R_4)$ mH

% Error = $\dfrac{\text{Observed inductance - Calculated inductance}}{\text{Calculated inductance}}$

Model Graph:

A graph is drawn between % Error and Measured



Result:

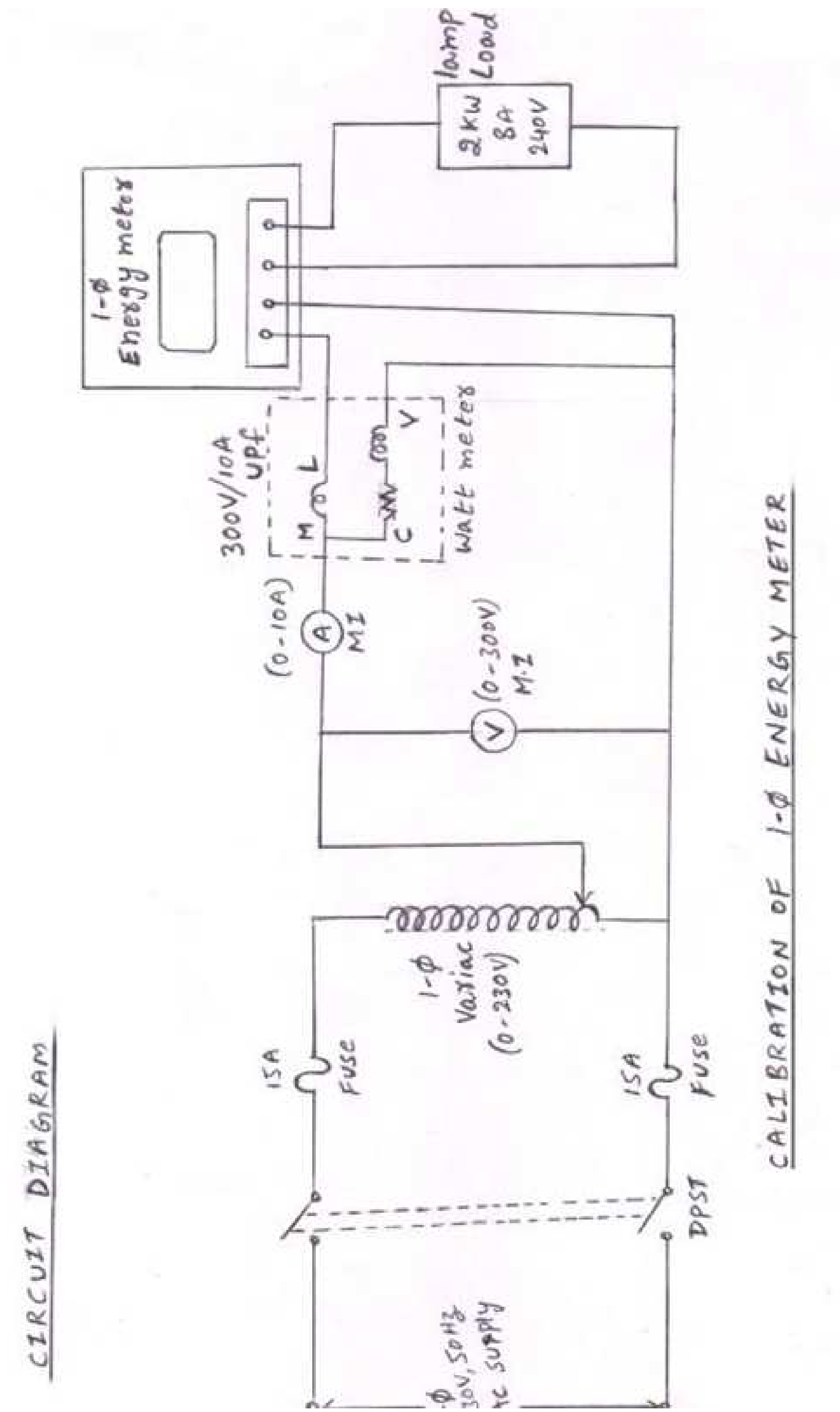
4. CALIBRATION AND TESTING OF SINGLE PHASE ENERGY METER

Aim:

To calibrate the given Energy Meter by using calibrated wattmeter.

Apparatus Required:

Sl. No.	Description	Type	Range	Quantity
01	Energy Meter	Induction	240V,(5-10)A, 50 Hz	01
02	Auto Transformer	1- Φ	230 / (0-270)V, (0-10)A	01
03	U.P.F. Wattmeter	Dynamometer Type	300V/10A	01
04	Voltmeter	MI	(0-300)V	01
05	Ammeter	MI	(0-10)A	01
06	Lamp Load	Resistive	230V, (0-10)A	01
07	Stop Watch	Digital	------	01
08	Connecting Wires	------	------	As required


CIRCUIT DIAGRAM
1-φ Energy meter
2KW 8A 240V
lamp Load
300V/10A UPF
M L C V
Watt meter
(0-10A) MI
(0-300V) M.I
1-φ Variac (0-230V)
15A Fuse
15A Fuse
DPST
CALIBRATION OF 1-φ ENERGY METER

Procedure:

1. Connect the circuit as per the circuit diagram.
2. Set Auto Transformer at zero voltage position before switching on the supply.
3. Gradually increase the voltage using the auto-transformer till the voltmeter reads 230V.
4. Now apply the Load at certain value must be less than half of the rated current of energy meter.
5. Note down the time taken for 5 rev. of the disc of the energy meter in the forward direction.
6. Note down the Voltmeter, Ammeter, & Wattmeter readings.
7. The experiment is repeated for different values of load current at constant voltage.
8. After noting the values slowly decrease the auto transformer till Voltmeter comes to zero voltage position and switch off the supply.
9. Calculate the % Error and % correction and draw the graph between % Error and load current

Precautions:

1. There should not be any loose connections.
2. Meter readings should not be exceeded beyond their ratings.
3. If the energy meter rotate in reverse direction change either its Current coil terminals or pressure coil terminal but not both

Observation Table:

Sl No.	Voltage (V)	Load Current (I_L)	Wattmeter Reading W (Watts)	Time for 5 rev t(Sec)	Actual Energy E_t = (w/1000) X (t/3600)	Energy meter Reading E_m=(n/k)	% Error = (E_m - E_t)/ E_t X 100
1							
2							
3							

Theoretical Calculations:

The energy meter constant (K) = 1200 rev/ kWh

I.e. for 1200 rev it records 1 unit or 1 kWh

For 5 rev it records = (n/K) = (5/1200) kWh Where n=number or revolutions of disc

Energy meter reading (or) measured value **E_m= (n/K)**

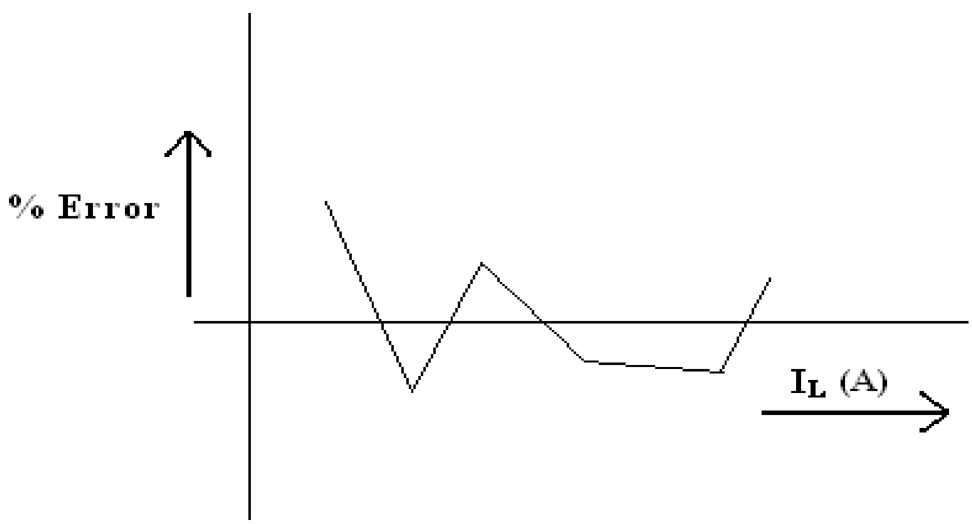
Actual energy consumed (or) true value **E_t= (w X t)**

Where W= Wattmeter reading and t=time for 5-revolutions

% Error = [(E_m - E_t)/ E_t] X 100 where **E_m=** measured value **E_t =**actual value

Model Graph:

A graph is drawn between **percent Error Vs Load current**.



Result:

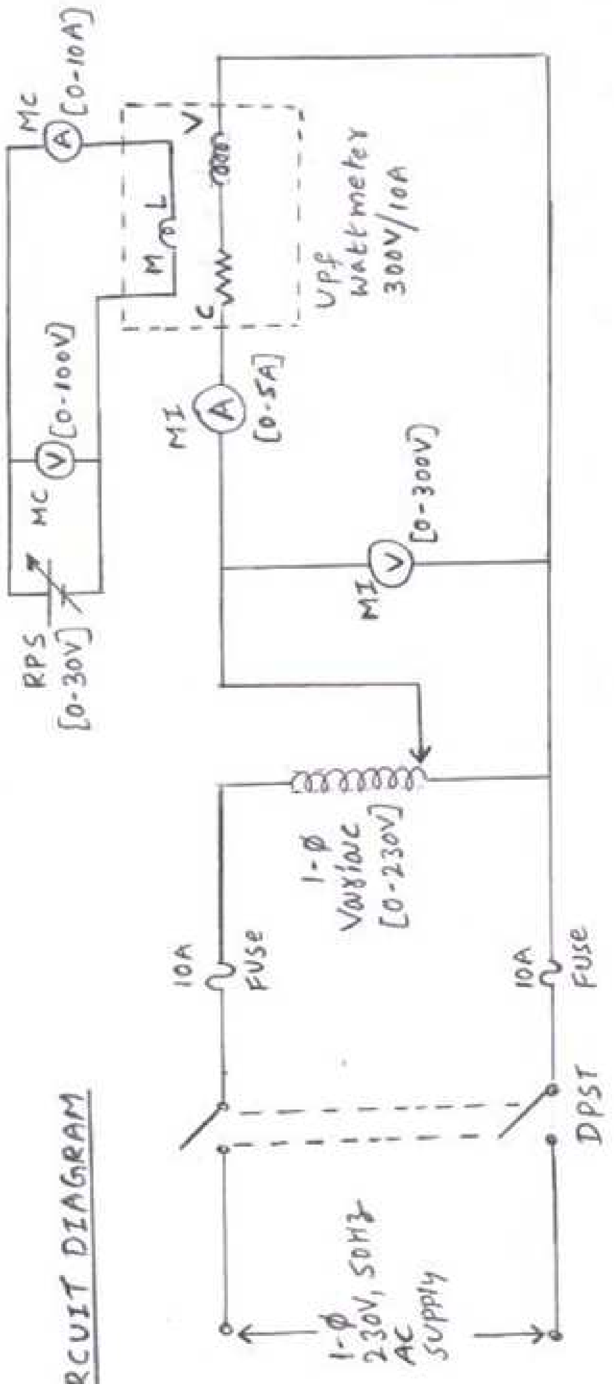
5. Calibration of dynamometer type wattmeter using phantom loading UPF

Aim:

To calibrate the given dynamometer type wattmeter using phantom loading UPF

Sl. No.	Description	Type	Range	Quantity
01	Auto Transformer	1- Φ	230 / (0-270)V, (0-10)A	01
02	U.P.F. Wattmeter	Dynamometer Type	300V/10A	01
03	Voltmeter	MI	(0-300)V	01
04	Ammeter	MI	(0-10)A	01
05	Resistive Load	1- Φ	230V, (0-10)A	01
06	Connecting Wires	------	------	As required

IRCUIT DIAGRAM



CALIBRATION OF DYNAMOMETER TYPE WATTMETER USING PHANTOM LOADING UPF

Procedure:

1. Connect the circuit as per the circuit diagram.
2. Set Auto Transformer at zero voltage position before switching on the supply.
3. Gradually increase the voltage using the auto-transformer till the voltmeter reads 230V across pressure coil.
4. Now apply the low DC voltage to the current coil by using a battery or RPS in steps until current coil carry its rated current.
5. For each step note down the Voltmeter, Ammeter & Wattmeter readings.
6. After noting the values slowly decrease the auto transformer till Voltmeter comes to zero voltage position and switch OFF the RPS Supply and 1-Φ AC supply.

Precautions:

1. There should not be any loose connections.
2. Meter readings should not be exceeded beyond their ratings
3. If the energy meter rotate in reverse direction, change either it's current coil terminals or pressure coil terminal but not both.

Observation Table:

Sl No.	V	I	Measured value (W_m)	Actual value(W_t)	% Error

Theoretical Calculations:

Measured value **(W_m)** = wattmeter reading

Actual value **(W_t)** = **V I cosΦ** where power factor=unity

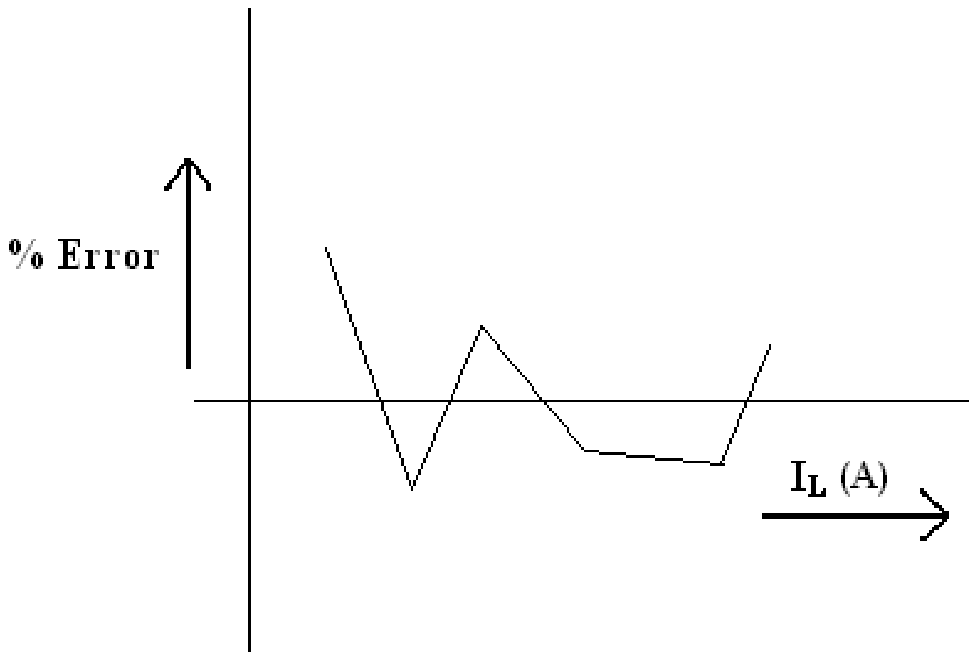
% Error = $[(W_m - W_t)/ W_t]$ X 100

Where **W_m=** measured value

W_t =actual value

Model Graph:

A graph is drawn between **percent Error Vs current coil current**.



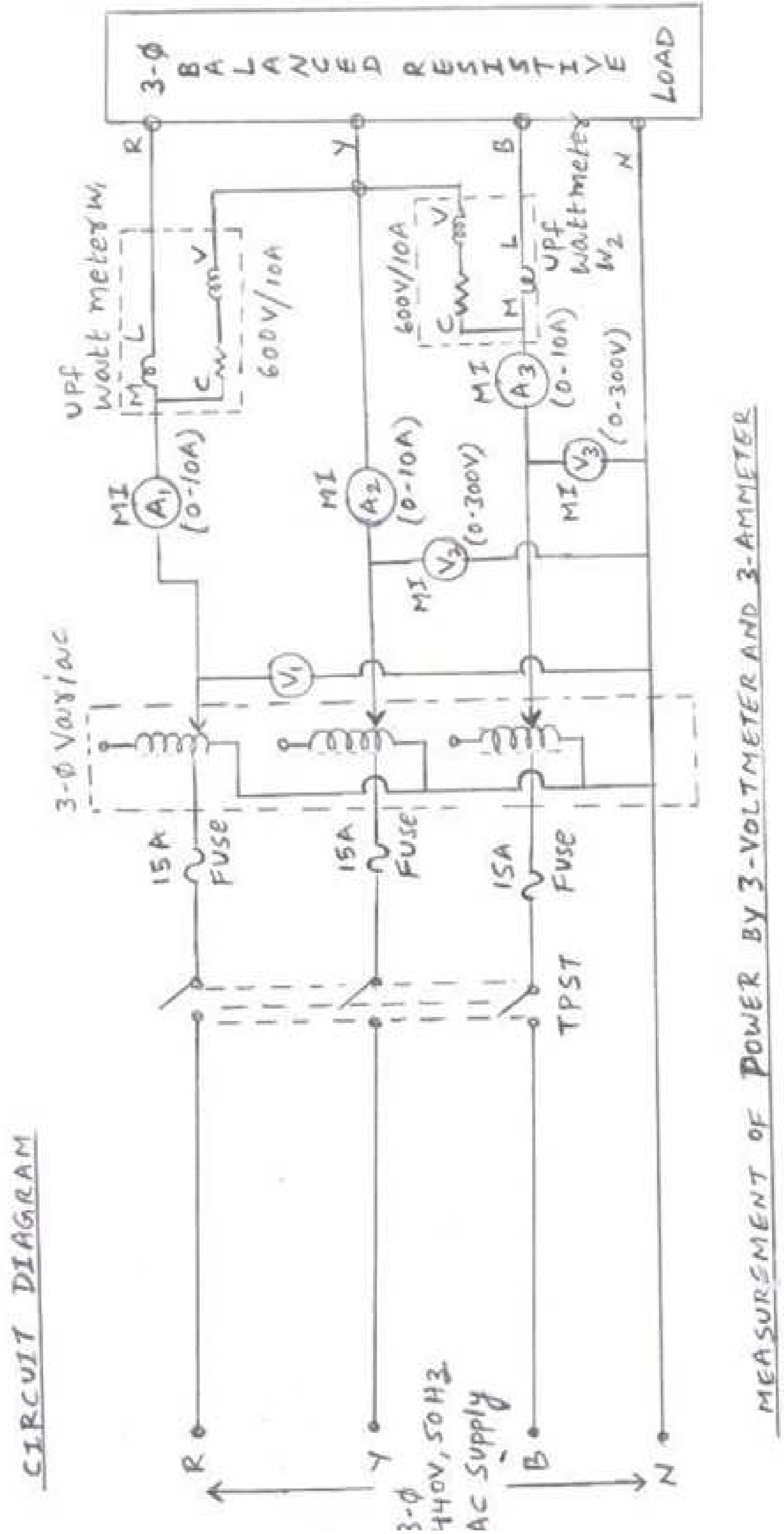
Result:

6. Measurement of power by 3-voltmeter and 3-Ammeter method

Aim:

To Measure the power in 3-Φ circuit by 3-voltmeter and 3-Ammeter method

Sl. No.	Description	Type	Range	Quantity
01	Auto Transformer	1- Φ	230 / (0-270)V, (0-10)A	01
02	U.P.F. Wattmeter	Dynamometer Type	300V/10A	01
03	Voltmeter	MI	(0-300)V	01
04	Ammeter	MI	(0-10)A	01
05	Resistive Load	1- Φ	230V, (0-10)A	01
06	Connecting Wires	-----	-----	As required


CIRCUIT DIAGRAM
3-Φ BALANCED RESISTIVE LOAD
UPF Watt meter W1
600V/10A
MI A1 (0-10A)
MI A2 (0-10A)
MI V2 (0-300V)
MI A3 (0-10A)
MI V3 (0-300V)
600V/10A
UPF Wattmeter W2
3-Φ Variac
V1
15A Fuse
TPST
3-Φ 440V, 50Hz AC Supply
R Y B N
MEASUREMENT OF POWER BY 3-VOLTMETER AND 3-AMMETER

Procedure:

1. Connect the circuit as per the circuit diagram.
2. Set three phase auto Transformer at zero voltage position before switching on the supply.
3. Gradually increase the voltage using the auto-transformer till the voltmeter in each phase reads rated phase voltage.
4. Now apply the three phase balanced resistive load in steps.
5. For each step note down the Voltmeters, Ammeters & Wattmeter readings.
6. After noting the values slowly decrease the auto transformer till Voltmeters come to zero voltage position and switch off the supply.
7. Calculate the % Error and draw the graph between percent Error and Load current

Precautions:

1. There should not be any loose connections.
2. Meter readings should not be exceeded beyond their ratings
3. If the energy meter rotate in reverse direction, change either it's Current coil terminals or pressure coil terminal but not both

Observation Table:

Sl No.	V_1	V_2	V_3	I_1	I_2	I_3	P_1	P_2	P_3	W_1	W_2	Actual value $P_t = P_1 + P_2 + P_3$	Measured value $W_m = W_1 + W_2$	% Error
1														
2														
3														
4														

Theoretical Calculations:

Power in each phase

$\mathbf{P_1 = V_1 I_1 COS\Phi}$

$\mathbf{P_2 = V_2 I_2 COS\Phi}$

$\mathbf{P_3 = V_3 I_3 COS\Phi}$

Where power factor COSΦ=unity

Total Power in three phases (or) actual 3-Φ power $\mathbf{P_t = P_1 + P_2 + P_3}$

Measured power = $\mathbf{W_m = W_1 + W_2}$

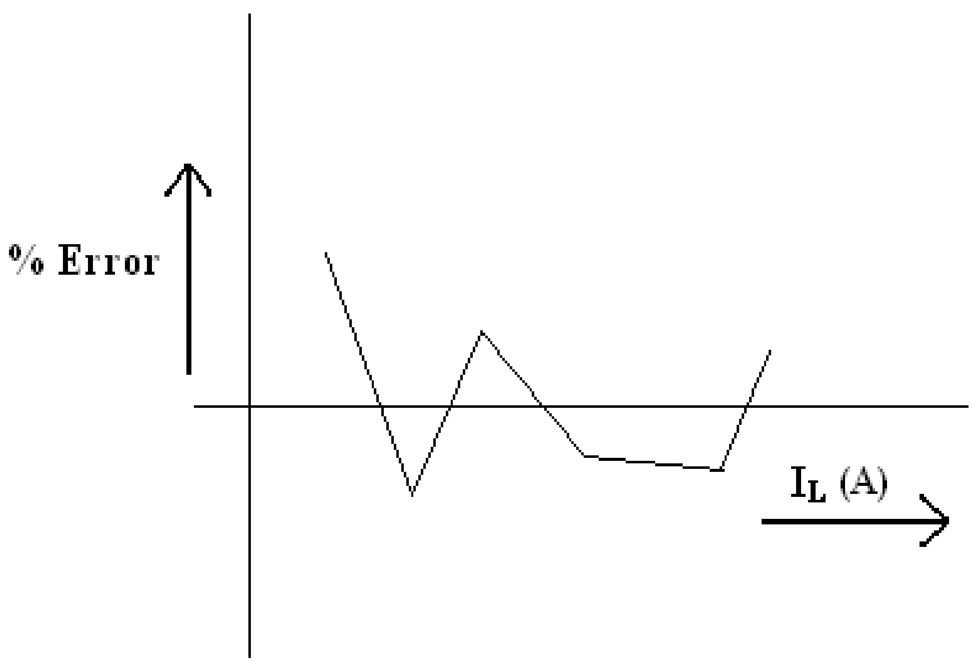
% Error = $\mathbf{[(W_m - P_t)/ P_t] \times 100}$

Where $\mathbf{W_m}$= measured value

$\mathbf{P_t}$ =actual value

Model Graph:

A graph is drawn between **percent Error Vs current coil current**.



Result:

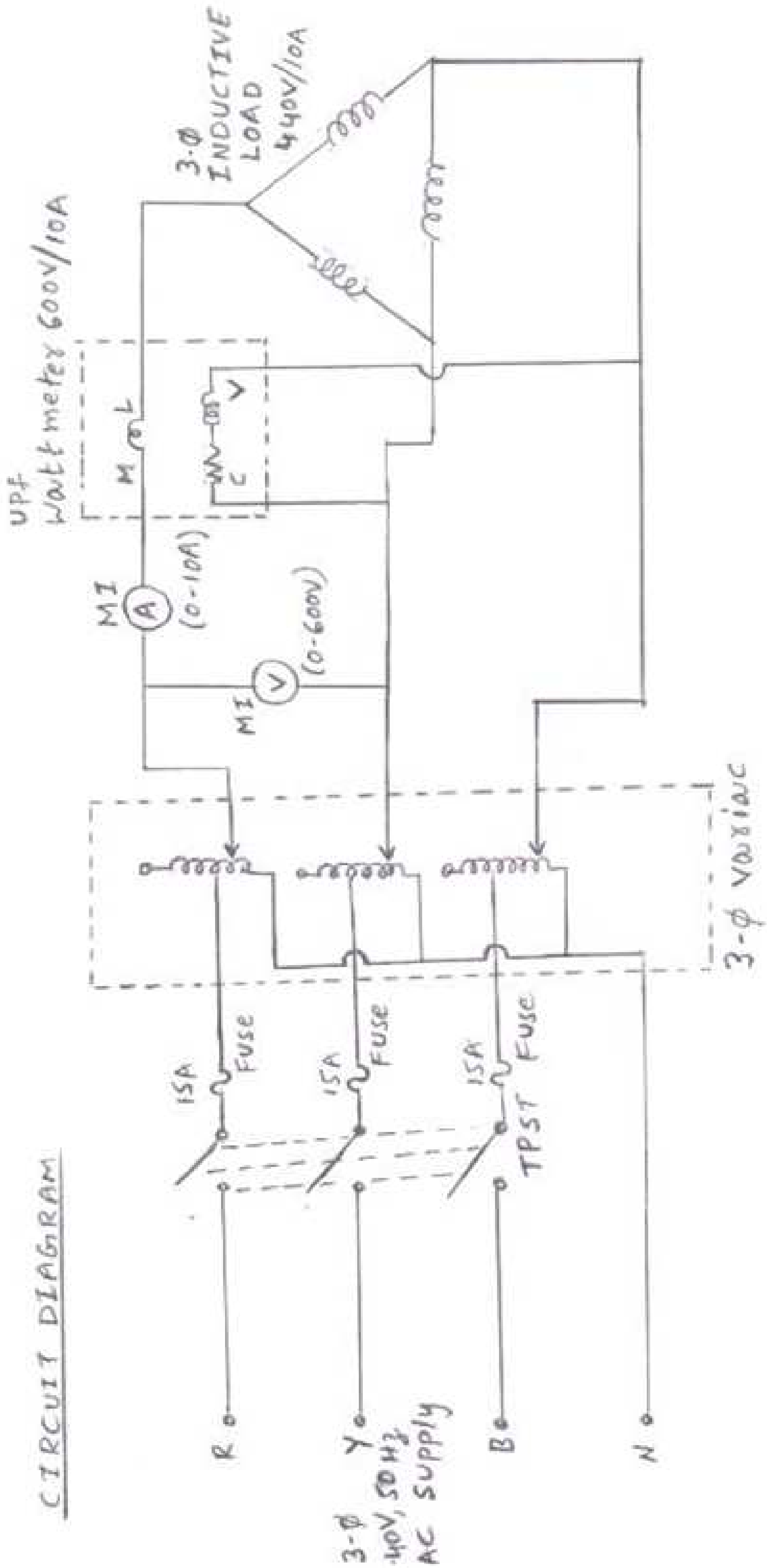
7. MEASUREMENT OF 3- PHASE REACTIVE POWER WITH SINGLE PHASE WATTMETER FOR BALANCED LOADING

Aim:

To measure the total reactive power of a three phase balanced load using single phase wattmeter method

Apparatus Required:

Sl. No.	Description	Type	Range	Quantity
01	Auto Transformer	3-Φ	415V/(0-440)V/10A	01
02	Ammeter	MI	(0-10)A	01
03	Voltmeter	MI	(0-600)V	01
04	U.P.F. Wattmeter	Dynamometer type	(150/300/600)V (0-5/10)A	01
05	Inductive Load	3-Φ	440V/10A, 1.5KVA	01
06	Connecting Wires	-----	------	As required



MEASUREMENT OF 3-Φ REACTIVE POWER WITH 1-Φ WATTMETER

Procedure:

1. Connect the circuit as per the circuit diagram.
2. Set three phase auto Transformer at zero voltage position before switching on the supply.
3. Gradually increase the voltage using the auto-transformer till the voltmeter reads rated line voltage.
4. Now apply the three phase balanced inductive load in steps.
5. For each step note down the Voltmeter, Ammeter & Wattmeter readings.
6. After noting the values slowly decrease the auto transformer till Voltmeters come to zero voltage position and switch off the supply.
7. Calculate the % Error and draw the graph between % Error and load current

Precautions:

1. There should not be any loose connections.
2. Meter readings should not be exceeded beyond their Ratings
3. Readings of the meters must be taking without parallax error.
4. Ensure that setting of the Auto Transformer at zero output voltage During starting

Observation Table:

S.No	V_{ph}	I_{ph}	Wattmeter reading (W_R)	$\sin\phi = W_R/(I_{ph} \times V_{ph})$	measured value (W_m)	Actual value (W_t)	% Error

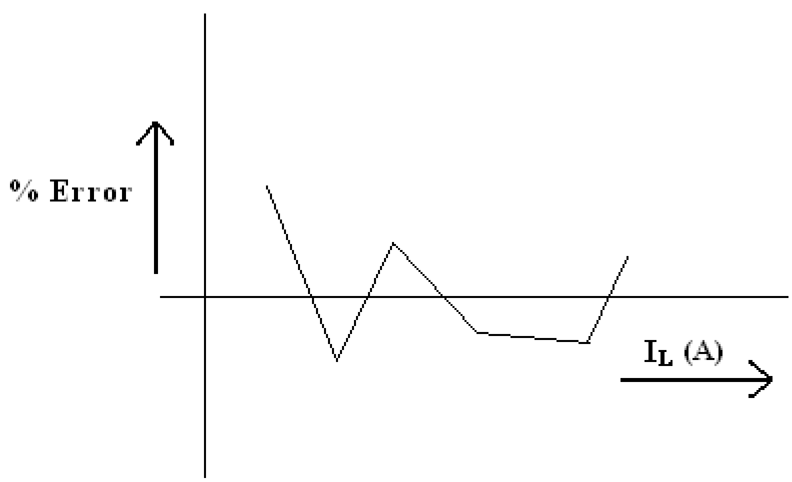
Theoretical Calculations:

Wattmeter reading (or) reactive power / Phase **(W_R) =**
I.e. measured value (or) total reactive power **(w_m) = 3x W_R=**

Ammeter reading **(I_{ph}) =**
Voltmeter reading **(V_{ph}) =**
Sinϕ= W_R/ (Iph× V_{ph})=
Actual value (or) total calculated reactive power **(W_t) = 3 V_{ph} I_{ph} Sinϕ**
% Error = [(W_m - W_t)/ W_t] X 100
Where **W_m=** measured value
W_t =actual value

Model Graph:

A graph is drawn between %Error Vs Load current



Result:

8. MEASUREMENT OF PARAMETERS OF A CHOKE COILS USING 3-VOLTMETER AND 3-AMMETER METHODS

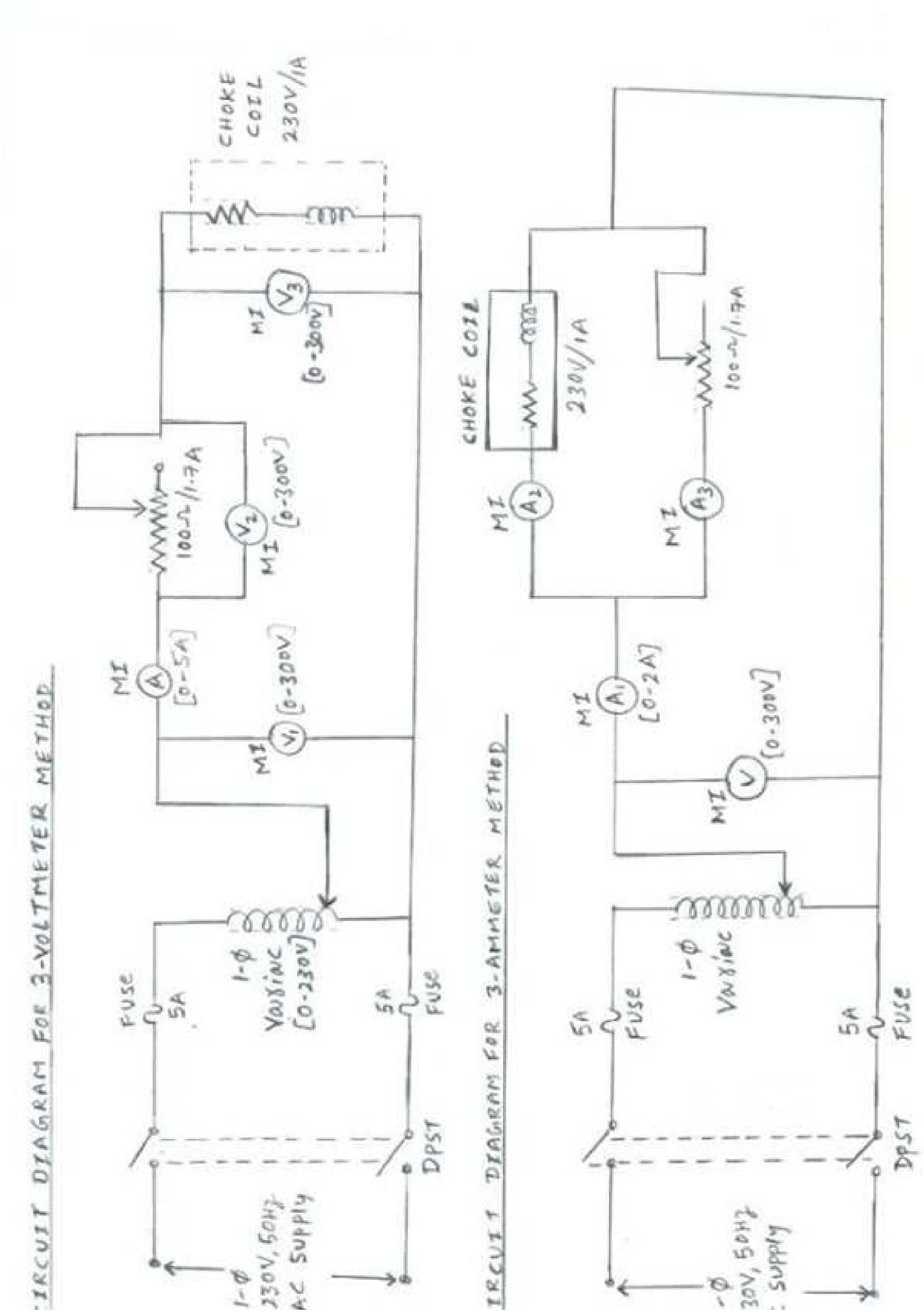
Aim:

To calculate the resistance and inductance of the given choke coil by Using (a) 3-Voltmeters method (b) 3-Ammeters method

(a) 3-Voltmeter method

Apparatus Required:

Sl. No.	Description	Type	Range	Quantity
01	Auto Transformer	1- Φ	230/(0-270)V, (0-10)A	01
02	Choke coil	50 Hz	0.41A, 40W, 230V,	01
03	Voltmeter	MI	(0-300)V	03
04	Ammeter	MI	(0-5)A	01
05	Rheostat	1- Φ	50/100Ω, 5A	01
06	Connecting Wires	------	------	As required


CIRCUIT DIAGRAM FOR 3-VOLTMETER METHOD
1-Φ 230V, 50Hz AC SUPPLY
DPST
FUSE 5A
1-Φ Variac [0-230V]
MI A [0-5A]
MI V1 [0-300V]
100Ω/1.7A
MI V2 [0-300V]
MI V3 [0-300V]
CHOKE COIL 230V/1A
CIRCUIT DIAGRAM FOR 3-AMMETER METHOD
1-Φ 230V, 50Hz SUPPLY
DPST
5A FUSE
1-Φ Variac
MI V [0-300V]
MI A1 [0-2A]
MI A2
MI A3
CHOKE COIL 230V/1A
100Ω/1.7A

Procedure:

1. Connect the circuit as per the circuit diagram.
2. Set single phase auto Transformer at zero voltage position before switching on the supply.
3. Gradually increase the voltage using the auto-transformer till the supply voltmeter reads rated voltage.
4. Now change the current through choke coil by varying the series rheostat of choke coil in steps.
5. For each step note down the three Voltmeters and one Ammeter readings.
6. After noting the values slowly decrease the auto transformer till Voltmeters come to zero voltage position and switch off the supply.
7. Calculate the parameters of choke coil for each current and tabulated in the tabular column.

Precautions:

1. There should not be any loose connections.
2. Meter readings should not be exceeded beyond their ratings
3. Readings of the meters must be taking without parallax error.
4. Ensure that setting of the Auto Transformer at zero output voltage During starting

Observation Table:

Sl.No	I	V_1	V_2	V_3	P	cosΦ	sinΦ	Z	R	X_L	L

Theoretical Calculations:

$P = (V_1^2 - V_2^2 - V_3^2)/2R$

$Cos\Phi = (V_1^2 - V_2^2 - V_3^2) / 2V_2V_3$

$I = V_2/R$

$Z = V_3/I$

$\mathbf{R = Z\ Cos\Phi}$

$X_2 = Z\ sin\Phi$

$\mathbf{L = X_L / 2\pi f}$

Average Inductance =

Average Resistance =

(b) 3-Ammeters method

Apparatus Required:

Sl. No.	Description	Type	Range	Quantity
01	Auto Transformer	1- Φ	230/(0-270)V (0-10)A	01
02	Choke coil	50 Hz	0.41A, 40W, 230V,	01
03	Voltmeter	MI	(0-300)V	01
04	Ammeter	MI	(0-5)A	02
05	Ammeter	MI	(0-1)A	01
06	Rheostat	1- Φ	50/100Ω, 5A	01
07	Connecting Wires	------	------	As required

Procedure:

1. Connect the circuit as per the circuit diagram.
2. Set single phase auto Transformer at zero voltage position before switching on the supply.
3. Gradually increase the voltage using the auto-transformer till the supply voltmeter reads rated voltage.
4. Now change the current through choke coil by varying the shunt rheostat of choke coil in steps.
5. For each step note down the three Ammeters and one voltmeter readings.
6. After noting the values slowly decrease the auto transformer till Voltmeters come to zero voltage position and switch off the supply.
7. Calculate the parameters of choke coil for each current and tabulated in the tabular column.

Precautions:

1. There should not be any loose connections.
2. Meter readings should not be exceeded beyond their ratings
3. Readings of the meters must be taking without parallax error.
4. Ensure that setting of the Auto Transformer at zero output voltage During starting

Observation Table:

Sl.No.	V	I_1	I_2	I_3	P	cosΦ	sinΦ	Z	R	X_L	L

Theoretical Calculations:

$P = [(I_1^2 - I_2^2 - I_3^2)/2] \times R$

$\cos\Phi = (I_1^2 - I_2^2 - I_3^2) / 2I_2I_3$

$V = I_2R$

$Z = V/I$

$\mathbf{R = Z \cos\Phi}$

$X_L = Z \sin\Phi$

$\mathbf{L = X_L / 2\pi f}$

Average Inductance =

Average Resistance =

Result:

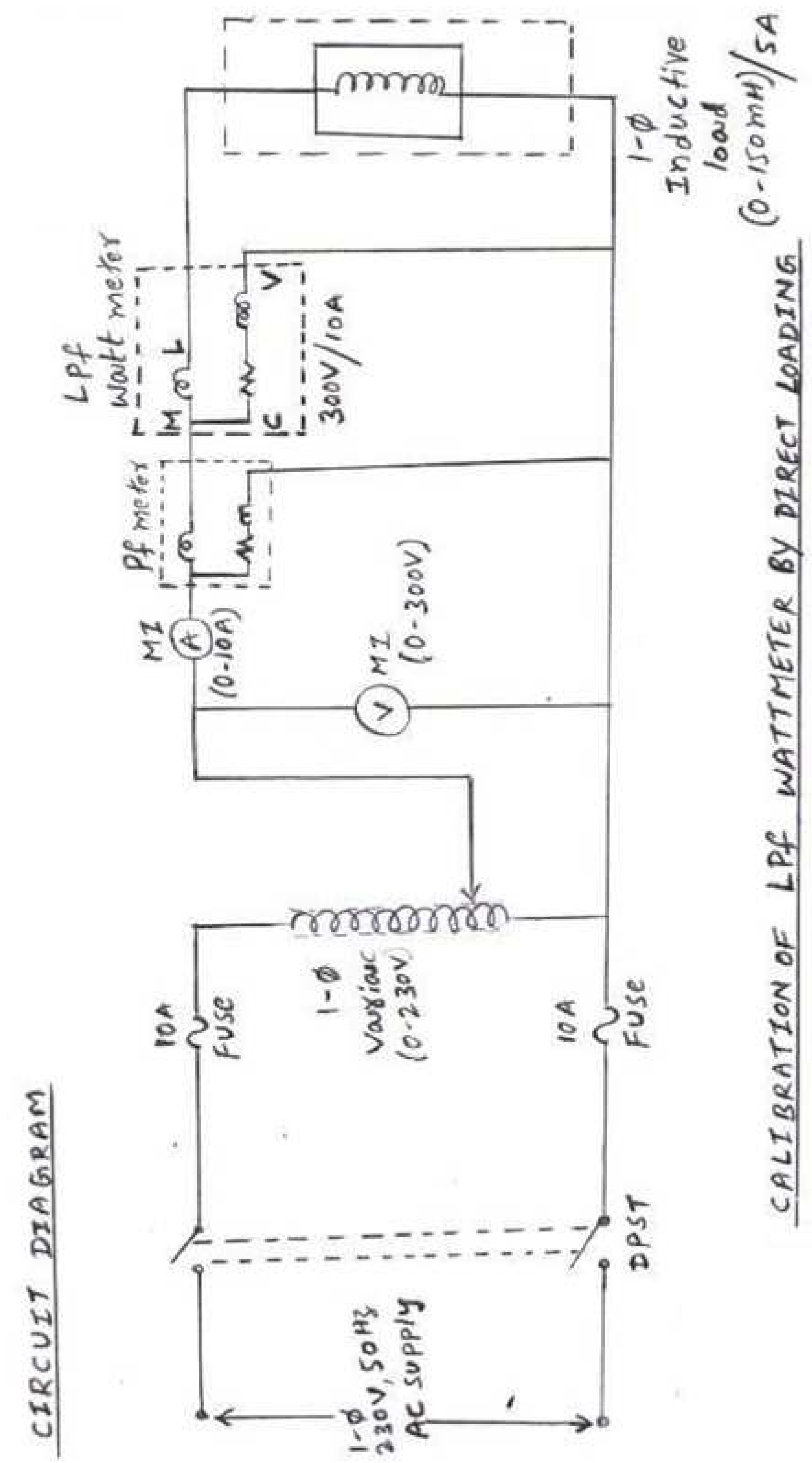
9. CALIBRATION OF LPF WATTMETER - BY DIRECT LOADING

Aim:

To calibrate the given LPF Wattmeter by direct loading

Apparatus Required:

Sl. No.	description	Type	Range	Quantity
01	Auto Transformer	1- Φ	230/(0270)V,10A	01
02	L.P.F. Wattmeter	Dynamometer Type	300 V/10A	01
03	Voltmeter	MI	(0-300)V	01
04	Ammeter	MI	(0-5)A	01
05	Inductive Load	1- Φ	0-150mH,10A	01
06	Connecting Wires	------	------	As required


CIRCUIT DIAGRAM
1-ϕ 230V, 50Hz AC supply
DPST
10A FUSE
10A FUSE
1-ϕ Variac (0-230V)
MI (0-10A)
MI (0-300V)
Pf meter
LPf Watt meter
M L C V
300V/10A
1-ϕ Inductive load (0-150mH)/5A
CALIBRATION OF LPF WATTMETER BY DIRECT LOADING

Procedure:

1. Connect the circuit as per circuit diagram.
2. Set single phase auto Transformer at zero voltage position before switching on the supply.
3. Gradually increase the voltage using the auto-transformer till the supply voltmeter reads rated voltage.
4. Now apply the single phase balanced inductive load in steps.
5. For each step note down the voltmeter, Ammeter, PF meter and wattmeter readings.
6. After noting the values slowly decrease the auto transformer till Voltmeter come to zero voltage position and switch off the supply.
7. Calculate the % Error and draw the graph between % Error and load current.

Precautions:

1. There should not be any loose connections.
2. Meter readings should not be exceeded beyond their ratings.
3. Readings of the meters must be taking without parallax error.
4. Ensure that setting of the Auto Transformer at zero output voltage During starting

Observation Table:

Sl. No.	V	I	P.F CosΦ	Wattmeter Reading (or) Measured value(W_m)	Actual value (W_t) = VI Cosϕ	%Error

Theoretical Calculations:

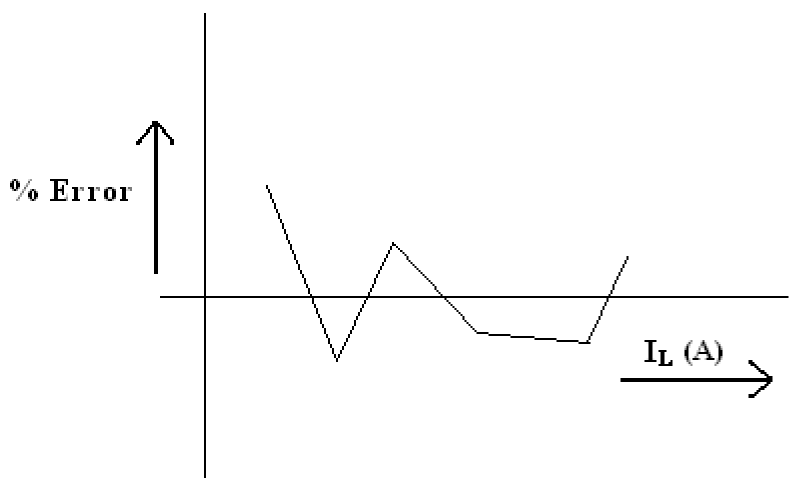
% Error = $[(W_m - W_t)/ W_t] \times 100$

Where W_m= measured value

W_t =actual value

Model Graph:

A graph is drawn between % Error and Load Current



Result:

10. CROMPTON DC POTENTIOMETER – CALIBRATION OF PMMC AMMETER & PMMC VOLTMETER

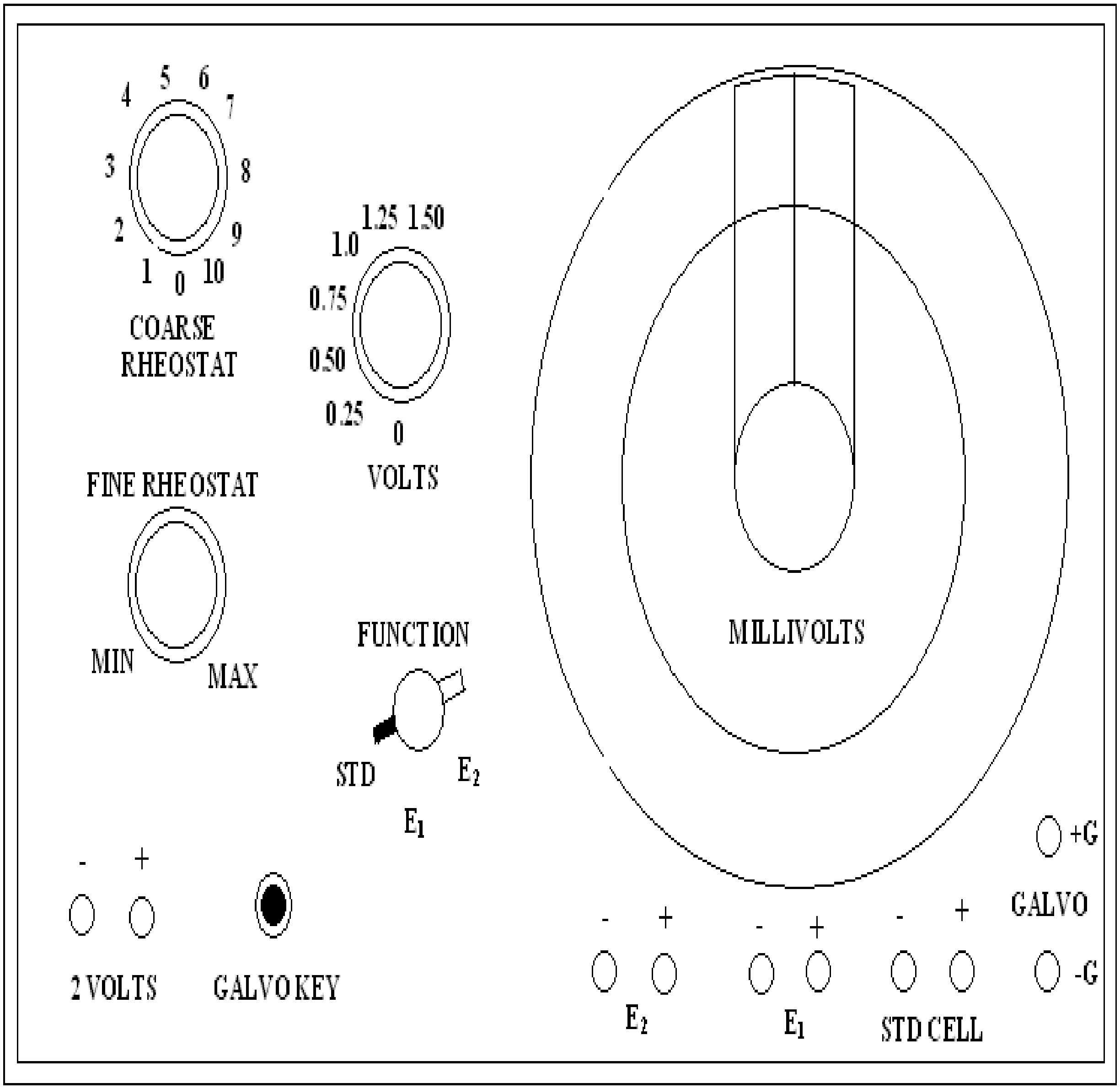
Aim:

To measure the unknown voltage using DC Crompton Potentiometer and calibration of voltmeter and ammeter

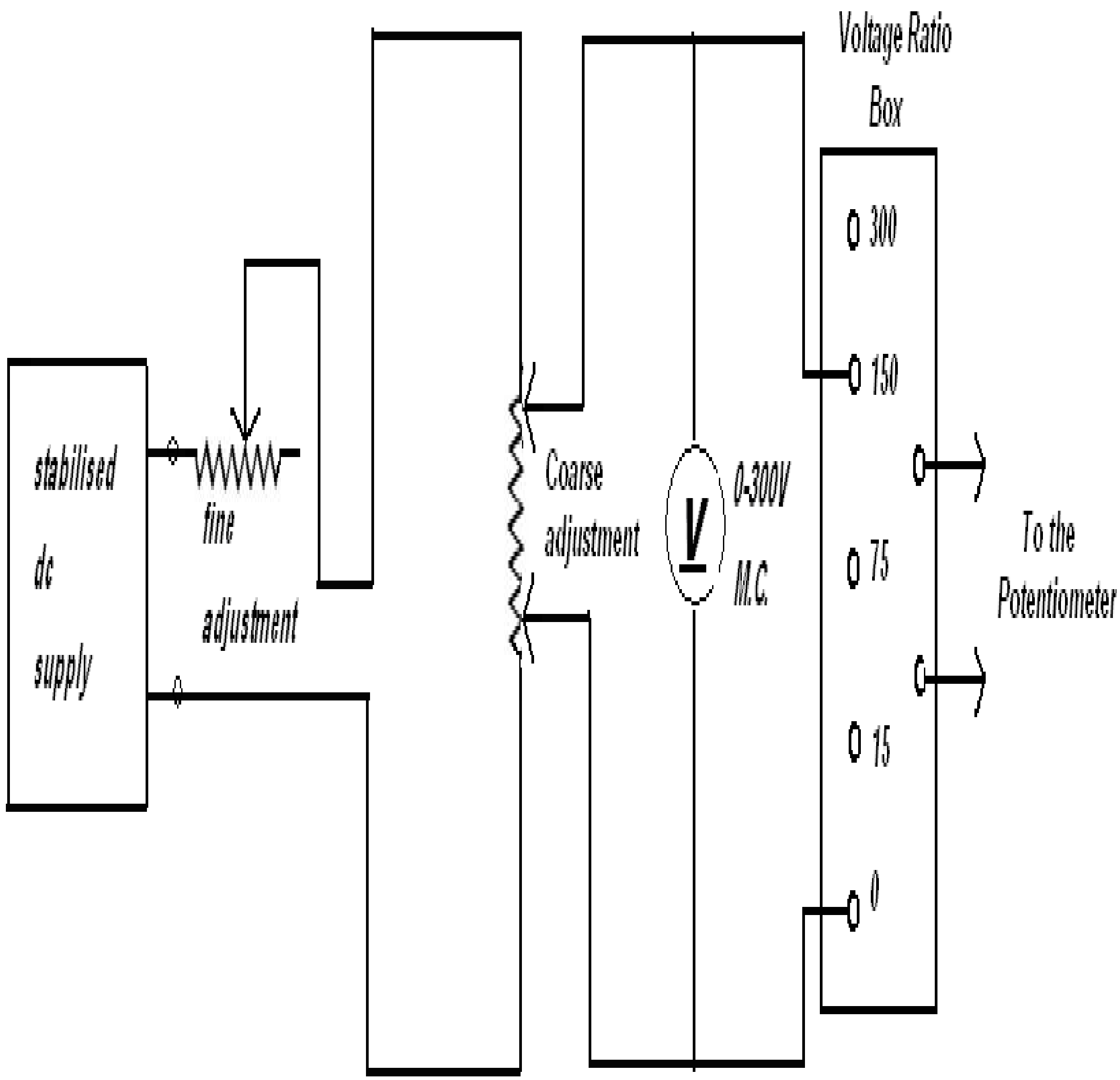
Apparatus required:

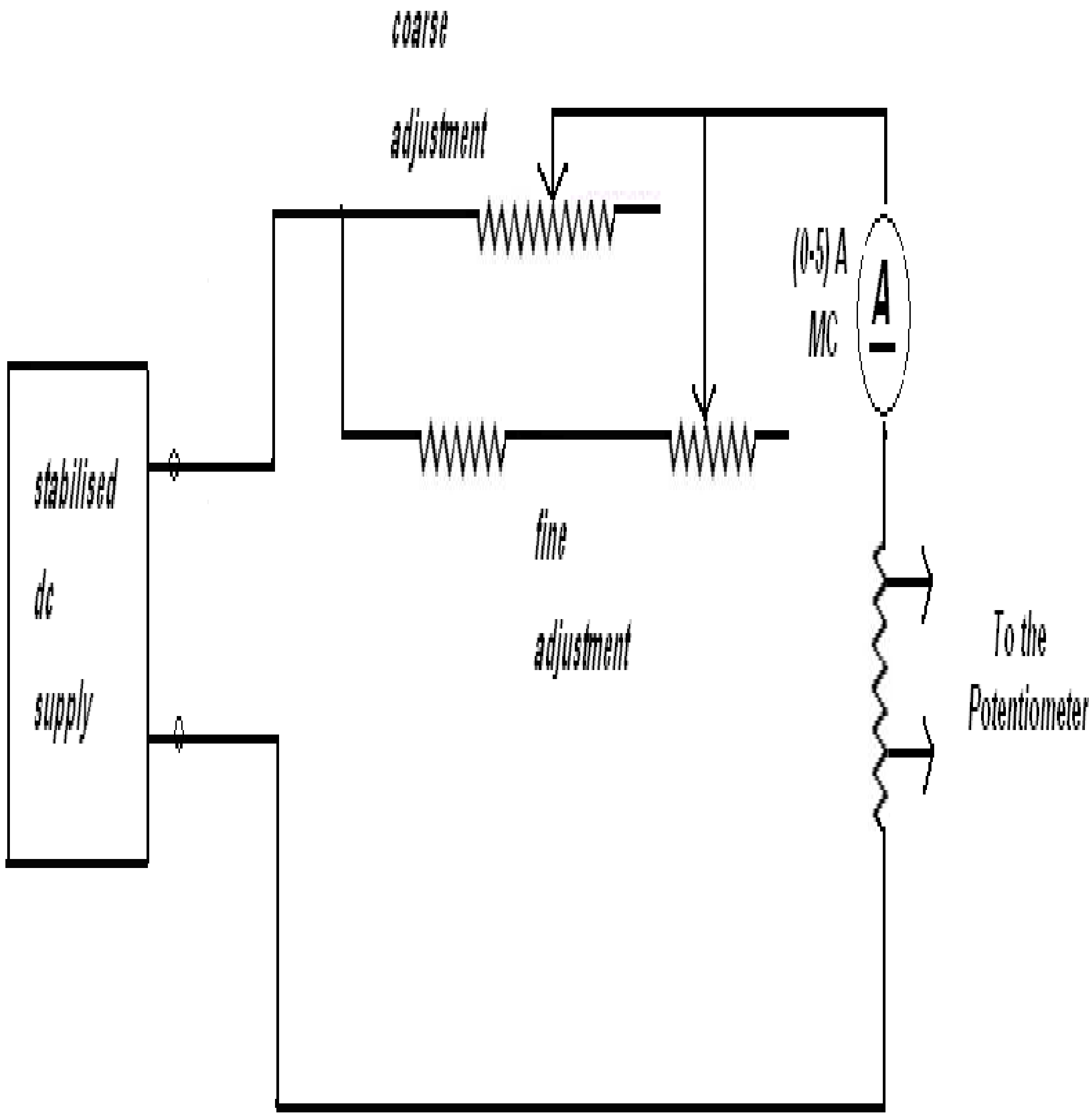
Sl. No.	Description	Type	Range	Quantity
1	Potentiometer	D.C	----	01
2	Stabilizer	-----	(0-300v)	01
3	Rheostat	Wire wound	110/5A	01
4	Standard cell	dry	1.018 v	01
5	Galvanometer	Analog	(0-100)mA	01
6	Voltmeter	MC	(0-300)V	01
7	Ammeter	MC	(0-5)A	01
8	patch cards	-----	-----	As required

Kit Diagram:


4
5
6
7
3
8
2
9
1
0
10
COARSE
RHEOSTAT
1.0
1.25
1.50
0.75
0.50
0.25
0
VOLTS
FINE RHEOSTAT
MIN
MAX
FUNCTION
STD
E2
E1
MILLIVOLTS
+G
GALVO
-G
- +
2 VOLTS
GALVO KEY
- +
E2
- +
E1
- +
STD CELL

Circuit Diagram:




coarse
adjustment
(0-5) A
MC
A
stabilised
dc
supply
fine
adjustment
To the
Potentiometer

Procedure:

Initial calibrations {Fixing working current}

1. Connect the battery, galvanometer in the kit as shown in the circuit diagram.
2. Put the switch ‘S’ in the standard cell position and connect the standard cell to the standard knob.
3. Rotate the main dial and slide wire in order to get the same voltage of the standard emf.
4. Now press the key and observe the galvanometer deflection.
5. If the galvanometer does not show the balance position, adjust the rheostat and make it to read zero.

To find unknown emf:

1. Connect the unknown battery across the knob marked ‘X’
2. Put the switch ‘S’ in the unknown emf position.
3. Adjust the main dial slide wire to get the null position in the galvanometer.
4. The reading in the main dial and slide wire gives the voltage of the unknown cell.

CALIBRATION OF AMMETER:

1. Made the connections as per the circuit diagram.
2. A standard resistance of suitable value and sufficient current Carrying capacity is placed in series with the Ammeter under calibration.
3. The voltage across the standard resistance is measured with the help of potentiometer and the current through the standard resistance can be compound current I= Vs / S amps.
5. Since the resistance of standard resistor is accurately known and the voltage across the standard resistor is measured by a potentiometer, this method of calibrating an Ammeter is very accurate.
6. A calibration curve indicating the errors at various scale reading of the ammeter may be plotted

CALIBRATION OF VOLTMETER:

1. Made the connections as per the circuit diagram.
2. The first and foremost requirement in this calibration is that a Suitable stable DC voltage supply is available since any changes in the supply voltage will cause a corresponding change in the voltmeter calibration.
3. The figure given is a potential divides, consisting of two rheostats, One or course and the other for fine control of calibrating voltage.
4. These controls are connected to the supply source and with the help Of these controls it is possible to adjust the voltage so that the pointer coincides exactly with a major division of the voltmeter.
7. The voltage across the voltmeter is stepped down to a value suitable for application to a potentiometer with the help of a volt-Ratio Box for accuracy of measurement, it is necessary to measure voltages near the maximum range of the potentiometer, as for as possible.
8. Thus the potentiometer has a maximum range of 1.6V. To achieve high accuracy we will have to use low voltage ranges for voltages less than 1.6V and use appropriate tapping's on volts ratio box for voltages higher than 1.6V.

Precautions:

1. There should not be any loose connections.
2. Meter readings should not be exceeded beyond their Ratings
3. Observe the ammeter reading. Apply the voltage slowly So that the current is within the limited range of ammeters
4. Handle the Bridge carefully.

Observation Tables:

Measurement of unknown emf:

S.No.	True Value of Unknown EMF (Volts)	Measured Value of Unknown EMF (Volts)	% Error

CALIBRAION OF AMMETER:

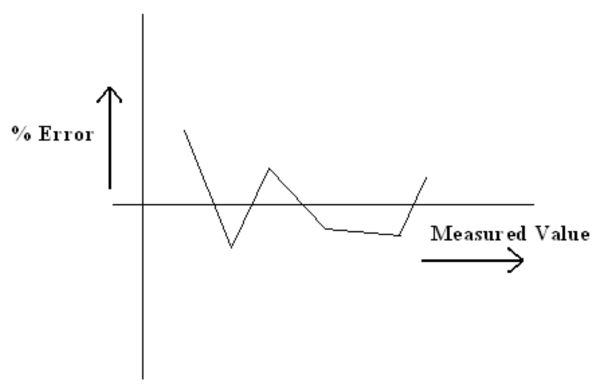
Sl. No.	Current (I_{in}) Amps	Current (I_{out}) Amps	% Error ((I_{out} - I_{in}) / I_{ou}) x 100

CALIBRATION OF VOLTMETER:

Sl. No.	Voltage (V_{in}) Volts	Voltage (V_{out}) Volts	% Error (V_{out} - V_{in}) / V_{ou}) x 100

Model Graph:

A graph is drawn between **% Error and measured Value**



Result: